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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.

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 and, as such, has been significantly disrupted by COVID-19 and the restrictions used to quell outbreaks. 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. 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), which for some individuals led to both a greater time spent at home and decreased purchasing power for balanced diets. However, for some individuals living in low-income households, the addition of unemployment benefits and federal supplements exceeded their prior wages.

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. Moreover, social isolation efforts and fears around virus exposure limited access to supermarkets and other food retailers. 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.

Stockpiling behaviors and breakdowns in the food supply chain also had an influence on peoples’ eating behaviors during the pandemic. 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 earthquakes 28 or even reading narratives about devastating hurricanes 29 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 and predict that the pandemic will continue to cause a nutrition crisis given factors like job loss and the closing of public food supports.30

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.33-35 Moreover, recent reviews assessing eating behaviors are narrower in scope, with specific focus areas such as weight changes and feeding children.36

This narrative review offers a summary of key research question findings regarding changes in eating behaviors during the COVID-19 pandemic. Further, challenges to 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 specific 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 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 e53,64 e66,68,69,73,76,79,81,85,86,89,91,92,100,102

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 e52,66,69,79,85,86,89,91,92 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 | Location, dates, design | Sample characteristics | Study characteristics | Change outcome variables | Specified eating behaviors | Reasons for eating |
|-----------|-------------------------|------------------------|----------------------|--------------------------|---------------------------|------------------|
| Adams and colleagues, 2020 | United States, April 30-May 23, 2020 | N = 584 parents | Location, dates, design | Study characteristics | Change outcome variables | Specified eating behaviors | Reasons for eating |
| | | 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 | | | | |
| Alhusseini and Alqahtani, 2020 | Riyadh, Saudi Arabia, May 5- May 15, 2020 | N = 2,706 | | | X | X |
| | | Sex: 54.2% female, 45.8% male | | Age: 70.2% 18-35 years | | | |
| | | Race and Ethnicity: 92.2% Saudi, 7.8% non-Saudi | | | | |
| Aljohani, 2020 | Saudi Arabia, Al Madinah city, April-June 2020 | N = 782 | | | X | X |
| | | Gender: 52.2% female, 47.8% male | | Age: 41.9% 31-40 y | | | |
| Almandoz and colleagues, 2020 | United States, Texas, April 15- May 31, 2020 | N = 123 patients with obesity | | | | |
| | | Sex: 87% female, 13% male | | Mean age: 51.2 ± 13 y | | | |

(continued on next page)
| Reference | Location, dates, design | Sample characteristics | Study characteristics | Change outcome variables |
|-----------|-------------------------|------------------------|----------------------|-------------------------|
| Ammar and colleagues, 2020 | Retrospective 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 | Amount of food: X |
| Antunes and colleagues, 2020 | Portugal | N = 1,404 | Gender: 69.6% female, 30.3% male, 0.1% preferred not to specify | Timing of eating: X |
| Bakhsh and colleagues, 2021 | Saudi Arabia | N = 2,255 | Sex: 64% female, 36% male | Types of food eaten: X |
| Bann and colleagues, 2020 | United Kingdom | N = 13,283 | Gender: 49.8% male, 50.2% female | Healthy eating: X |
| Ben Hassen and colleagues, 2020 | Qatar | N = 577 | Gender: 61.39% female, 38.61% male | Specified eating behaviors: X |
| Bin Zarah and colleagues, 2020 | United States | N = 3,133 | Sex: 79.4% female, 19.8% male, 0.8% other | Reasons for eating: X |

(continued on next page)
| Reference                      | Location, dates, design                                      | Sample characteristics | Study characteristics | Change outcome variables |
|-------------------------------|-------------------------------------------------------------|------------------------|-----------------------|--------------------------|
| Błaszczyk-Bębenek and colleagues, 2020 | 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 | Race and ethnicity: 5.1% African American, 2.9% Asian, 84.5% White, 2.8% Hispanic, 0.4% Native American, 4.3% other | Amount of food Frequency of eating Timing of eating Types of food eaten Healthy eating Specified eating behaviors Reasons for eating |
| Buckland and colleagues, 2021 | 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 | | |
| Cancelllo and colleagues, 2020 | 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 | | |
| Carroll and colleagues, 2020 | 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 | | |
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 | Location, dates, design | Sample characteristics | Study characteristics | Change outcome variables |
|-----------|-------------------------|------------------------|-----------------------|--------------------------|
| Celik and Dane, 2020<sup>54</sup> | Nigeria, Turkey, United States, Europe April 25-May 5, 2020 Cross-sectional survey | N = 411 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 Children: N = 310 Mean age: 5.7 y | | |
| Cheikh Ismail and colleagues, 2020<sup>55</sup> | United Arab Emirates April-May 2020 Cross-sectional survey | N = 1,012 Gender: 16.3% women, 73.7% men Age: 20-65 y | | |
| Cheikh Ismail and colleagues, 2021<sup>56</sup> | 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 | | |
| Chenarides and colleagues, 2021<sup>13</sup> | 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 | | |

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| Reference | Location, dates, design | Sample characteristics | Change outcome variables |
|-----------|-------------------------|------------------------|-------------------------|
| Di Renzo, Gualtieri, Cinelli and colleagues, 2020 | Italy April 24-May 18, 2020 Cross-sectional survey | N = 602 Gender: 79.7% female Mean age: 38.2 y | |
| Di Renzo, Gualtieri, Pivari, and colleagues, 2020 | 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 | 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 | 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 | 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 | 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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| Reference                           | Location, dates, design | Sample characteristics | 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      | 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         | Brisbane, Australia; May 12-26, 2020; Longitudinal | N = 84; Race and ethnicity: 32.1% Asian, 9.5% Asian subcontinental, 52.4% Caucasian, 2.4% Multi, 3.6% Other/not disclosed | X               | X                   | X                |                    | X              |                          |                   |
|                                    |                         | 2020 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 | X               | X                   | X                |                    | X              |                          |                   |
|                                    |                         | 2019 males: N = 77; Age range: 19-25 y; Race and ethnicity: 23.4% Asian, 9.1% Asian subcontinental, | X               | X                   | X                |                    |                |                          |                   |

(continued on next page)
| Reference | Study characteristics | Change outcome variables |
|-----------|----------------------|--------------------------|
| Giacalone and colleagues, 2020<sup>65</sup> | Location, dates, design | Amount of food | Frequency of eating | Timing of eating | Types of food eaten | Healthy eating | Specified eating behaviors | Reasons for eating |
| Denmark | April 24-May 5, 2020 Cross-sectional survey | | X | X | X | |
| | N = 2,462 | Gender: 71.1% women, 28.7% men, 0.2% other | |
| | Age: 37.2% 36-50 y | |
| Górnick and colleagues, 2020<sup>66</sup> | 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 | |
| Haddad and colleagues, 2020<sup>67</sup> | Lebanon | April 3-18, 2020 Cross-sectional survey | | | | | | |
| | N = 407 | Gender: 51.3% female, 48.7% male | |
| | Mean age: 30.6 ± 10.1 y | |
| Herle and colleagues, 2021<sup>68</sup> | 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, | |

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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 | Location, dates, design | Sample characteristics | Location, dates, design | Sample characteristics | Study characteristics | Change outcome variables |
|-----------|-------------------------|------------------------|-------------------------|------------------------|-----------------------|-------------------------|
| Huber and colleagues, 2021 | German federal state Bavaria 2 wk during March and April 2020 Cross-sectional survey | N = 1,957 students Sex: 71.5% female, 28.5% male Mean age: 23.3 ± 4.0 y | | | | X |
| Husain and Ashkanani, 2020 | 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 |
| Ingram and colleagues, 2020 | Scotland 5 wk during COVID-19 restrictions in Scotland Cross-sectional survey | 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 | 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 | 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 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 | Location, dates, design | Sample characteristics<sup>a</sup> | 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<sup>74</sup> | Turkey, April 15-30, 2020 Cross-sectional survey | N = 1,012 Gender: 81.7% female, 18.3% male Mean age: 28.3 ± 8.7 y | X | X |
| Khubchandani and colleagues, 2020<sup>75</sup> | 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<sup>76</sup> | 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 | |
| Lamarche and colleagues, 2021<sup>77</sup> | 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<sup>78</sup> | 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<sup>79</sup> | 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 |

<sup>a</sup>Sample characteristics include age, gender, and race/ethnicity.
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                              | Location, dates, design                        | Sample characteristics | Study characteristics | Change outcome variables |
|----------------------------------------|------------------------------------------------|------------------------|-----------------------|--------------------------|
| Malta and colleagues, 2020             | Brazil April 24-May 24, 2020 Cross-sectional survey | N = 45,161             | Sex: 53.6% female, 46.4% male  | Amount of food: X         |
|                                        |                                                | Age: 24.7% aged 18-29 y |                       | Frequency of eating: X    |
| Marty and colleagues, 2021             | France April 30-May 1, 2020 Cross-sectional survey | N = 938                | Gender: 78.5% female, 21.5% male  | Timing of eating: X       |
|                                        |                                                | Mean age: 38.7 ± 11.6 y |                       | Types of food eaten: X    |
| Matsungo and Chopera, 2020             | Zimbabwe May 11-25, 2020 Cross-sectional survey | N = 507                | Gender: 63.0% female, 37.0% male  | Healthy eating: X         |
|                                        |                                                | Age: 48.1% aged 31-40 y |                       | Specified eating behaviors: X |
| Murphy and colleagues, 2021            | Island of Ireland, Great Britain, United States, and New Zealand May-June 2020 Cross-sectional survey | N = 538                | Gender: 87.5% female, 12.5% male  | Reasons for eating: X     |
|                                        |                                                | Mean age: 35.9 ± 12.5 y |                       |                          |
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 | 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<sup>84</sup> | 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 | X | X | X | X | X |
| Papandreou and colleagues, 2020<sup>85</sup> | 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 | X | X |
| Pellegrini and colleagues, 2020<sup>86</sup> | 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 | X |
| Pham and colleagues, 2020<sup>87</sup> | Vietnam February 14-May 31, 2020 Cross-sectional survey | N = 8,291 Gender: 53% women, 41% men Age: 43.6 ± 16.9 y | X | X | X | X | X | X |
| Phillipou and colleagues, 2020<sup>88</sup> | 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 | 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                  | Location, dates, design                  | Sample characteristics | Study characteristics | Change outcome variables |
|----------------------------|------------------------------------------|------------------------|-----------------------|--------------------------|
| Poelman and colleagues, 2021<sup>99</sup> | Netherlands, April 22-May 5, 2020 Cross-sectional survey | male, Mean age: 49.9 ± 17.0 y |                       | Amount of food Frequency of eating Timing of eating Types of food eaten Healthy eating Specified eating behaviors Reasons for eating |
| Puhl and colleagues, 2020<sup>90</sup> | 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<sup>91</sup> | 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-Olavarria and colleagues, 2020<sup>92</sup> | Chile, 8 wk: May-June, 2020 Cross-sectional survey | N = 700, Sex: 75.4% women, 24.6% men, Median age: 31 y |                       | X | X |
| Robertson and colleagues, 2021<sup>93</sup> | 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<sup>94</sup> | 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 |
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                              | Location, dates, design | Sample characteristics | Study characteristics | Change outcome variables |
|----------------------------------------|-------------------------|------------------------|-----------------------|-------------------------|
| Robinson and colleagues, 2020          | United Kingdom, April 19-22, 2020 | N = 723 Gender: 67% female Mean age: 30.7 ± 9.6 y Race and ethnicity: 80% White, 20% non-White | N = 723 |          |
| Rodríguez-Pérez and colleagues, 2020   | Spain, March 20- April 10, 2020 | N = 7,514 Gender: 71% female, 29.3% male, 0.7% other gender Age: 92% 31-65 y | N = 7,514 |          |
| Rolland and colleagues, 2020           | France, March 25-30, 2020 | N = 11,391 Gender: 52.1% female, 47.5% male, 0.4% other Mean age: 47.5 ± 17.3 y | N = 11,391 |          |
| Rossinot and colleagues, 2020          | France, April 23-May 7, 2020 | 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 | N = 1,454 |          |
| Sánchez-Sánchez and colleagues, 2020   | Spain, May 2020 | N = 385 Gender: 72.8% female, 27.2% male Age: 38.7 ± 12.4 y | N = 385 |          |
| Scarmozzino and Visioli, 2020          | Italy, April 3-15, 2020 | N = 1,929 Sex: 67% female, 32.9% male, 0.1% not answered | N = 1,929 |          |

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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 | Location, dates, design | Sample characteristics | Change outcome variables |
|-----------|-------------------------|------------------------|--------------------------|
| Sharma and colleagues, 2020 | United States: Houston; Dallas; Washington, DC; and southwest Florida | N = 1,048 Age: 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 | X |
| Sidor and Rzymski, 2020 | Poland | N = 1,097 Gender: 95.1% female, 4.9% male Mean age: 27.7 ± 9.0 y | X |
| Şimsek and Şen, 2020 | Turkey | N = 397 Gender: 39.8% female, 60.2% male Age: 40.3% aged 36-50 y | X |
| Sutaria and colleagues, 2020 | India | N = 422 Sex: 56.4% female, 43.6% males Age: 83.9% aged 20-50 y | X |
| Wang and colleagues, 2020 | China | N = 2,289 Sex: 48.6% female, 51.4% male Mean age: 27.5 ± 12.0 y | X |
| Werneck and colleagues, 2020 | Brazil | Without depression: N = 35,042 Sex: 50.8% women, 49.2% men Age: 48.2% aged 18-39 y With depression: | X |

(continued on next page)
### 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,     |                          | Amount | Frequency | Timing of | Types of | Healthy | Specified | Reasons |
|           | design                |                          | of food | of eating | of eating | food eaten | eating   | eating    | for eating |
| Yilmaz and colleagues, 2020<sup>107</sup> | Turkey, April 5-6, 2020 | Cross-sectional survey | N = 6,881 | Sex: 68.2% women, 31.8% men | Age: 51.8% aged 18-39 y | X | X | |
| Zeigler and colleagues, 2020<sup>108g</sup> | United States, Not specified | Cross-sectional survey | N = 866 students | Sex: 78.2% female, 21.8% male | Mean age: 21.2 ± 1.4 y | X | | |
| Zhang and colleagues, 2020<sup>109</sup> | 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 | |

<sup>a</sup>Some 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.

<sup>b</sup>References with publication dates of 2021 were made available in the year 2020.

<sup>c</sup>Gallo and colleagues<sup>64</sup> 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.

<sup>d</sup>Ingram and colleagues<sup>71</sup> 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.

<sup>e</sup>Rodríguez-Pérez and colleagues<sup>96</sup> 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.

<sup>f</sup>The original reporting by Scarmozzino and Visioli<sup>100</sup> did not include an age category that contained age 20 years.

<sup>g</sup>Study dates for Zeigler and colleagues<sup>108</sup> 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/NC/I                                    | 2,255             | NC: 878 (38.9)                  |
|                                  |                                                                                 |                   | I: 894 (39.6)                   |
|                                  |                                                                                 |                   | D: 483 (21.4)                   |
| Blaszczyk-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               | NC: 141 (25.2)                  |
|                                  |                                                                                 |                   | I: 268 (48.0)                   |
|                                  |                                                                                 |                   | D: 150 (26.8)                   |
| Cencello 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               | 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: 1,229 (51.6)                |
|                                  |                                                                                 |                   | I: 816 (34.3)                   |
|                                  |                                                                                 |                   | D: 336 (14.1)                   |
| Huber and colleagues, 2021 59    | M/I: “How has your diet changed since implementation of lockdown? Overall food amount” RO: Less/Unchanged/More | 1,957             | NC: 1,019 (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      | Spain:                           |
|                                  |                                                                                 | Greece: 839       | 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)                  |

(continued on next page)
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.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

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 and RO | Study sample size | Findingsc |
|-----------|------------|--------------------|------------|
| Pellegrini and colleagues, 202086 | 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, 202189 | 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, 202091 | 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, 202092 | M/I: Perceived amount of food consumedf 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 colleagues85 | | 12,560 | NC: 6,168 (49.1) I: 4,194 (33.4) D: 2,198 (17.5) |

*M/I = measure/item. 
RO = response option. 
Findings are reported as n (%). 
*D = decrease in amount of food consumed. 
NC = no change in amount of food consumed. 
I = increase in amount of food consumed. 
The 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. 
In Cancello 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. 
Reyes-Olavarría and colleagues92 reported the measure variable as “Among of consumption food, perception.”

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| Reference                  | M/I and RO                                                      | 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[13] | 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. |
| Giacalone 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 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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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. 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 pandemic compared with normal periods.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. Two studies used validated measures of energy intake. One found that on average, French participants reported eating significantly more (3.235 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. Lastly, Herle and colleagues48 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.88

### 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. 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. 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...

| Reference | M/I<sup>a</sup> and RO<sup>b</sup> | Finding |
|-----------|----------------------------------|---------|
| Kriaucioniene and colleagues 2020<sup>76</sup> | M/I: “Perception of eating more during the quarantine” RO: Yes/No | 50.6% No 49.4% Yes |
| Marty and colleagues 2021<sup>81</sup> | 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<sup>100</sup> | 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 Rzymski, 2020<sup>102</sup> | 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 |

<sup>a</sup>M/I = measure/item.
<sup>b</sup>RO = response options.

<sup>c</sup>Chenarides and colleagues<sup>13</sup> 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.

<sup>d</sup>The original item reflected in Herle and colleagues<sup>68</sup> was “Over the past week have you eating more than usual?”

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**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.

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| Reference                                      | M/I and RO | Findings                                                                 |
|-----------------------------------------------|------------|---------------------------------------------------------------------------|
| Aljohani, 202042                              | M/I: “In the occurrence of having an increase in your food intake, how many meals do you consume a day?” RO: 4-5 meals/6-7 meals/More than 7 meals M/I: “Have you started eating light meals after dinner (during the lockdown period)” RO: Yes/No/Sometimes | 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. Percent reporting light meals after dinner 47.9% started eating during lockdown 41.3% did not start eating during lockdown 10.7% started eating sometimes during lockdown |
| Ammar and colleagues, 202044                  | Both measured as before and after lockdown M/I: “How likely are you to have a snack between meals or a late-night snack?” RO: Never/Sometimes/Most of the time /Always M/I: “How many main meals do you eat a day?” RO: 1-2/3/4/5/more than 5 | Percentage of people reporting having a snack between meals or a late-night snack: Never: 19.77% before; 14.71% during Sometimes: 59.41% before; 45.56% during Most of the time: 13.85% before; 24.36% during Always: 6.97% before; 15.38% during Overall, there was a significant increase in snacking between meals or late-night (P < 0.001). Percentage of respondents reporting eating certain numbers of main meals: 1-2 meals: 35.15% before; 29.99% during 3 meals: 55.11% before; 46.42% during 4 meals: 6.59% before; 14.52% during 5 meals: 2.39% before; 6.30% during More than 5 meals: 0.76% before; 2.77% during There was a significant increase in the number of meals eaten |
| Antunes and colleagues, 202045                | M/I: “Do you feel you eat more often than usual?” RO: Yes/No | 45.2% reported a higher food frequency 54.8% reported their food frequency was not higher |
| Ben Hassen and colleagues, 202048             | M/I: Change of food-related activities during the COVID-19 pandemic. Eating between meals (eg, snacks) RO: Never /First time /Much less /Slightly less/About the same /Moderately more /Much more | Percent of respondent reporting on snacking between meals: 4.7% reported never snacking 0.50% reported their first time snacking 6.8% reported snacking much less 7.3% reported snacking slightly less 45.5% reported snacking about the same 23.3% reported snacking moderately more 12% reported snacking much more |
| Blaszczynski-Bebenek and colleagues, 202050   | Survey questions were adapted from the Dietary Habits and Nutrition Beliefs | Percentage of people reporting eating certain numbers of main meals before |

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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 |
|-----------|--------------------------|----------|
| **Questionnaire for people aged 15-65 y\(^{111}\)**<br>M/I: “How many meals do you usually consume daily?”<br>RO: 1 meal per day/2 meals per day/3 meals per day/4 meals per day/5+ meals per day<br>M/I: How often do you snack between the meals?<br>RO: Not listed or Never/1-3 times per month/Once per week/Few times per week/Once per day/Few times per day | and after lockdown:<br>1 meal/d 0.6% before; 0.3% after (0.3% decrease)<br>2 meals/d 7.1% before; 4.8% after (2.3% decrease)<br>3 meals/d 32.1% before; 23.1% after (9% decrease)<br>4 meals/d 40.4% before; 40.7% after (0.3% increase)<br>5 meals+/d 19.9% before; 31.1% after (11.2% increase)<br>The increase in 5+ meals/d was significant (<i>P < 0.001</i>)<br>72.8% before and 77.9% during reported they regularly snacked (few times per week and more), This was a significant increase (<i>P = 0.0001</i>)<br>**Cheikh Ismail and colleagues, 2020\(^{55}\)** | **Percentage of respondents reporting eating certain numbers of main meals:**<br>1-2 meals: 46.4% before; 36.5% during<br>3-4 meals: 51.5% before; 56.5% during<br>5+ meals: 2.1% before; 7.0% during<br>The increase in 5+ meals/d was significant (<i>P < 0.001</i>)<br>**Cheikh Ismail and colleagues, 2021\(^{56}\)** | **Percentage of respondents reporting eating certain numbers of main meals:**<br>1-2 meals: 45.6% before; 37.5% during<br>3-4 meals: 52.2% before; 56.2% during<br>5+ meals: 2.2% before; 6.2% during<br>The increase in 5+ meals/d was significant (<i>P < 0.001</i>)<br>**Di Renzo, Gualtieri, Pivari and colleagues, 2020\(^{58}\)** | 57.8% did not change their number of daily meals<br>17.5% skipped a meal or snack<br>23.5% introduced a meal or snack<br><br>**Flanagan and colleagues, 2021\(^{52}\)** | 25.8% reported an increase in healthy snacking<br>43.5% reported an increase in unhealthy snacking<br><br>**Flanagan and colleagues, 2021\(^{52}\)** | **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**<br>The optional long form was a modification of the Rapid Eating Assessment\(^{12}\) | **(continued on next page)**

*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 and RO | Findings                                                                 |
|-------------------------------|------------|---------------------------------------------------------------------------|
| Gallo and colleagues, 2020⁶⁴  | 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) |
| Giacalone and colleagues, 2020⁶⁵ | 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, 2020⁷⁰  | 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, 2020⁷⁹ | 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, 2020⁸⁵ | M/I: The Dutch Eating Behaviour Questionnaire¹¹³ 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, 2020⁸⁶  | 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” |

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/I² and RO² | Findings |
|-----------|-------------|----------|
| Poelman and colleagues, 2021⁸⁹ | 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).<br>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) | 14.2% ate more frequently<br>22.1% reported eating more sweets and snacks |
| Robinson and colleagues, 2021⁹⁴ | M/I: “Compared to before the COVID-19 lockdown in the United Kingdom, I have: Eaten large meals or snacks”<br>RO: A lot less/Less/A little less/The same amount/A little more/More/A lot more<br>M/I: “Compared to before the COVID-19 lockdown in the United Kingdom, I have: Snacked”<br>RO: A lot less/Less/A little less/The same amount/A little more/More/A lot more | Compared with before lockdown:<br>3% ate a lot less large meals or snacks<br>8% ate less large meals or snacks<br>10% ate a little less large meals or snacks<br>34% ate the same amount of large meals or snacks<br>26% ate a little more large meals or snacks<br>14% ate more large meals or snacks<br>4% ate a lot more large meals or snacks.<br>5% snacked a lot less<br>8% snacked less<br>10% snacked a little less<br>22% snacked the same amount<br>27% snacked a little more<br>21% snacked more<br>8% snacked a lot more |
| Sidor and Rzymski, 2020¹⁰² | M/I: “Indicate the number of meals eaten per day during quarantine”<br>RO: 1/2/3/4/5/6 or more<br>M/I: “Did you snack more frequently than usual during quarantine?”<br>RO: decidedly yes /yes/hard to decide/ no/ decidedly no”<br>M/I: “Indicate the number of snacks eaten per day during quarantine”<br>RO: None/1/2/3/4 or more | 51.8% snacked between meals more frequently<br>Most frequent number of meals per day during quarantine:<br>3 (30.3%)<br>4 (39.3%)<br>Most frequent number of snacks per day during the quarantine:<br>1 (28.3%)<br>2 (36.1%) |
| Wang and colleagues, 2020¹⁰⁵ | 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]<br>Translated:<br>M/I: “Your staple food intake during the pandemic compared to before the pandemic”<br>RO: Increase/Reduce/No significant changes | 23.1% reduced their daily eating frequency<br>17.3% increased their daily eating frequency, and 60% reported no changes in eating frequency |

*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.\textsuperscript{55,58,70,85,105,107} For example, the majority of cross-sectional study participants in Turkey (71%),\textsuperscript{107} China (60%),\textsuperscript{105} and Italy (58%)\textsuperscript{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.\textsuperscript{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 \((t = −5.83; P < 0.001; \; d = 0.22)\).\textsuperscript{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.\textsuperscript{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%).\textsuperscript{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.\textsuperscript{98} 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.\textsuperscript{45}

### Snacks

Across the 12 studies that assessed snacking frequency,\textsuperscript{44,48,50,62,64,65,85,86,89,94,102,107} most found that individuals either reported an increase\textsuperscript{44,50,86,94,102} or no change\textsuperscript{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),\textsuperscript{94} 51.8% of a sample from Poland,\textsuperscript{102} and 32.7% of a sample from Italy (28.0% indicated they do not consume snacks usually, and 28.0% reported no change).\textsuperscript{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 \((t = −6.89; P < 0.001; \; d = 0.30)\).\textsuperscript{44} Further, whereas studies from Turkey,\textsuperscript{107} Denmark,\textsuperscript{65} and Qatar\textsuperscript{46} 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.\textsuperscript{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.\textsuperscript{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

### Table

| Reference | M/I\textsuperscript{a} and RO\textsuperscript{b} | Findings |
|-----------|----------------------------------|----------|
| Yilmaz and colleagues, 2020\textsuperscript{107} | M/I: Main meal in COVID-19 pandemic RO: Increased/Not changed/Decreased M/I: Snacks in COVID-19 pandemic RO: Not changed/Increased/Decreased M/I: Mean meal [daily number of meals consumed before the COVID-19 pandemic] RO: 1/2/3 M/I: Snacks [daily number of snacks consumed before the COVID-19 pandemic] RO: 1/2/3 | 71% no change in the number of main meals 23% increased number of main meals 6% decreased in the number of main meals 57.5% no change in the number of snacks 38% increased the number of snacks 4.5% decreased the number of snacks 58.3% consumed two main meals per day and 43.9% consumed 1 snack before COVID-19 During COVID-19, 23.0% reported an increase in the number of meals and 38.0% an increase of snacks |

\textsuperscript{a}M/I = measure/item.  
\textsuperscript{b}RO = response options.  
\textsuperscript{c}The 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.
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.35,80,104 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 colleagues50 and Poelman and colleagues50 both included measures of meal timing but did not explicitly ask their participants how they modified their meal schedules. As previously mentioned, Papandreou and colleagues50 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,13,46,47,48,53,78,82,86,92,101,106 whereas 20 studies examined fruits separately from vegetables.89,50,51,54,58,62,65,66,69,70,73,76,77,80,82–84,86,99,100 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),35,51,65,66,69,76,82,96,107 seven of these 12 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,59,76,96,107 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,54,62,70,81,95 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, increased, decreased, or remained the same).35,51,65,66,69,76,82,96,107 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 pandemic55,66,69,76,96,107 with the second most frequently reported option being increased consumption (17% to 40.5%) in four studies.59,76,96,107 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 consumption51,77 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
| Reference | M/I and RO | Frozen food | Dairy products | Homemade foods | Legumes | Breads/grains | Meats |
|-----------|------------|-------------|----------------|----------------|---------|---------------|-------|
| Alhusseini and Alqahtani, 2020<sup>41</sup> | 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?” | N/A<sup>1</sup> | N/A | Significant increase ($P < 0.001$) | N/A | N/A | N/A |
| Bakhsh and colleagues, 2021<sup>46</sup> | M/I: How has your consumption of the following foods changed during the pandemic: dairy products, meat, fish, poultry? | N/A | I = 26% | U = 12% | D = 62% | N/A | N/A | Meat/fish/poultry: I = 34% U = 57% D = 9% |
| Ben Hassen and colleagues, 2020<sup>48</sup> | 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% | 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<sup>49</sup> | 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 | 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 = 19.9% U = 63.7% D = 16.4% | Processed meat: I = 19.9% U = 63.7% D = 16.4% |

<sup>1</sup>N/A: Not applicable
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                                                                 |
|-----------------------------------|-------------------------|----------------------------------------------------------------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------|------------------------------------------------------------------------|----------------|---------------------------------------------------------------------|
| Blaszczyk-Bebenek and colleagues, | 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 | 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 | 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% |
| Celik and Dane, 2020$^{14}$       | 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 | 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 | Meat general: Before = 29.2% During = 22.9% | (continued on next page)
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/Ia and ROb | Frozen food | Dairy products | Homemade foods | Legumes | Breads/grains | Meats |
|----------------------------------|--------------|-------------|----------------|----------------|---------|---------------|-------|
| Cheikh Ismail and colleagues, 2020 | M/I: What meal types were your most consumed meals both before the pandemic and during the pandemic? | 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 | M/I: What meal types were your most consumed meals both before the pandemic and during the pandemic? | No significant change | N/A | Significant increased consumption ($P < 0.001$) | N/A | N/A | N/A |
| Chenarides and colleagues, 2021 | 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…” | 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 | M/I: “During this [quarantine] period, which of these foods are you consuming MORE 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 = 4.7% Increased intake = 15.3% | Reduced intake = 9.3% Increased intake = 15.3% | Fresh bread: Reduced intake = 12.7% Increased intake = 13.3% | Preserved 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<sup>a</sup> and RO<sup>b</sup> | 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…” | N/A | N/A | Homemade Pastries: I = 7.1% | N/A | N/A | White meat: Reduced intake = 4.7% Increased intake = 12.0% |
| Giacalone and colleagues, 2020<sup>65</sup> | M/I: How has your consumption of the following foods changed during the pandemic:…red meat, legumes… pastries (homemade)…? RO: Higher, Lower, or As before | N/A | N/A | I = 38.1% | U = 84.4% | I = 11.5% | U = 76.2% |
| | | | U = 53.8% | D = 8.1% | | D = 12.3% |
| Górnick and colleagues, 2020<sup>66</sup> | 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…? RO: “I eat more/I eat the same/I eat less/I didn’t eat before and during the pandemic” | N/A | I = 20.8% | U = 71.0% | D = 8.2% | | E | |
| | | | I = 39.9% | U = 51.1% | D = 9.0% | | |
| | | | I = 48.0% | U = 48.8% | D = 3.1% | | |
| Huber and colleagues, 2021<sup>69</sup> | M/I: How has your consumption of the following foods changed during the pandemic:…Bread, Meat, Dairy…? RO: Increased, Decreased, or Unchanged | N/A | I = 25% | U = 58.5% | D = 16.5% | | N/A |
| | | | N/A | N/A | | Meat general: I = 16% |
| | | | | | | |
| Husain and Ashkanani, 2020<sup>70</sup> | 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% | |
| | | | Before: Other = 2.4% | White = 42.9% | Brown/brown seeds = 44.1% | Whole wheat = 9.4% | 3-4/wk = 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<sup>a</sup> and RO<sup>b</sup> | Frozen food | Dairy products | Homemade foods | Legumes | Breads/grains | Meats |
|-----------|-----------------------------------|-------------|----------------|----------------|---------|--------------|-------|
|           | M/I: What type of milk do you consume most frequently? |     | Almond milk = 5.1% | Seeds = 0.0% | 5-6/w = 0.5% |
|           | RO: "None/whole milk/semi-skimmed/skimmed/soy milk/almond milk/other (rice/goat milk)/do not know" |     | Other (rice/goat) = 2.7% | None = 1.2% | 7 or more = 0.0% |
|           | M/I: What type of bread do you consume most frequently? |     | During: None = 23.9% | During: Other = 1.7% | I don’t know = 1.0% |
|           | RO: "Other/white/brown or brown seeds/ whole wheat/ [nonbrown] seeds/none" |     | Whole milk = 30.8% | White = 48.0% | During: Never = 69.4% |
|           |                                       |     | Semi-skimmed = 24.8% | Brown/brown seeds = 39.5% | Less than 1/w = 16.1% |
|           |                                       |     | Skimmed = 11.3% | Whole wheat = 9.6% | 1-2/w = 7.0% |
|           |                                       |     | Soy milk = 1.2% | Seeds = 0.0% | 3-4/w = 5.1% |
|           |                                       |     | Almond milk = 3.6% | None = 1.2% | 5-6/w = 1.0% |
|           |                                       |     | Other (rice/goat) = 3.1% | I don’t know = 1.2% | 7 or more = 0.2% |
|           |                                       |     |                                | Red meat: | I don’t know = 1% |
|           |                                       |     |                                | 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 |
|-----------|-----------------------------|-------------|---------------|----------------|---------|--------------|-------|
| Kansiime and colleagues, 2021 \(^{20}\) | 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 | 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% |
| Kriaucioniene and colleagues, 2020 \(^{19}\) | M/I: How has your consumption of the following foods changed during the | N/A | N/A | N/A | N/A | N/A | Red meats, hamburgers, sausages: |
| | | | | Homemade pastries such as cookies, custards, sweets, | Pulses: I = 9.1% | | |

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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<sup>a</sup> and RO<sup>b</sup>                                                                 | Frozen food                  | Dairy products                                                                 | Homemade foods                                                                 | Legumes                                                                 | Breads/grains                                                                 | Meats                                                                 |
|-----------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Lamarche and colleagues, 2021<sup>77</sup> | M/I: Which of the following foods did you eat in the last 24 hours?                              | N/A                         | Total diary:                                                                  | N/A                                                                            | N/A                                                                  | N/A                                                                            |                                                        |
|                                   | RO: Higher, Lower, or As usual                                                                     |                             | Significant increased consumption                                               |                                                                                |                                                                     |                                                                                |                                                        |
| Malta and colleagues, 2020<sup>77</sup>   | M/I: “Before the pandemic how many days a week did you usually eat any of the following foods: beans, frozen food...?”<br>“During the pandemic, how frequently do you eat these foods now?”<br>RO: “5 days or more; 2 to 4 days; 1 day or less” | Frozen food more than 2 d: | Before = 10.0%<br>During = 14.6%                                             |                                                                                |                                                                     |                                                                                |                                                        |
| Matsungo and Chopera, 2020<sup>82</sup>   | M/I: How has your consumption of the following foods changed during the pandemic: Meat and Meat Groups.<br>Cereal Breads and Tubers.<br>Dairy Products.<br>Pulses/legumes...?<br>RO: “1=less/decreased, 2=same/did not change, 3=more/increased, or 4=not applicable” | N/A                         | I = 8.3%<br>U = 41.7%<br>D = 45.9%                                          |                                                                                | I = 16.7%<br>U = 37.5%<br>D = 33.4%                                      | Cereal, breads, and tubers:<br>Meat General:<br>I = 8.3%<br>U = 45.9%<br>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                                                    |                                                                                | Legumes, nuts, and seeds:<br>Significant increased                     | Cereals: No significant change<br>Organ meat:<br>Significant decreased     |                                                        |
|                                   |                                                                                                  |                             |                                                                                |                                                                                |                                                                     |                                                                                |                                                        |

<sup>a</sup> M/I: Reference study question and response format.

<sup>b</sup> RO: Reference study question and response format.
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/Ia and ROb | Frozen food | Dairy products          | Homemade foods | Legumes | Breads/grains | Meats |
|----------------------------------|--------------|-------------|-------------------------|----------------|---------|---------------|-------|
|                                     |              |             | significant change     |                |         |               |       |
| Pellegrini and colleagues, 2020   | 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% | N/A | N/A | Protein (meat, fish, eggs, cheese, legumes): Don’t consume = 0.7% I = 27.3% U = 54% D = 18% |
| Reyes-Olavarría and colleagues, 2020 | 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 | 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                     | I= 15% U = 78% D= 8% | N/A | N/A | Red meat: I = 8% U = 68% D = 24% |
| Sánchez-Sánchez and colleagues, 2020 | 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 butter, margarine, or cream: significant increased consumption (P < 0.001) | N/A          | Butter, margarine, or cream: significant increased consumption (P < 0.001) | N/A | N/A | Significant increased consumption (P < 0.001) | N/A | Red meat, hamburger, sausages, or cold meat: Significant increased consumption (P < 0.001) |
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 |
|-------------------------------|--------------------------|-------------|----------------|----------------|---------|---------------|-------|
|                               |                          | N/A         | I = 41.0%      | N/A            | N/A     | N/A           | N/A   |
|                               |                          | U = 58.5%   | D = 0.5%       |                |         |               |       |
| Yilmaz and colleagues, 2020   | 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           | Frozen food: |                |                |         |               |       |
|                               |                          | I = 19%     |                |                |         |               |       |
|                               |                          | U = 40%     |                |                |         |               |       |
|                               |                          | D = 41%     |                |                |         |               |       |
|                               |                          | Imported frozen food: | I = 3.3% |                |         |               |       |
|                               |                          |              | U = 40%        |                |         |               |       |
|                               |                          |              | D = 57%        |                |         |               |       |

\(^a\)M/I = measure/items.
\(^b\)RO = response options.
\(^c\)N/A = not available.
\(^d\)I = increased intake.
\(^e\)D = decreased intake.
\(^f\)U = no change in intake.

Findings 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.\(^{82}\)

Studies where values were estimated from a figure.
Brazil reporting decreases,20,73,80 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.3,50,66,77 Studies based in Poland and the United States found that the highest portion (59.3% to 72.3%) of participants reported no change in their consumption of grains and whole grains.13,3,56 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).50,58,84,86 Two studies from Iran and Italy found that consumption of cereals did not change.50,86 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.56 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%).45 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.13,46,48,69,82 The second most common response for studies in Saudi Arabia46 and Italy48 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%)75 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.50,58,65,66,70 When consumption did change, there were both increases49,50,70 and decreases58,66 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/Uganda49,70,73 examined how the consumption of poultry products changed during the pandemic, with results indicating no change or decreases in consumption.70,73 58

Of the more specified measures of meat consumption, no change in intake was the most common response for low-fat meats (Poland),52,66 “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.59 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.49,50,58,65,66,73,76,77,84,96,99 When consumption did change, it tended to decrease (14.3% to 21%).50,65,66,76,96 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.50,58,65,66,76,82,96,107 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 study\textsuperscript{109} from China and five cross-sectional studies\textsuperscript{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\textsuperscript{55,109} or no change in intake.\textsuperscript{13,48,55} 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.\textsuperscript{80}

Fast Food. Ten studies examined how the consumption of fast food changed during the pandemic.\textsuperscript{13,50,53,55,56,62,65,66,76,96} Overall, consumption tended to remain the same\textsuperscript{65,66,76,96} or decrease\textsuperscript{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.\textsuperscript{53}

Homemade Foods. Eight studies examined changes in consumption of homemade foods during the pandemic.\textsuperscript{41,55,56,65,66,76,94,96} 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).\textsuperscript{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).\textsuperscript{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%).\textsuperscript{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.\textsuperscript{65,66,76} Further, in a study out of Italy, more participants reported increased than decreased consumption of both homemade sweets and homemade pizza.\textsuperscript{58}

Snack Food. Eighteen studies assessed how the consumption of snack foods changed during the pandemic.\textsuperscript{46,48,49,51,53,58,64,65,66,76,80,85,86,91,96,100,107,109} One longitudinal\textsuperscript{84} and eight cross-sectional\textsuperscript{46,53,65,76,85,86,107} 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)\textsuperscript{59,66} and one study from Italy assessed salty and sweet snacks together.\textsuperscript{100} In the three studies, most participants (49.6% to 62.2%) reported that their consumption of salty snacks was unchanged.\textsuperscript{49,66,100} The second most common response was increased consumption (23.5% to 37.4%) in the studies from Italy\textsuperscript{100} and the United States\textsuperscript{49} and decreased consumption (19.7%) in the study from Poland.\textsuperscript{66} One study asked only about increased consumption with 21% of respondents from the United Arab Emirates reporting increased salty snack intake.\textsuperscript{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%).\textsuperscript{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.\textsuperscript{51,80} Two studies found the highest proportion of participants (40% to 49%) reported no change in consumption\textsuperscript{46,51} with the second highest portion of participants reporting increased consumption (28%) in the United Kingdom\textsuperscript{41} and equal portions reporting decreased consumption (30%) and increased consumption (30%) in Saudi Arabia.\textsuperscript{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%).\textsuperscript{30}

Two studies measured changes in consumption of sweet snacks (ie, chocolate, biscuits, cakes, ice cream, cupcakes, and cookies).\textsuperscript{51,121} 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.\textsuperscript{51} Another study from United Arab Emirates found that only 7.1% of participants reported consuming more sweet snacks during vs before the pandemic.\textsuperscript{91}

One study from Qatar assessed snack consumption as the change in intake for both healthier snack foods and unhealthful snacks and found the largest portion of participants (41.1% to 57.7%) reported no change in consumption regardless of healthfulness.\textsuperscript{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%).\textsuperscript{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.\textsuperscript{46,48,49,50,54,58,62,65,66,69,76,77,80,84,85,86,91,96,99,100} 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).\textsuperscript{46,48,49,50,58,62,80,84,86,100} Studies from Saudi Arabia,\textsuperscript{46} Poland,\textsuperscript{50} Brazil,\textsuperscript{80} Italy,\textsuperscript{86} and a large international sample (United States/United Kingdom/Australia/Canada/other)\textsuperscript{121} 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. Studies from Qatar and Italy 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 study and increased (42.5%) for the other. Finally, one study from Iran found that there was a significant decrease in sweets consumption 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.

Five studies based in Denmark, Poland, Spain/Greece, Spain, and Lithuania assessed changes in the consumption of pastries during the pandemic. For most participants (55.2% to 60.6%) consumption was unchanged. 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. When consumption did change there were both reported increases and decreases.

Two studies from an international sample (Nigeria/Turkey/United States/Europe) and Spain 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 with before (20%). The other study found a significant increase in the consumption of bakery foods during the pandemic.

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

Two studies assessed more specified measures of sweets and/or bakery products. 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%). In addition, one study from Canada found a significant decrease in the consumption of added sugars.

Healthy Eating
A total of 21 studies addressed changes in the healthiness of food eaten during the pandemic. 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?”). The most common finding was no change in the healthiness of foods eaten. When the second most common responses are considered for studies that had predominately no-change responses, results are almost equally divided 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. Concordantly, studies from Italy and France found the second most common response behind no change (47% and 54%, respectively) was improved diet quality (34%) and a more balanced diet (29%). However, the second most common response in a study from Italy was a worsening in eating habits (37.2%) and one large international study found more participants reported eating less healthfully (35.6%) than more healthfully (20.7%).

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). Similarly, a study from Vietnam found that 42.8% of respondents reported eating healthier in 2020 than before the pandemic. 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. A study from Scotland showed 40.9% of respondents reported their diet was less healthy in 2020 than it was prepandemic and 61.2% of participants from a US study reported greater challenges in adhering to healthy diet plans during the pandemic relative to before. 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. 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 Kingdom and United States 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. 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. 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. 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. 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. 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).
whereas studies from France and Vietnam showed a significant decrease in healthy eating compared with before lockdown ($P < 0.001$). 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.

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, 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, we see four studies measuring binge eating used full validated measures, whereas studies from France and Vietnam showed a significant decrease in healthy eating compared with before lockdown ($P < 0.001$). 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.

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, we see four studies measuring binge eating used full validated measures, whereas studies from France and Vietnam showed a significant decrease in healthy eating compared with before lockdown ($P < 0.001$). 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.

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. Four articles specifically discussed binge eating and found that it generally increased or remained the same during the pandemic. 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). 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).

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 pre-pandemic weight stigma. 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.

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.

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. A total of four articles included uncontrolled eating as a reported measure of eating behavior change during the pandemic. 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). Similarly, two studies from Turkey found increases in uncontrolled eating behavior compared with before COVID-19: 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). 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.

Overeating. Two articles discussed overeating. 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. 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.

Restrictive Eating. Six studies assessed changes in restrictive eating (outside of meal skipping) during the COVID-19 pandemic with mixed results. 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 Australia and a decrease (28%) of restricted eating in the study from the United States. In one study from Turkey, cognitive restraint decreased during the pandemic, and in another study, 9.1% of adults from Turkey reported increased restrained eating during the pandemic.

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.69 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.40,43,55,56,58,70,73,74,75,54 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.5455 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%).5556 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 ± 2.3 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.33 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%).5556

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.40,43,51,53,55,56,70,73,74,75,61,63,67,70,72,73,74,81,84,86,89,90,93,94,97,98,100,103,108

One’s reasons for changes in eating behaviors can be related to psychological, social, and emotional states,118119 of which have been altered during the COVID-19 pandemic.97 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 and longitudinal 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.73 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.73

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),61,87,98 Turkey (n = 1),74 Lebanon (n = 1),67 the United States (n = 1),94 the United Kingdom (n = 1),93 and Italy (n = 3)63,74,100 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.93

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.93 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.94 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.63 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 during
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), France (n = 3), 63,73,84,85,86 Kuwait (n = 1), 70 Poland (n = 1), 72 and the Netherlands (n = 1) 108 investigated stress and found increases in stress eating 43,108 feelings of stress managed by eating, 63,90 the percentage of participants reporting eating in response to stress, 72 and specific eating behaviors (e.g., binging, restricted eating) related to stress. 63,73 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 and the amount of food eaten in response to stress. 104 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 food 57 and negative changes in diet nutrition. 56 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 Kuwait 70 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. 79

**Boredom.** Five studies found boredom to be a strong influence on eating behaviors during the COVID-19 pandemic. 67,70,86,85,108 For example, one study from Italy found that boredom was a main reason for changes in eating behaviors 86 and in another study from the United States, 73% of adults reported eating more when bored. 108 Studies from the Netherlands 89 and Lebanon 57 found that boredom was linked to increased eating concern 67 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. 67,70,94,95,96 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. 91 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). 91,95 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. 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. 67,90,93,108 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. 74 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. 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. 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.60 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.63 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 come and a study from Iran showed that food insecurity significantly reduced during the pandemic.64 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.¹⁸⁹

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.

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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| Reference                        | M/I and RO | Fruits/vegetables | Fruits | Vegetables | Snacks | Sweets and/or bakery products | Fish and/or seafood | Fast food |
|--------------------------------|------------|-------------------|--------|------------|--------|-------------------------------|---------------------|-----------|
| Baksh and colleagues2021       | 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: F, D, or U | I = 48% | N/A | N/A | Frequency of snacking: | Sweets: | N/A | N/A |
|                                |            | U = 43%           |        |            | I = 45% | U = 31% | D = 25% | N/A | N/A |
|                                |            | D = 9%            |        |            | I = 19% | U = 40% | D = 30% | N/A | N/A |
| Bann and colleagues2020        | 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 | I = 32.4% | N/A | N/A | Healthy snacks: | Candy, cookies, cakes, and pastries: | N/A | N/A |
|                                |            | U = 60%           |        |            | I = 20.9% | U = 57.7% | D = 12.7% | I = 24.6% | N/A |
|                                |            | D = 5.8%          |        |            | I = 12.2% | U = 41.4% | D = 32.4% | Unhealthy Snacks: | N/A |
|                                |            |                    |        |            |          |          |          |            | |
| Ben Hassen and colleagues2020  | 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 = 14.9% | N/A | N/A | Salty snacks: | Sweets such as candy, cookies, pies: | N/A | N/A |
|                                |            | U = 50.2%         |        |            | I = 37.4% | U = 49.6% | D = 13% | Fish or shellfish: | N/A |
|                                |            | D = 33.4%         |        |            | I = 21.5% | U = 43.9% | D = 12.6% |            | |
| Bin Zarah and colleagues2020   | 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% | Starchy vegetables | Salty snacks: | Sweets such as candy, cookies, pies: | N/A | N/A |
|                                |            | U = 50.2%         |        |          | I = 49.6% | U = 43.9% | D = 16.7% |            | |
|                                |            | D = 33.4%         |        |          | I = 14.9% | U = 68.4% | D = 16.7% |            | |

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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 and RO | Fruits/vegetables | Fruits | Vegetables | Snacks | Sweets and/or bakery products | Fish and/or seafood | Fast food |
|-----------|------------|-------------------|--------|------------|--------|-------------------------------|----------------------|-----------|
| Blaszczyk-Bębenek and colleagues 2020 | M/I: How frequently have you consumed the following foods before the pandemic and during the pandemic: fish… fruits, vegetables, fast foods… sweets…? | N/A | Frequency: No significant change | Frequency: No significant change | N/A | | | |
| | | | 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 before and during the pandemic? | | Portion size: No significant change | Portion size: No significant change | | | | |
| | RO: *(1)* zero, (2) half a portion, (3) one, (4) two, (5) three, (6) four or more” | | | | | | |
| | 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” | | | | | |
| Buckland and colleagues 2021 | M/I: How has your child’s diets changed during the pandemic? | N/A | I = 48% | I = 49% | Sweet snacks: | N/A | N/A | N/A |
| | 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” | | U = 36% | U = 40% | I = 28% | | |
| | | | D = 16% | D = 11% | U = 46% | | |
| | Carroll and colleagues 2020 | M/I: How has your child’s diets changed during the pandemic? | Mothers: Eating fewer 22% | Mothers: Eating fewer 22% | N/A | N/A | Mothers: Eating fewer 42% | |
| | 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” | Eating more 20% | Eating more 4% | | | Eating more 44% | |
| | | Fathers: Eating fewer 12% | Fathers: Eating fewer 4% | | | Eating more 10% | |
| | | Eating more 32% | Eating more 58% | | | Eating more 13% | |

N/A Frequency: No significant change
Portion size: No significant change

Sweet snacks:
Fathers: Eating fewer 4%
Fathers: Eating more 66%

Fish frequency:
Significant increase (P = 0.0241)

Fishes Portion size:
Significant decrease, (P < 0.0001)
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 and RO | Fruits/vegetables | Fruits | Vegetables | Snacks | Sweets and/or bakery products | Fish and/or seafood | Fast food |
|------------------------------------------|------------|-------------------|--------|------------|--------|-------------------------------|---------------------|-----------|
| Children: Eating fewer = 20%             | N/A        | Before = 18.5%    | Before = 14.4% | N/A      | Bakery foods: Before = 20%   | Children Eating fewer = 26% |
| Eating more = 24%                       |            | During = 26.5%    | During = 24.6% |          | During = 10%                 | Eating more = 8% |
| Celik and Dane, 2020                     | M/I: Which foods did you have a preference to consume both before and during the pandemic? | RO: Vegetables, fruits… bakery foods |        |            |        |                               |                     |           |
| Cheikh Ismail and colleagues, 2020      | M/I: What meal types were your most consumed meals both before the pandemic and during the pandemic? | RO: “…fast food…” |        |            |        |                               |                     |           |
| Cheikh Ismail and colleagues, 2021      | M/I: What meal types were your most consumed meals both before the pandemic and during the pandemic? | RO: “…fast food…” |        |            |        |                               |                     |           |
| Chenarides and colleagues, 2021         | 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” |        |            |        |                               |                     |           |
| Di Renzo, Gualtieri, Pivari, and colleagues, 2020 | 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…” |        |            |        |                               |                     |           |

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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 |
|----------------------------|----------------------------------------------------------------------------------------|-------------------|--------|------------|--------|--------------------------------|---------------------|-----------|
| Flanagan and colleagues2021 | 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…? | N/A               | Significant decrease in frequency of eating <2 servings per day \(P < 0.001\) | N/A          | Significant increase in the frequency of eating <2 servings per day | N/A               | Significant decrease in the frequency of eating two or more meals from fast food \(P < 0.001\) |
|                            | RO: Usually/often, Sometimes, or Rarely/never                                            |                   | No significant change in the frequency of eating <2 servings per day |             |                         |                    |                         |
| Gallo and colleagues2020    | M/I: Which foods did you consume in the last 24 hours?                                  | N/A               | N/A    | N/A        | N/A    | N/A                            | N/A                | N/A                     |
|                            | 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 |                   |        |            |        |                                |                     |                         |
| Giacalone and colleagues2020| M/I: How has your frequency of snacking changed during the pandemic?                      | N/A               | I = 11.1% | I = 11.3%  | I = 41.7% | N/A                            | N/A                | N/A                     |
|                            | How has your consumption of the following foods changed during the pandemic:             |                   | U = 64.0% | U = 69.2%  | U = 47.5% | Pastries commercial:           |                     |                         |
|                            | Vegetables, fruit…Fish,                                                                 |                   | D = 24.9% | D = 19.5%  | D = 10.8% | I = 15.8%                      |                     |                         |

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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 and RO | Fruits/vegetables | Fruits | Vegetables | Snacks | Sweets and/or bakery products | Fish and/or seafood | Fast food |
|----------------------------------|------------|-------------------|--------|------------|--------|-------------------------------|---------------------|-----------|
| Górnick and colleagues2020⁵⁶     | 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? RO: "I eat more/I eat the same/I eat less/I didn't eat before and during the pandemic" | N/A | I = 15.2% | I = 18.5% | Salty snacks: Confectionary: | I = 6.8% | I = 8.1% |
|                                 |            |                   | U = 64.7% | U = 62.1% | Increased = 18.1% | U = 76.2% | U = 55.3% |
|                                 |            |                   | D = 20.1% | D = 19.4% | U = 62.2% | D = 17.0% | D = 36.6% |
| Huber and colleagues2021⁶⁹      | M/I: How has your consumption of the following foods changed during the pandemic: Confectionaries… Fruits, vegetables? RO: Increased, Decreased, or Unchanged | N/A | I = 33% | I = 31.5% | N/A | Confectionaries: | N/A | N/A |
|                                 |            |                   | U = 52% | U = 53.5% | D = 15% | I = 44.5% | N/A | N/A |
|                                 |            |                   | D = 14.5% | D = 15% | | U = 27.5% | N/A | N/A |
|                                 |            |                   | | | | | | |
| Husain and Ashkanani, 2020⁷⁰    | M/I: How frequently do you eat each of the following foods: fruit… vegetables… fish and | N/A | Before: None = 8% | Before: None = 7% | N/A | N/A | Before: Never = 10.6% | N/A |
|                                 |            |                   | Less than 1/ | Less than 1/d = | | | Less than 1/w = | | |

(continued on next page)
| Reference | M/I and RO | Fruits/vegetables | Snacks | Sweets and/or bakery products | Fish and/or seafood | Fast food |
|-----------|-----------|-------------------|--------|-------------------------------|-------------------|-----------|
| **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)** |
| **Kansiime and colleagues2021** | M/I: How often did you consume the following foods before the pandemic and during the pandemic: fruits, vegetables, fish and seafood...? | N/A | Percent of participants who reported a frequent consumption (>10 times per mo) | N/A | N/A | Percent of participants who reported a frequent consumption (>10 times per mo) | N/A |
| | 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” | | Kenya: Before = 57.6% | Uganda: Before = 60.8% | Kenya: Before = 22.4% | Uganda: Before = 28.8% |
| | | | During = 22.4% | During = 60.8% | During = 62.4% | During = 62.8% |
| | | | N/A | N/A | N/A | N/A |
| **Kriaucioniene and colleagues2020** | 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% | Commercial pastries such as cookies, custards, sweets: |
| | | | I = 18.8% | U = 66.3% | D = 17.5% | I = 7.5% | |
| | | | I = 45.1% | U = 45.1% | D = 9.8% | U = 78.3% | |
| | | | I = 57.6% | U = 51.9% | D = 41.3% | D = 41.3% | |
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/Ia and ROb | Fruits/vegetables | Fruits | Vegetables | Snacks | Sweets and/or bakery products | Fish and/or seafood | Fast food |
|-----------------------------------|--------------|-------------------|--------|------------|--------|--------------------------------|---------------------|-----------|
| Lamarche and colleagues2021††      | M/I: Which of the following foods did you eat in the last 24 hours? RO: Higher, Lower or As usual | N/A | Whole fruits: Total vegetables: | N/A | N/A | Added sugars: Seafood and plant proteins: | N/A | N/A |
|                                    |              |                   | Significant reduced consumption | Significant increased consumption | | | | | |
| López-Bueno and colleagues2020††   | 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 fruits or vegetables a day was considered a health risk behavior | Significant decrease in consuming fewer than three fresh fruits or vegetables a day ($P = 0.011$) | N/A | N/A | N/A | N/A | N/A | N/A |
| Malta and colleagues2020††         | 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 consumption of fruit: Regular consumption of greens and vegetables: | N/A | N/A | Chocolate/sweet biscuits/ pieces of tart more than 2 d: | N/A | N/A |
| Matsungo and Chopera, 2020†††       | M/I: “How has your consumption of the following foods changed during the | Other vitamin A rich fruits and Other fruits: | Dark green leafy vegetables | N/A | N/A | N/A | N/A | 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<sup>a</sup> and RO<sup>b</sup> | Fruits/vegetables | Fruits | Vegetables | Snacks | Sweets and/or bakery products | Fish and/or seafood | Fast food |
|-----------|---------------------------------|-------------------|--------|------------|--------|-------------------------------|---------------------|-----------|
| Murphy and colleagues<sup>2021</sup> | 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 colleagues<sup>2020</sup> | 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 (i.e., wild fruits and 100% fruit juices made from fruits), Fruits… Fish… Sweets | 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 colleagues<sup>2020</sup> | 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: | Pastries: | N/A | N/A |
| | | | | | Yes = 34.1% | Spain: | No = 65.9% | | |
| | | | | | No = 69.4% | Greece: | No = 69.4% | | |
| | | | | | Greece: <3/wk = 19.7% | Greece: >3/wk = 10.9% | | |
| | | | | | Yes = 40.8% | Greece: No = 62.2% | | |
| | | | | | No = 59.2% | | | | |

(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 and RO<sup>a</sup> | Fruits/vegetables | Fruits | Vegetables | Snacks | Sweets and/or bakery products | Fish and/or seafood | Fast food |
|-----------------------------------|------------------------|-------------------|--------|------------|--------|--------------------------------|---------------------|-----------|
| Pellegrini and colleagues<sup>2020</sup> | M/I: Has your consumption changed: The number of snacks you consume a day… | N/A | N/A | N/A | Don’t consume | Sweets: | N/A | N/A |
|                                   | RO: “Yes or no”         | I = 27.3%         | U = 54%| D = 18%   |         | Don’t consume                 |                    |           |
|                                   |                        |                   |       |           |        |                               |                    |           |
| Radwan and colleagues<sup>2020</sup> | M/I: Which of the following foods did you consume more of during the pandemic? | N/A | N/A | N/A | Salty snacks: 21% reported consuming more during COVID-19 | N/A | N/A | N/A |
|                                   | RO: “…salty snacks, sweet snacks…” |                   |       |           |        |                               |                    |           |
| Reyes-Olavarría and colleagues<sup>2020</sup> | M/I: How has your consumption of vegetables and fruits changed during the pandemic? | I = 30.9%         | N/A   | N/A | N/A | N/A | N/A | N/A |
|                                   | RO: “Less than before/same than before/more than before” | U = 48.4%         | D = 20.7% | | | | | |
| Rodríguez-Pérez and colleagues<sup>2020</sup> | M/I: How has your fast-food frequency changed during the pandemic? | I = 18.3%         | I = 16.7% | I = 37.6% | Non-home | I = 8% | I = 5.1% |
|                                   | How has your snacking frequency changed during the pandemic? | U = 67.6% | U = 71% | U = 46.7% | made | U = 72% | U = 60.0% |
|                                   | How has your consumption of the following foods changed during the pandemic: Vegetables, fruits… Fish, Non- | D = 13.6% | D = 11.8% | D = 15.7% | pastries | D = 21% | D = 34.9% |

(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 and RO | Fruits/vegetables | Fruits | Vegetables | Snacks | Sweets and/or bakery products | Fish and/or seafood | Fast food |
|-----------|------------|-------------------|--------|------------|--------|-------------------------------|---------------------|-----------|
| Sánchez-Sánchez and colleagues, 2020 | M/I: “How many portions of vegetables do you consume every day? (Garnishes and accompaniments would be \( \frac{1}{2} \) portion, 1 portion is equal to 200 g)” | N/A | Significant increased consumption \( (P < 0.001) \) | Significant increased consumption \( (P = 0.032) \) | N/A | Industrial bakery foods: Significant increased consumption \( (P < 0.001) \) | N/A | N/A |
| | 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” | | | | | | | |
| Scarmozzino and Visioli, 2020 | M/I: “Have you changed your fresh fruit and vegetables consumption during the lockdown?” | | I = 21.2\% | N/A | N/A | Salty or sweet snacks: (choco late, spreads, cakes, ice creams) | | N/A |
| | RO: “Yes, I increased, I increased only the consumption of canned fruits and vegetables, No, I have been eating more | I (canned) = 0.9\% | U = 69.2\% | D = 8.7\% | U = 57.6\% | D = 18.9\% | I = 42.5\% | U = 44.0\% | D = 13.5\% |

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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 and RO          | Fruits/vegetables | Fruits | Vegetables | Snacks | Sweets and/or bakery products | Fish and/or seafood | Fast food |
|----------------------------|---------------------|-------------------|--------|------------|--------|-------------------------------|---------------------|-----------|
| Sharma and colleagues2020  | M/I: How has your consumption of fruits and vegetables changed because of COVID-19? | I = 30.2%        | N/A    | N/A        | N/A    | N/A                           | N/A                 | N/A       |
|                            | RO: I, D, Stayed the same | U = 28.4%               | N/A    | N/A        | N/A    | N/A                           | N/A                 | N/A       |
|                            |                     | D = 41.4%               | N/A    | N/A        | N/A    | N/A                           | N/A                 | N/A       |

Werneck and colleagues2020  | 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% | N/A    | N/A        | N/A    | N/A                           | N/A                 | 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 |
|-----------|--------------------------|--------------------|--------|------------|--------|-------------------------------|-----------------------|-----------|
| Yılmaz and colleagues2020 | M/I: How has your consumption of the following foods changed during the pandemic: vegetables, fruits, snacks… | N/A | I = 49.1% | I = 40.5% | I = 38% | N/A | N/A | N/A |
|           | RO: I, D, or U | | U = 49.4% | U = 58.4% | U = 57.5% | | | |
|           |               | | D = 1.5% | D = 1.0% | D = 4.5% | | | |
| Zhang and colleagues2020 | M/I: How has your consumption of the following food types changed during the pandemic: seafood… snacks and beverages? | N/A | N/A | N/A | Consuming | N/A | Seafood: | N/A |
|           | RO: I, U, or D | | | | Snacks and beverages: | | I = 9.5% | |
|           |               | | | | | | U = 37.5% | |
|           |               | | | | | | D = 53% | |

\(^a\)M/I = measure/items.
\(^b\)RO = response options.
\(^c\)I = increased intake.
\(^d\)D = decreased intake.
\(^e\)U = no change in intake.
\(^f\)N/A = not available.

Findings 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, \(^g\) “do not consume” for Chenardes and colleagues, \(^i\) and “not applicable” for Matsungo and Chopera, \(^k\).

\(^g\)Studies where values were estimated from a figure.
| Reference                        | M/I<sup>a</sup> and RO<sup>b</sup>                                                                 | Finding                                                                                                                                                                                                 |
|---------------------------------|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alhusseini and Alqahtani, 2020<sup>41</sup> | M/I: “How would you rate your overall habits of eating healthy foods?” (Before and during COVID-19)  | 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<sup>43</sup> | 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<sup>44</sup>   | 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<sup>48c</sup> | 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 |
| Cancello and colleagues, 2020<sup>52</sup> | 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 isolation 34% reported improved diet quality 19% reported worsened diet quality                                                                                   |
| Di Renzo, Gualtieri, Pivari, and colleagues, 2020<sup>58</sup> | M/I: “Did your lifestyle and eating habits change<sup>e</sup> during the COVID-19 pandemic period?” | 46.1% no change in lifestyle/eating habits during COVID-19 37.2% COVID-19 made habits worse 16.7% COVID-19 made habits improve (continued on next page)                                                                 |
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 and RO | Finding                                                                 |
|----------------------------------|------------|-------------------------------------------------------------------------|
| Do and colleagues, 202059        | 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, 202060     | 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   | M/I: Perception of overall healthy eating habits and weight change M/I: Optional long form was a modification of the Rapid Eating Assessment112 | 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, 202066  | 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, 202071   | 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 healthier 6.3% diet was a lot healthier |
| Kansiime and colleagues, 202173  | M/I: The Food Insecurity Experience Scale110 | 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 (continued on next page) |
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/Ia and ROb | Finding                                                                 |
|-----------------------------------|--------------|------------------------------------------------------------------------|
| Khubchandani and colleagues, 2020 | 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         | M/I: Simplified Programme National Nutrition Santé guidelines score 2 (an index to reflect the 2017 French main dietary recommendations) “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    | 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          | M/I: Healthy intake: 5-item Healthy Eating Score | Being under the lockdown associated with lower healthy dietary intake scores \( (P < 0.001) \) |
| Poelman and colleagues, 2021      | 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     | 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 (continued on next page)
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<sup>a</sup> and RO<sup>b</sup>                                                                 | Finding                                                                                                                                                                                                 |
|------------------------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rossinot and colleagues, 2020<sup>98</sup> | M/I: Self-evaluation of the change during the lockdown of their diet                             | 54.1% unchanged                                                                                                                             |
|                                    | RO: Less balanced/no change/more balanced                                                      | 28.7% more balanced                                                                                                                        |
|                                    |                                                                                                | 17.1% less balanced                                                                                                                        |
| Sánchez-Sánchez and colleagues, 2020<sup>99</sup> | 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<sup>105</sup>   | M/I: Not listed                                                                                 | 23% of adults reported changing their diets to be healthier                                                                                   |

<sup>a</sup>M/I = measure/items.  
<sup>b</sup>RO = response options.  
<sup>c</sup>Findings 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.  
<sup>d</sup>The original item from reference 67 reads “Did your lifestyle and eating habits changed during the COVID-19 pandemic period?”  
<sup>e</sup>Measure 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)."
| References                        | Behavior         | M/I° and RO°                                                                 | Findings                                                                                                                                                                                                 |
|----------------------------------|------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Adams and colleagues, 2020        | 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 | 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)                                                  |
|                                  |                  | RO: Number of days per month ≥3 d considered food insecure                    |                                                                                                                                                                                                           |
| Almandoz and colleagues, 2020     | Meal skipping    | M/I: Food security: The 6-item US Adult Food Security Survey Module 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        | 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| 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| 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 (\(P < 0.001\))                                                                 |

(continued on next page)
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 |
|------------|----------|--------------------------|----------|
| **Meal skipping** | 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) | 17.5% reported skipping more snacks or meals 23.5% reported introducing more meals/snacks |
| Di Renzo, Gualtieri, Pivari, and colleagues, 2020\(^58\) | 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\(^c\) | 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 |
| Elmacloğu and colleagues, 2021\(^57\) | Uncontrolled eating Restrictive eating | M/I: Uncontrolled eating, cognitive restriction, and emotional eating behavior: 18 items in total\(^40,141\) RO: 1 = absolutely true; 2 = mostly true; 3 = mostly false; and 4 = absolutely false | 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 |
| Flaudias and colleagues, 2020\(^63\) | Binge eating Restrictive eating | M/I: Depression and anxiety: The Hospital Anxiety and Depression Scale\(^42\) M/I: Perceived stress: The 10-item Perceived Stress Scale\(^43\) M/I: Eating behaviors: The body dissatisfaction and impulse regulation subscales of the Eating Disorder Inventory, 2nd edition\(^44\) an eating disorder screening tool (Sick, Control, | (continued on next page)


| References                        | Behavior                      | M/I$^a$ and RO$^b$                                                                 | Findings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------|-------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Haddad and colleagues, 2020$^67$  | Restrictive eating           | M/I: The Eating Disorder Examination-Questionnaire$^{147}$                       | 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” 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 (continued on next page)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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 and RO | Findings                                                                 |
|-------------------------------------|-----------------------------------|------------|--------------------------------------------------------------------------|
| Kansiime and colleagues, 2021<sup>73</sup> | Meal skipping                      | M/I: Food insecurity experience scale<sup>110</sup> 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<sup>74</sup> | Meal skipping                      | M/I: Fear: The fear of COVID-19 Scale<sup>148</sup> M/I: Anxiety: The Generalized Anxiety Disorder-7 test<sup>149</sup> 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<sup>75</sup> | Overeating Restrictive eating Meal skipping | M/I: Stress: 10-item Perceived Stress Scale<sup>143</sup> 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<sup>88</sup> | Binge eating Restrictive eating | M/I: Current negative mood states (over the past week): The Depression Anxiety Stress Scale<sup>150</sup> M/I: Restricted eating and binge eating questions adapted from the Eating Disorders Examination Questionnaire<sup>151</sup> | 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 |
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 and RO          | Findings                                                                 |
|-----------------------------|-------------------|---------------------|--------------------------------------------------------------------------|
| Puhl and colleagues, 2020   | 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 | 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| 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 lore 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). |

(continued on next page)
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<sup>a</sup> and RO<sup>b</sup>                                                                 | Findings                                                                                     |
|-------------------------------|----------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| Robinson and colleagues, 2020<sup>95</sup> | Binge eating   | M/I: Binge Eating: “Compared with before the COVID-19 virus crisis, I have binged on food.” 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 binging  
33% of participants reported no changes in binging  
19% reported decreased binging |
| Şimsek and Şen, 2020<sup>103</sup> | Uncontrolled eating  
Restrictive eating | M/I: Eating behaviors: 20 questions from the 3-factor eating questionnaire<sup>157</sup> | 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 |

<sup>a</sup>M/I = measure/items.  
<sup>b</sup>RO = response options.  
<sup>c</sup>The 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.  
<sup>d</sup>As cited in reference 97.
| Reference                      | Reason          | M/Ia and ROb               | Finding                                                                 |
|-------------------------------|-----------------|----------------------------|-------------------------------------------------------------------------|
| Adams and colleagues, 202040  | 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 food139 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, 202043 | Stress          | M/I: Do you stress eat more? | 61.2% reported stress eating 78.3% of the sample was not food insecure |
|                                | Food insecurity | RO: Yes/No                 |                                                                          |
|                                |                 | M/I: 6-item US Adult Food Security Survey Module139 |                                                                          |
| Buckland and colleagues, 202151 | Emotional eating | M/I: Food responsiveness, emotional eating: The Adult Eating Behavior questionnaire158 | 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 |
|                                | Craving         | M/I: Cravings: The Control of Eating Questionnaire159 |                                                                          |
|                                |                 |                            |                                                                          |
| Carroll and colleagues, 202053 | 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, 202055 | Weight control | 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) |
|                                | Time            |                            | (continued on next page)                                                |
| Reference                                      | Reason                | M/I\(^a\) and RO\(^b\) | Finding                                                                 |
|-----------------------------------------------|-----------------------|--------------------------|--------------------------------------------------------------------------|
| Cheikh Ismail and colleagues, 2021\(^{56}\)   | Weight control        | M/I: Meal skipping?      | 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) |
|                                               | Time                  | 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 |                                                                          |
| Di Renzo, Gualtieri, Cinelli, and colleagues, 2020\(^{57}\) | Emotional eating      | M/I: Anxiety: 14-item Hamilton Anxiety Rating Scale\(^{160}\) | 57.8% of participants reported feeling anxious due to their eating habits |
|                                               | Anxiety               | M/I: Depression: 17-item Hamilton Depression Scale\(^{161}\) | 48.7% reported using food to respond to anxious feelings                 |
|                                               |                       | M/I: Emotional eating: 25-item Yale Food Addiction Scale\(^{162}\) | 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\(^{51}\)    | Emotional eating      | M/I: Uncontrolled eating, cognitive restriction, and emotional eating behavior: 18 items in total\(^{140,141}\) | In normal individuals, emotional eating behavior increased significantly during the pandemic compared with before |
|                                               |                       | RO: 1 = absolutely true; 2 = mostly true; 3 = mostly false; and 4 = absolutely false | Women’s emotional eating scores were higher than men during the pandemic compared to before |
| Flaudias and colleagues, 2020\(^{63}\)      | Depression            | M/I: Depression and Anxiety: The Hospital Anxiety and Depression Scale\(^{142}\) | 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 |
|                                               | Anxiety               | M/I: Perceived stress: The 10-item Perceived Stress Scale\(^{143}\) | Higher stress related to the lockdown and anxiety were associated with a higher likelihood of dietary restriction over the past 7 d |
|                                               | Stress                |                           | Higher endorsement of appearance ideals and body dissatisfaction \((P < 0.001)\) associated with a higher likelihood of dietary restriction (past 7 d) |
|                                               | Body image            | 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\(^{146c}\) | Lower body dissatisfaction was related to |

\(^a\) M/I = Main reason

\(^b\) RO = Reference
| Reference | Reason                        | M/I and RO                                      | Finding                                                                 |
|-----------|-------------------------------|------------------------------------------------|------------------------------------------------------------------------|
| Haddad and colleagues, 2020<sup>67</sup> | Anxiety                      | M/I: The Eating Disorder Examination-Questionnaire<sup>147</sup> | increased intentions to binge eat in the coming 2 wk ($P < 0.001$)     |
|           |                               | M/I: 10 questions related to fear of COVID-19 (eg, “Thinking about COVID-19 makes me feel anxious”) | Greater anxiety, fear of COVID-19, anger, and boredom were significantly associated with higher eating concerns scores |
|           | Fear and anger                | RO: 5-point Likert scale ranging from 1 (not at all) to 5 (extremely) Higher scores indicate increased fear | Greater fear of COVID-19 predicted higher restraint scores               |
|           | Boredom                       | M/I: Short boredom proneness scale<sup>163</sup> |                                                                          |
|           |                               | M/I: Lebanese anxiety scale<sup>164</sup>     |                                                                          |
|           |                               | M/I: Anger subscale of the Buss-Perry scale<sup>165</sup> |                                                                          |
| Husain and Ashkanani, 2020<sup>70</sup> | Stress                       | M/I: “Do you eat when you feel stressed, unhappy, angry, or bored?” Reported in reference to before and during the pandemic | Participants reported eating when stressed, unhappy, angry, or bored (before and during the pandemic): |
|           |                               | RO: Never/rarely/occasionally/ usually        | 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<sup>72</sup> | Stress                       | M/I: “Have you noticed changes in the availability of food in stores over the last month?” | Higher levels of perceived stress were related greater fears of limited access to food and purchasing of larger quantities of food during the pandemic |
|           |                               | RO: No, I did not notice any changes/yes      | 87.4% of respondents reported perceiving changes in food availability at the onset of the pandemic |
|           |                               | M/I: Fear of limited access to food as the pandemic spreads | 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 |
|           |                               | RO: Definitely not/rather not/neither no nor yes/rather yes/ definitely yes | Perceived changes in food availability were the strongest predictor of fear for limited food access |
|           |                               | M/I: Perceived Stress Scale 4<sup>143</sup> |                                                                          |
| Kansiime and colleagues, 2021<sup>73</sup> | Food security                | M/I: Food security: The food insecurity experience scale<sup>110</sup> | 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 |

(continued on next page)
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/Ia and ROb | Finding                                                                                                                                                                                                 |
|-----------|-----------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Kaya and colleagues, 202174 | Anxiety Fear | M/I: Fear: The fear of COVID-19 Scale148 | 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 |
|           |                 | M/I: Anxiety: The Generalized Anxiety Disorder-7 test149 |                                                                                       |
|           | Anxiety Fear    | M/I: Fear: The fear of COVID-19 Scale148 | 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 |
|           |                 | M/I: Anxiety: The Generalized Anxiety Disorder-7 test149 |                                                                                       |
| Khubchandani and colleagues, 202075 | Stress       | M/I: Stress: 10-item Perceived Stress Scale143 | High stress scores were related to worsening diet and changes in restricted eating, fasting, skipping meals, and overeating |
|           |                 | M/I: Dietary behaviors: 4 questions about dietary behaviors (eg, overeating and fasting) | Stress scores were lowest among those that had no changes in these behaviors |
| Marty and colleagues, 202181 | Mood Weight control | M/I: Food choice motives: French version of the Food Choice Questionnaire developed in English166 and adapted167 | 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 |
| Pakravan-Charvadeh and colleagues, 202184 | Food security | M/I: Food security: modified version of the Household Food Insecurity Access Scale,168 validated in Iran | 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 |
|           |                 | RO: More than before the pandemic/same as before the pandemic/less than before the pandemic |                                                                                       |

In the total sample here were significant increases in the amount of people who were food insecure (39% increase) and severely insecure (16% increase).
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/Ia and ROb Finding |
|-----------|--------|----------------------|
| Pellegrini and colleagues, 202086 | 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, 202189 | 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 |

(continued on next page)
### 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 and RO | Finding                                                                 |
|-----------------------------------|-------------------------|------------|------------------------------------------------------------------------|
| Puhl and colleagues, 2020<sup>90</sup> | 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 | 35.6% reported facing more unhealthy temptations at home |
|                                   |                         | M/I: Depressive symptoms: 6-item scale<sup>169</sup> M/I and RO: Perceived stress<sup>170</sup> 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) | Participants who experienced weight stigma and weight teasing before the COVID-19 pandemic reported greater depression, stress, and eating to cope during the pandemic |
|                                   |                         | M/I: Eating as a coping strategy: The 5-item coping subscale of the Motivations to Eat Scale<sup>171</sup> | |
| Robertson and colleagues, 2021<sup>93</sup> | 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” | Psychological distress was significantly related to difficulty in eating control and regulation (P < 0.001) |
|                                   |                         | M/I: Psychological distress: The 4-item version of the Patient Health Questionnaire<sup>154</sup> | 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<sup>94</sup> | 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’)” | 42% of participants reported eating more due to their feelings |
|                                   |                         | RO: 7-point scale ranging from 1 = “a lot less frequency” to 7 = “a lore more frequently” | 26% of participants reported eating less due to their feelings |
|                                   |                         | M/I: The 5-item World Health Organization well-being scale<sup>155</sup> | COVID-19 mental health decline was significantly related to overeating |
|                                   |                         | M/I: Overeating: The Appetitive Drive subscale of the Addiction-Like Eating Behavior Scale<sup>156</sup> | 88% reported having time to eat healthily |
| Rolland and colleagues, 2020<sup>97</sup> | Mental well-being General stress Family and friends | M/I: Warwick-Edinburgh Mental Well-being Scale<sup>172</sup> 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. |

(continued on next page)
| Reference                          | Reason                   | M/I* and RO** | Finding                                                                 |
|-----------------------------------|--------------------------|---------------|-------------------------------------------------------------------------|
| Rossinot and colleagues, 2020[96] | 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 |
| Scarmozzino and Visioli, 2020[100]| Anxiety                  | M/I: Measures are all in Italian and can be found through this link: https://clikka.net/0fIBP
|                                   |                          |               | Negative changes in nutrition were related to negative changes in mental health (depression, stress, irritability) |
| Şimsek and Şen, 2020[103]          | Emotional eating         | M/I: Eating behaviors: 20 questions from the 3-factor eating questionnaire[57]
|                                   |                          |               | 42.7% of participants reporting an increase in “comfort food” consumption reported it was due to higher anxiety levels |
| 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] | Emotional eating significantly increased during compared with before the pandemic No significant differences in emotional eating by age |

* M/I = measure/item.
** RO = response item.
*As 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 (continued)
| 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.