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"Stay at home with bakery products" can be public motto of quarantine days in the early period of COVID-19 outbreak: A nutritional infodemiology study

Elif Günalan

Department of Nutrition and Dietetics, Istanbul Health and Technology University, Faculty of Health Sciences, Istanbul, Turkey

A B S T R A C T

Aims: The aim of this retrospective infodemiological study is to investigate the public interest to the bakery products in the early period of coronavirus outbreak through Google Trends and open access data banks.
Methods: The category and regions were selected "food and drink", Turkey, Italy and Sweden, respectively. Keywords were searched in Turkish, Italian and Swedish language by Google Trends. Search spectrums were "1 February 2011-1 September 2020" and "1 February-1 September 2020" to determine the monthly and daily search queries, successively. Sweden was included into study as a control group because there was no strict implementation in the pandemic. Daily case number of coronavirus, stringency index, stay at home requirements value and relative search volume (RSV) scores about selected foods and coronavirus were synthesized.
Results: Search queries of "flour", "yeast", "dough" and "bread" were too higher in Turkey and Italy within the outbreak period, corresponding to previous years. The RSV score of bread was higher than vegetable, fruit, fish and meat in all countries, but search profiles were different. It has been determined the potential relationship between RSV scores about some bakery products and stringency index in Turkey and Italy. In addition, daily new case number of coronavirus and RSV score of coronavirus can be related to public interests to bakery products in Italy. Bakery products related top queries were usually about finding a recipe.
Conclusion: Quarantine enforcement can cause the increased web-based search volume of the bakery products in the early period of COVID-19 outbreak. Understanding of search queries about food choices will help to effectively combat against coronavirus. According to followed data, the public should be informed about the outcomes of dietary habits in the quarantine regions.

Introduction

Coronavirus disease (COVID-19) first appeared in Wuhan, China in December 2019. Within several months, new type of coronavirus spread all over the world and the World Health Organization (WHO) declared the outbreak (WHO/ Europe Coronavirus Disease COVID-19 Outbreak). During the pandemic, governments applied the various public health measures to keep the pandemic under the control. These were use of personal protective equipment, the social distancing and quarantine application in the infected regions (Güner et al., 2020). In the quarantine period, all schools and universities, cinemas, concert centers, theaters, entertainment centers and. etc. places were closed and people were forced to stay at home. However, some governments such as Sweden did not mandate that people stay at home (Korhonen and Granberg, 2020).

Quarantine process caused social anxiety, depression and changes in lifestyle, eating habits and food choices (Bracale and Vaccaro, 2020). The perceived stress in the pandemic contributed to emotional eating habits which depend on motivation such as mood, convenience, sensory appeal, price, and familiarity (Shen et al., 2020). During the outbreak, online sales ratio of food items, online surveys and infodemiological studies, and etc. many type of studies were published to provide the changes in dietary habits. For instance, Laguna et al. reported that Spanish consumers preferred foods that are perceived as healthier during the strict quarantine process. In this context, higher purchased ratio of pasta and vegetables were related to health motivations and also the increasing sales of nuts, cheese and chocolates were associated with improvement of mood (Laguna et al., 2020). Interestingly, in a study which investigated dietary habits of 820 adolescents from Italy, Spain, Chile, Colombia and Brazil, was found that no effect of COVID-19 confinement on the adolescents' dietary habits (Ruiz-Roso et al., 2020).

Table 1

According to data normalization in the last 10 years', the amounts of percentage change in keywords' monthly RSV scores between February - August 2020, corresponding to previous year.

		February	March	April	May	June	July	August
Flour	TR	↑ (2%)	↑ (36.7%)	↑ (208.3%)	↑ (77.7%)	↓ (3.1%)	↓ (20.5%)	↓ (19.4%)
	IT	↑ (3.7%)	↑ (203.8%)	↑ (376.2%)	↑ (155%)	↑ (92.9%)	↑ (21.4%)	↑ (5.9%)
	SE	–	↑ (23.5%)	↑ (33.3%)	↑ (35.4%)	↓ (3.8%)	↑ (51%)	–
Yeast	TR	↓(20%)	↑ (230.7%)	↑ (1011.1)	↑ (209.1%)	↑ (70%)	↑ (18.2)	–
	IT	–	↑ (700%)	↑ (900%)	↑ (375%)	↑ (220%)	↑ (80%)	↑ (33.3%)
	SE	↑ (20%)	↑ (148.7%)	↑ (170.3%)	↑ (86.1%)	↑ (95.7%)	↑ (70.6%)	↑ (18.8%)
Dough	TR	↓ (13.5%)	↑ (41.7%)	↑ (185.7%)	↑ (123.3%)	↑ (32%)	↓ (22.9%)	↓ (9.7%)
	IT	↓ (15.8%)	↑ (383.3%)	↑ (614.3%)	↑ (275%)	↑ (125%)	↑ (57.1%)	↑ (10%)
	SE	↓ (2%)	↑ (27.8%)	↑ (88.5%)	↑ (100%)	↑ (10.6%)	↑ (59.6%)	↓ (10%)
Bread	TR	–	↑ (188.9%)	↑ (488.2%)	↑ (95%)	↑ (18.8%)	↑ (12.5%)	↑ (5.8%)
	IT	–	↑ (388.2%)	↑ (488.2%)	↑ (193.3%)	↑ (75%)	↑ (25%)	–
	SE	↑ (17.1%)	↑ (52.3%)	↑ (66.7%)	↑ (86.8%)	↑ (23.6%)	↑ (43.5%)	↑ (22.4%)
Pastry	TR	–	↓(14.8%)	↑ (75.4%)	↑ (148.3%)	↑ (11.8%)	↓(36.8%)	↓ (35.4%)
	IT	↑ (72.4%)	↓ (13.6%)	↓ (33.3%)	↓ (31.3%)	↓ (16.1%)	↑ (78.9%)	↓ (39.1%)
	SE	↑ (8.4%)	↑ (36.2%)	↑ (12.9%)	↑ (30.2%)	↑ (14.3%)	↑ (38.2%)	↑ (34.8%)
Biscuit	TR	↓ (7.7%)	↑ (29.2%)	↑ (138.1%)	↑ (68.2%)	↑ (38.9%)	↑ (38.9%)	↑ (40%)
	IT	↑ (7.7%)	↑ (92.1%)	↑ (156.1%)	↑ (78.7%)	↑ (14.3%)	↑ (21.3%)	↑ (14.3%)
	SE	↑ (39.7%)	↓ (3.6%)	↓ (25.3%)	↑ (25.4%)	↑ (13.1%)	↓(7.8%)	↑ (5%)
Cake	TR	↓ (4.3%)	↑ (23.4%)	↑ (78.6%)	↑ (82.1%)	↑ (28.3%)	↓ (10.3%)	↑ (10.6%)
	IT	↓ (2.2%)	↑ (135.7%)	↑ (156.4%)	↑ (83.3%)	↑ (62.5%)	↑ (27.3%)	↑ (7.4%)
	SE	↑ (1.4%)	↑ (34.8%)	↑ (31.6%)	↑ (30.7%)	↑ (26.7%)	↑ (15.4%)	↑ (19.4%)
Pasta	TR	–	↑ (74.5%)	↑ (125%)	↑ (61.3%)	↑ (21.3%)	↑ (28.3%)	↑ (31.3%)
	IT	↑ (2.2%)	↑ (79.5%)	↑ (122.2%)	↑ (57.1%)	↑ (29.7%)	↑ (10.5%)	↑ (7.3%)
	SE	↑ (14%)	↑ (24.4%)	↑ (45.3%)	↑ (37.3%)	↑ (18.3%)	↑ (32.4%)	↑ (24%)
Pizza	TR	↓(1.2%)	↑ (23.6%)	↑ (92.3%)	↑ (93.6%)	↑ (6.8%)	↑ (18.5%)	↓ (3.1%)
	IT	↓(10.8%)	↑ (175.8%)	↑ (203%)	↑ (106.9%)	↑ (29.7%)	↑ (10.7%)	↑ (15.2%)
	SE	↑ (9.2%)	↓ (9.8%)	↑ (10.8%)	↑ (14.7%)	↑ (8.2%)	↑ (11.1%)	↑ (13%)
Fruit	TR	↑ (4.8%)	↑ (3.8%)	↑ (31.3%)	↑ (47.6%)	↑ (20.6%)	↓ (1.5%)	↑ (13.6%)
	IT	↑ (2.9%)	↑ (62%)	↑ (150%)	↑ (71.7%)	↑ (14.8%)	↑ (6.1%)	↑ (2.1%)
	SE	↑ (4.8%)	↑ (3.1%)	↑ (38.6%)	↑ (31.6%)	↑ (1.4%)	↑ (1.5%)	↑ (18.8%)
Vegetable	TR	↑ (9.8%)	↑ (4.4%)	↑ (69%)	↑ (19%)	↑ (15.2%)	–	↑ (1%)
	IT	↑ (7.3%)	↑ (35.9%)	↑ (75.4%)	↑ (31%)	↑ (26.4%)	↑ (7.4%)	↑ (3.7%)
	SE	↑ (30.6%)	↓ (9.7%)	↑ (1.4%)	↑ (131.6%)	↑ (61.4%)	↓ (21.1%)	↑ (18.8%)
Fish	TR	↑ (6.3%)	↓ (30%)	↓ (31.6%)	↓ (41.1%)	↓ (13.8%)	↓ (1.4%)	↑ (5.1%)
	IT	↑ (6%)	↓ (29.6%)	↓(5.3%)	↑ (8.3%)	↑ (18.9%)	↑ (10.8%)	↑ (4.9%)
	SE	↑ (2.6%)	↑ (9.3%)	↑ (20.8%)	↑ (13%)	↑ (12%)	↑ (7.5%)	↑ (4.7%)
Meat	TR	↑ (3.8%)	↑ (2%)	↑ (42%)	↓(18%)	↑ (3.9%)	↑ (30%)	↑ (8.5%)
	IT	↑ (7.8%)	↑ (18.8%)	↑ (56.3%)	↑ (25.5%)	↑ (24.5%)	↑ (7.7%)	↑ (3.2%)
	SE	↓ (6.6%)	↓ (3%)	↑ (11%)	↑ (17.5%)	↑ (17.4%)	↑ (12.5%)	↓ (4.6%)

In another study, increase sales were determined in baking ingredients, fresh vegetables, fresh fruit and chocolate, while highly decrease sales were reported in the bakery products, fresh fish and salted snacks during lockdown in the Italy (Scacchi et al., 2021). In contrast, Bracale and Vaccaro et al. demonstrated large increase in the sales of flour, pizza, dry legume, ingredients for cakes, cake mix, and etc. In addition, increasing in the consumption of flour, eggs, long-life milk and frozen foods and decreasing in the consumption of fresh food were reported during quarantine period in Italy (Bracale and Vaccaro, 2020).

The reason of these conflicting results could be associated with limited participants and research areas, possibility of misrepresentation, indigenous food supply characteristics and region spesific coronavirus restrictions. To overcome from these barriers, open access data banks can be used (White et al., 2021). In this context, data from many websites such as Google Trends, WHO, Our World in Data Bank and etc. can be synthesized to determine the effect of confinement on the food choices. In addition, each society should be evaluated within its own dynamics (food safety, food supply, sociocultural structure, employment and etc.) and their governments' practices against coronavirus.

The changes in eating habits and food choices reflect to the online search trends. Many of public health researches about the public interests and concerns have carried out with internet search trend statistics during the pandemic (Knipe et al., 2020; Kutlu, 2020; Strzelecki et al., 2020). These studies focus on region specific public interest in cooking practice at home and certain foods such as seafood, meat, cake and etc (Laguna et al., 2020; Mayasari et al., 2020; White et al., 2021) Especially, the determination of the public interests to bakery products

plays important role in effectively fight against coronavirus and to prediction of potential increasing of non-communicable diseases in the future. However, the effect of governments' statements and procedures on the public interest to the bakery products is not fully understood.

This retrospective infodemiological study focused on the investigation the public interest to the bakery products in the early period of coronavirus pandemic through open access data banks and online search trends. Especially, the effect of stay at home enforcements on the search queries about bakery products was investigated. According to the normalize data in the last 10 years, the percentage changes in monthly search queries about bakery products were determined during February-August period, corresponding to previous year. In addition, the potential relationship between daily relative search volume (RSV) of bakery products and stringency index, stay at home requirements, daily new cases of coronavirus was investigated for each country within 1 February-1 September 2020.

Materials and methods

Study design

Google Trends (Google Trends) allows to determine about the interests and concerns of internet users. It provides the RSV scores about any keyword within a specific search category, specific region and spesific time period. The popularity of the keyword represents with RSV scores from 0 to 100 (Cervellin et al., 2017).

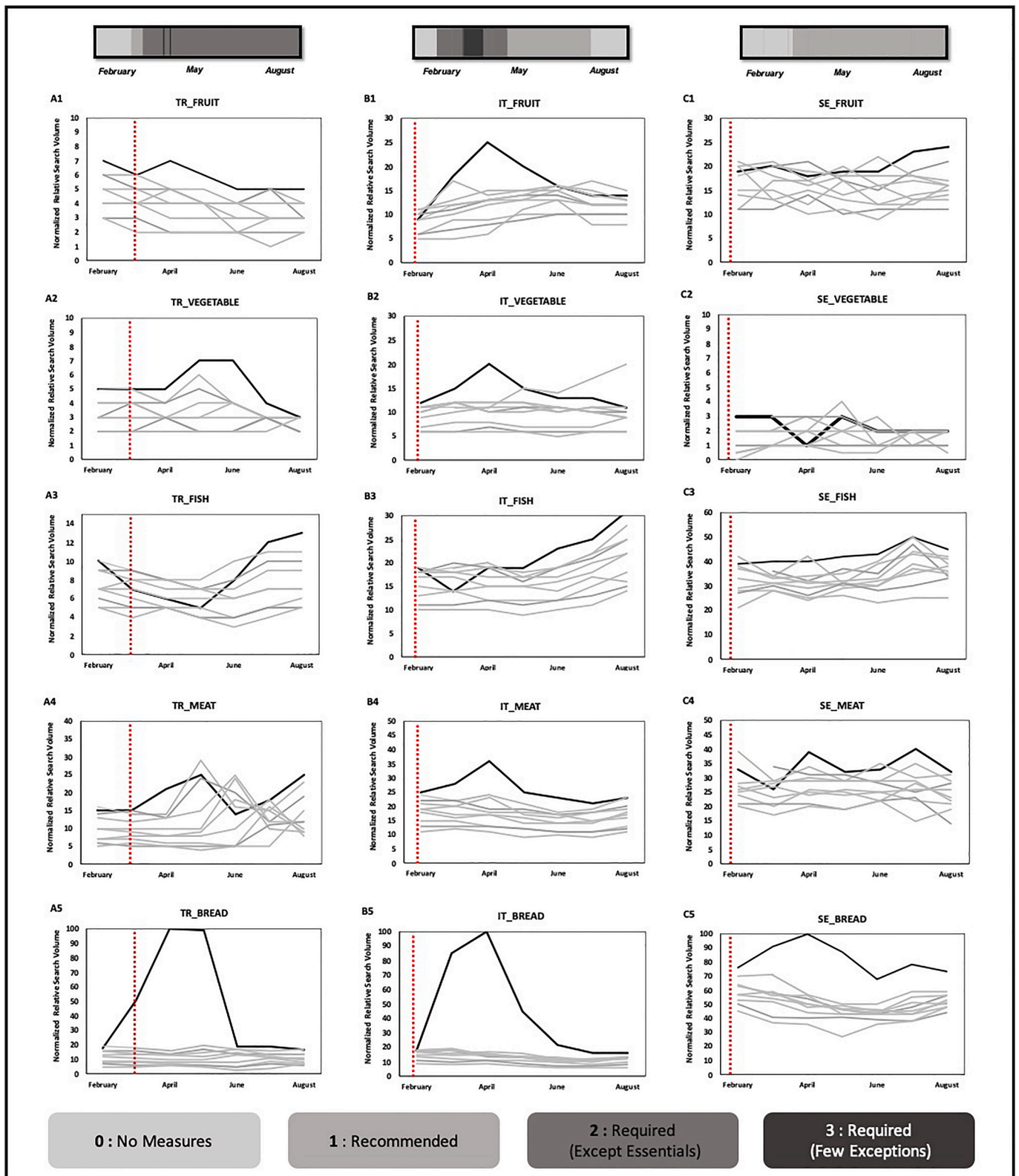In this study design, "food and drink" option was selected as search

Fig. 1. As the data normalization in multiple search option , the comparison of the RSV scores of "fruit", "vegetable", "fish", "meat" and "bread" in the Turkey (**A1-A5**), Italy (**B1–B5**) and Sweden (**C1–C5**). *Stay at home requirements are available in top of the Fig. as coloured scale and the meaning of the colour in the scale is given in bottom of the Fig. The dashed red line shows the first confirmed case of coronavirus; dark black trend indicates 2020 data; the gray trends show data from previous years.* (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)
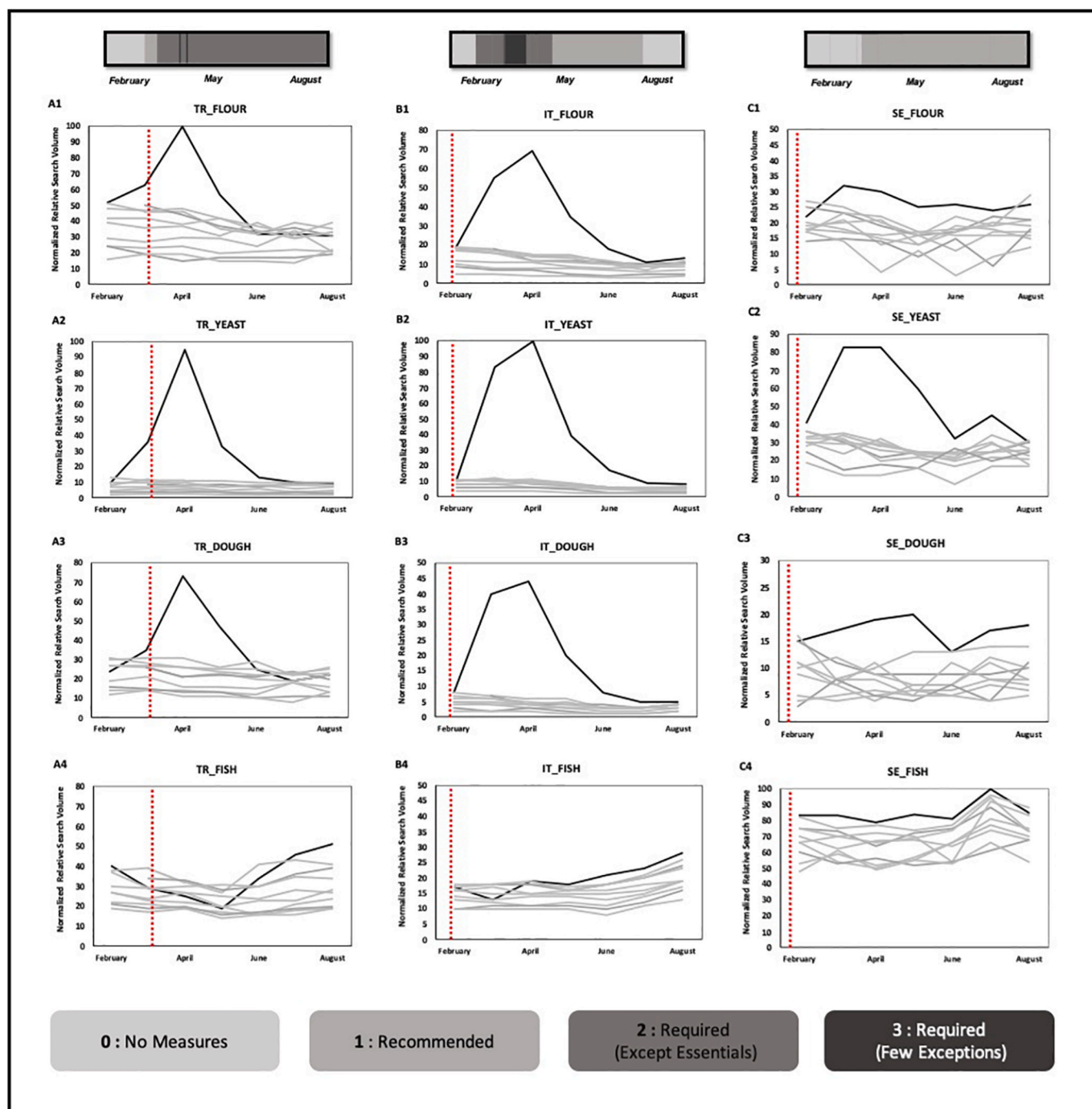
Fig. 2a. As the data normalization in multiple search option, the comparison of the RSV scores of "flour", "yeast", "dough" and "fish" in the Turkey (**A1-A4**), Italy (**B1–B4**) and Sweden (**C1–C4**). *Stay at home requirements are available in top of the Fig. as coloured scale and the meaning of the colour in the scale is given in bottom of the Fig. The dashed red line shows the first confirmed case of coronavirus; dark black trend indicates 2020 data; the gray trends show data from previous years.* (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

category because this category reflects the popular food preferences in the public. The keywords were searched in Turkey, Italy and Sweden by the use of Google Trends. Sweden was included into study as control group because there was no strict implementation in the pandemic. Citizens in Turkey and Italy forced to stay at home within outbreak and so they were included to study as intervention group.

In the Turkey, first confirmed case of coronavirus was determined on 11 March 2020 and social restrictions started on 16 March 2020. Both in Italy and Sweden, first coronavirus case was confirmed on 31 January 2020. Coronavirus restrictions started in Italy since February. Therefore,

search spectrums in this study were "1 February 2011-1 September 2020" and "1 February-1 September 2020" to determine the monthly and daily search queries, successively.

Keywords were classified as three groups and the decision process of the keywords, common and mostly preffered foods were taken into consideration. In the study design, "flour", "yeast" and "dough" keywords were the common ingredients of bakery products, "bread", "pastry", "biscuit", "cake", "pasta" and "pizza" were bakery products and "fruit", "vegetable", "fish" and "meat" were included to study as other foods group for comparison with bakery products. All keywords
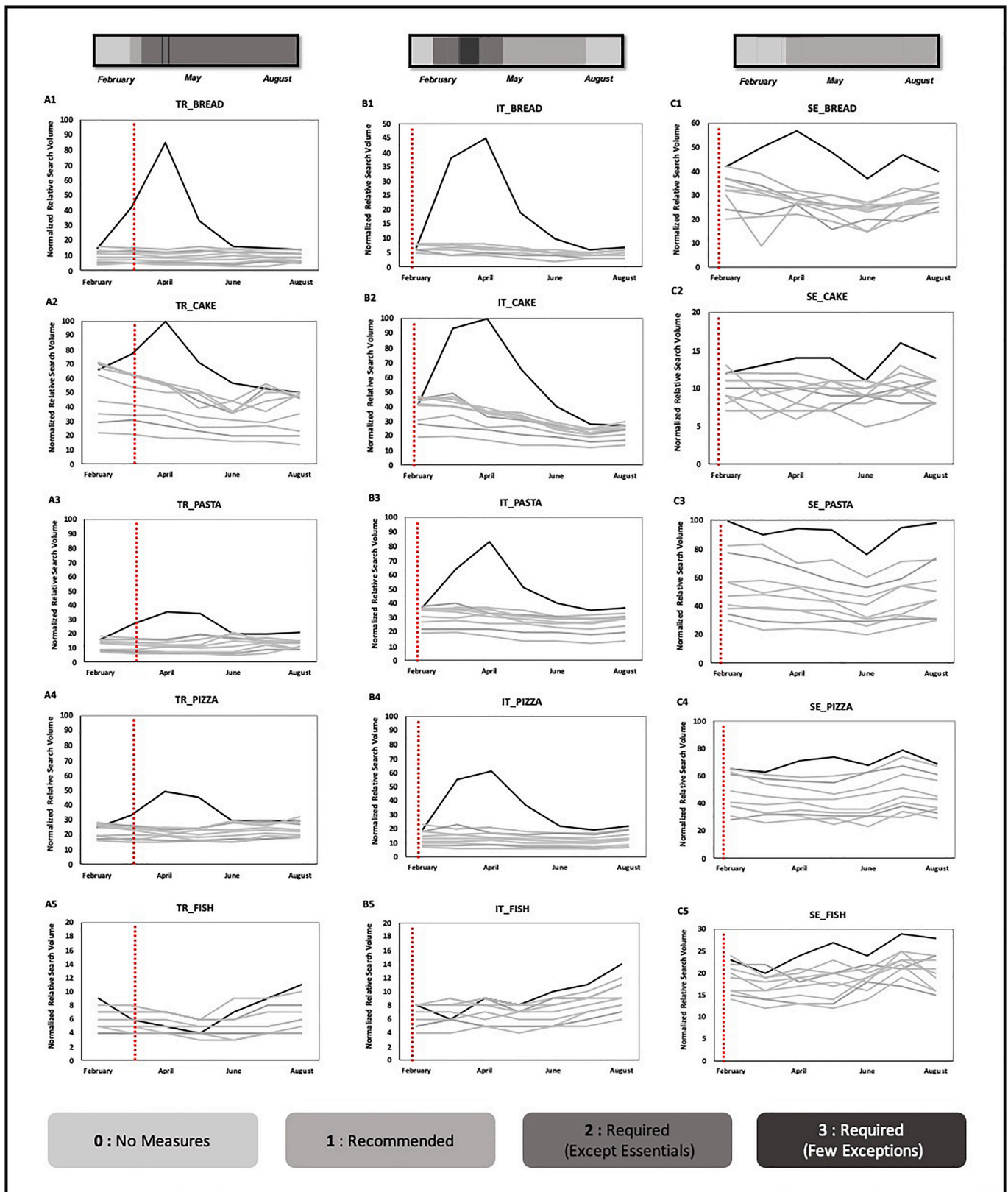
Fig. 2b. As the data normalization in multiple search option, the comparison of the RSV scores of "bread", "cake", "pasta", "pizza" and "fish" in the Turkey (**A1-A5**), Italy (**B1–B5**) and Sweden (**C1–C5**). *Stay at home requirements are available in top of the Fig. as coloured scale and the meaning of the colour in the scale is given in bottom of the Fig. The dashed red line shows the first confirmed case of coronavirus; dark black trend indicates 2020 data; the gray trends show data from previous years.* (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

were searched as Turkish, Italian and Swedish language. The translation of keywords was confirmed with the use of translation and back-translation on Google Translate (Google Translate) such as English-Turkish/Turkish-English, English-Swedish/Swedish-English and English-Italian/Italian-English (Table S1 in Supplemental Material). It is due to the fact that the public searches in their national language in daily routine (Çimke and Gürkan, 2021).

Data collection

During the data collection process, it is focused on the answers to the following five questions. Therefore, data mining strategy depend on these questions.

Question 1: What was the amount of percentage change in the monthly RSV values of the keywords during the outbreak, corresponding to previous year?

To answer this question, all keywords were searched between 1 February 2011–1 September 2020 period and then monthly RSV data were obtained as xls format from Google Trends. The amount of percentage changes in monthly RSV values was determined between 2020–2019 (Table 1). This strategy provides eliminate the seasonal effects on the search trends.

Question 2: According to time dependent normalization of the data, what was the comparison of search ranking of other foods group with the control keyword of bakery products during coronavirus period and previous years?

In this section, bread was selected as internal control in order to represent the bakery products. To determine the search ranking of other foods group with "bread" control keyword, "fruit", "vegetable", "fish", "meat" and "bread" in Turkey, Italy and Sweden, were searched through the use of multiple search option in the Google Trends. Search period was 1 February 2011–1 September 2020 in order to obtain time dependent normalization of the data. Then, query ranking of keywords between each other was determined (Fig. 1).

Question 3: According to time dependent normalization of the data, what was the comparison of search ranking of the ingredients of bakery products or bakery products group with the control keyword of other foods group during coronavirus period and previous years?

In this section, fish was selected as external control in order to represent the other foods group. To determine the search ranking of ingredients in bakery products with "fish" control keyword, "flour", "yeast", "dough" and "fish" in Turkey, Italy and Sweden, were searched with the use of multiple search option (Fig. 2a). Then, to obtain the search ranking of bakery products with "fish" control keyword, "bread", "cake", "pasta", "pizza" and "fish" were searched with the use of multiple search option in Turkey, Italy and Sweden (Fig. 2b). Search period was 1 February 2011–1 September 2020 in order to obtain time dependent normalization of the RSV data. Query ranking of keywords between each other was determined.

Question 4: What was the correlational relationship between coronavirus related parameters and RSV score of keywords during outbreak?

In this part, coronavirus related parameters were stringency index, stay at home requirements, daily case number of coronavirus and RSV score of coronavirus. To determine the daily confirmed case number of coronavirus from 1 February to 1 September 2020, WHO Coronavirus Dashboard was used (WHO Coronavirus Dashboard). During the search spectrum, each government has different policies and restrictions. In order to determine the numerical value of government response to outbreak for each country, Coronavirus Government Response Tracker (OxCGRT) in the Our World in Data website was used (Our World In Data, 2020). OxCGRT which is a dataset, collects and represents information about government responses and policies against outbreak since January 2020 (Hale et al., 2021). Stay at home requirements and government stringency index were used as government response data from OxCGRT. Search spectrum covered the period from 1 February to 1 September 2020. In this context, the range of government stringency

index varies from 0 to 100. In addition, stay at home requirements score can be varied from 0 to 3. 0 indicates no measures, 1 indicates recommend not leaving home, 2 indicates require not leaving house with exceptions and 3 indicates require not leaving home with minimal exceptions. Stay at home requirements scale for each country is available in Figs. 1, 2a and b.

Keywords were searched by Google Trends in the same period when cover the strict lockdown process in Turkey and Italy. The correlations between daily RSV value of each keyword and the stringency index, new case number of coronavirus and RSV score of coronavirus were investigated within the search spectrum. These correlations can be important in the determination of potential relationship between outbreak and food choices (Table 2).

Question 5: What were the reasons of search queries about bakery products?

To determine the reason of search queries, related top queries of keywords in the Turkey, Italy and Sweden were obtained from Google Trends and results were presented in Table 3.

Statistical analysis

Statistical analysis was applied by the SPSS software, version 21 (SPSS Inc., Chicago, Illinois, USA). Shapiro-Wilk normality test was used in order to determine the normal distribution of the data. Spearman's rho correlation analysis was used to determine the correlation between daily RSV value of each keyword and the stringency index, new case number of coronavirus and RSV score of coronavirus for each country. Statistical significance was defined as $p < 0.05$.

Results

According to normalize data in the last 10 years data, the amount of percentage change in monthly RSV scores of "flour", "yeast", "dough", "bread", "pastry", "biscuit", "cake", "pasta", "pizza", "fruit", "vegetable", "fish" and "meat" between 2020–2019 were present in Table 1. Search queries of "flour", "yeast", "dough" and "bread" were too higher in Turkey and Italy within the pandemic period, corresponding to previous year. The RSV scores of "flour", "yeast" and "dough" keywords increased in Sweden, corresponding to previous year. However, the amount of percentage increase was less when compared to Turkey and Italy. The increase in search queries of other foods group were generally lower than bakery products in all countries (Table 1).

When it is compared to search queries of "bread" with other foods group, the RSV score of bread had the highest during the pandemic in all countries, but it's search profile varied. There were similar profile between stay at home requirements score and the RSV score of bread in Turkey and Italy within search spectrum. The RSV score of "fruit" and "vegetable" had the highest value in the early period of pandemic when compared to previous years in Turkey and Italy but was not in Sweden. The RSV scores of "fish" keyword increased in August 2020 compared to February 2020 in all countries and there were no association between stay at home requirements and RSV score of "fish" keyword. In addition, the search profile of "meat" were different in all countries (Fig. 1).

The relative search ranking from high to low of ingredients in bakery products was "flour", "yeast", "dough" in Turkey while the popularity ranking was "yeast", "flour" and "dough" in Italy and Sweden. The "fish" had the lowest RSV value compared to bakery products in Turkey and Italy. On the other hand, the "fish" had the highest RSV value by comparison with "flour", "yeast" and "dough" in Sweden. In Turkey and Italy, the days of highest RSV scores about ingredients in bakery products was generally overlap with the days when stay at home requirements score was highest. (Fig. 2a).

The relative search ranking through high to low of bakery products was "cake", "bread", "pizza" and "pasta" in Turkey while the popularity ranking was "cake", "pasta", "pizza" and "bread" in Italy. In addition, the relative search ranking through high to low of bakery products was

Table 2

The Spearman's rho correlation analysis between stringency index, daily new case number of coronavirus and RSV of coronavirus with daily RSV scores of foods between the 1 February-1 September 2020 in Turkey (TR), Italy (IT) and Sweden (SE). Data represents as Spearman's rho correlation coefficients (rs) and p values.

			Stringency Index		Daily New Case Number		RSV of Coronavirus	
			r_s	p	r_s	p	r_s	p
Ingredients in Bakery Products	**Flour**	TR	.41**	.00	.017	.80	.10	.15
		IT	**.70****	**.00**	**.68****	**.00**	**.72****	**.00**
		SE	-.03	.70	.00	.98	.05	.44
	Yeast	TR	**.67****	**.00**	.15*	.03	.224**	.00
		IT	**.72****	**.00**	**.71****	**.00**	**.66****	**.00**
		SE	.14*	.13	.13	.06	.32**	.00
	Dough	TR	**.66****	**.00**	.21**	.00	.20**	.00
		IT	**.71****	**.00**	**.69****	**.00**	**.68****	**.00**
		SE	.44**	.00	.31**	.00	.32**	.00
Bakery Products	**Bread**	TR	**.63****	**.00**	.14*	.04	.24**	.00
		IT	**.70****	**.00**	**.71****	**.00**	**.65****	**.00**
		SE	.17*	.02	.14*	.04	.25**	.00
	Pastry	TR	.26**	.00	.06	.36	.13	.07
		IT	-.07	.29	-.20**	.01	-.05	.44
		SE	.02	.80	.01	.88	.01	.90
	Biscuit	TR	.49**	.00	.15*	.03	.20**	.00
		IT	.43**	.00	.47**	.00	.32**	.00
		SE	-.02	.80	-.02	.80	.04	.52
	Cake	TR	.46**	.00	-.02	.81	.16*	.02
		IT	**.69****	**.00**	**.64****	**.00**	**.70****	**.00**
		SE	.10	.17	.08	.25	.06	.38
	Pasta	TR	**.66****	**.00**	.32**	.00	.34**	.00
		IT	**.64****	**.00**	**.69****	**.00**	**.60****	**.00**
		SE	-.15*	.03	-.28**	.00	.08	.22
	Pizza	TR	**.68****	**.00**	.35**	.00	.19**	.01
		IT	**.60****	**.00**	**.69****	**.00**	**.61****	**.00**
		SE	.16*	.02	.27**	.00	.02	.77
Other Foods (For Comparison)	**Fruit**	TR	.17*	.02	-.09	.17	-.10	.17
		IT	**.62****	**.00**	**.65****	**.00**	.43**	.00
		SE	0.32	.64	.07	.29	-.01	.84
	Vegetable	TR	.30**	.00	-.02	.83	-.04	.56
		IT	.54**	.00	.49**	.00	.30**	.00
		SE	.01	.84	-.05	.48	.01	.84
	Fish	TR	-.60**	.00	.02	.74	-.10	.13
		IT	-.40**	.00	-.23**	.00	-.43**	.00
		SE	.01	.89	.01	.87	.01	.88
	Meat	TR	.33**	.00	.57**	.00	.12	.08
		IT	.35**	.00	.40**	.00	.33**	.00
		SE	0.05	.35	.16*	.02	-.01	.90

Note: r_s: 0.40–0.59 indicates to moderately correlation; r_s: 0.60–0.79 indicates to highly correlation; r_s: 0.79–0.99 indicates to very highly correlation. *Correlation is significant at the 0.05 level. **Correlation is significant at the 0.01 level.

"pasta", "pizza", "bread" and "cake" in Sweden. The search queries of bakery products had the highest value in the outbreak in all countries when compared to their data in the previous nine years. The search profile of bakery products was paralleled with stay at home requirements scale in the Turkey and Italy. In the search volume of "fish" was lower than bakery products in Turkey and Italy (Fig. 2b).

A significantly positive correlation was determined between stringency index and daily RSV scores of "yeast", "dough", "bread", "pasta" and "pizza" between 1 February-1 September 2020 in Turkey (*Spearman's rho correlation coefficient (rs) > 0.6, p < 0.00*). A highly positive correlation was detected between stringency index, daily new case number of coronavirus, RSV score of coronavirus with daily RSV scores of "flour", "yeast", dough", "bread", "cake", "pasta" and "pizza" within the search period in Italy (*Spearman correlation's rho coefficient (rs) > 0.6, p < 0.00*). In addition, search trend of the "fruit" keyword in Italy highly correlated with the stringency index and daily new case number (*Spearman's rho correlation coefficient (rs) > 0.6, p < 0.00*). No any significantly correlation was detected in Sweden (Table 2).

Bakery products related top queries were usually about finding a recipe. Also, "pizza" keyword had top queries about certain pizza brand. In addition, some local bakery products such as piroger and carbonara, were searched by the internet users in Sweden (Table 3).

Discussion

This study provided some evidence about the role of coronavirus pandemic under quarantine conditions on the food choices from info-demiological perspective. Accordingly, increase in search queries of "flour", "yeast" and "dough" in all countries indicated that the public interests to ingredients of bakery products could be associated with pandemic, without the lockdowns. In addition, large increase in search queries of "flour", "yeast" and "dough" in Turkey and Italy have shown that lockdowns contribute to their search volume. Especially in Turkey and Italy, the elevated percentage in the RSV scores of "bread", "biscuit", "cake", "pasta" and "pizza" were relatively higher in the pandemic, corresponding to previous year. In a study from Italy confirmed that the percentage change in sales of flour, yeast, pizza and cakes increased in stay at home period of the pandemic. It was also reported that the sales of snacks dropped in associated with the production of homemade bread, pizza and cake (Bracale and Vaccaro, 2020). The similarity between sales report and search trends in related countries indicates the validity of results in this study.

In the Sweden, the percentage change in the ingredients of bakery products' RSV scores notably increased, while the percentage change in the RSV scores of bakery products slightly increased. The search queries of "pastry" during confinement period quite different between countries. These differences could be explained by the social subconscious,

Table 3
Related top queries of keywords in the Turkey, Italy and Sweden.

			Related Top Queries
Ingredients in Bakery Products	**Flour**	TR	Flour halva, flour cookie, flour halva recipe, flour cookie recipe
		IT	Rice flour, pizza flour, flour, wholemeal flour
		SE	Gluten free, gluten free flour, flour grams dl
	Yeast	TR	Sour yeast, dry yeast, instant yeast, fresh yeast
		IT	Mother yeast, without yeast, brewer's yeast
		SE	Bread yeast, bread, pizza dough, pizza dough yeast
	Dough	TR	Pastries, recipes, fried dough
		IT	Pizza dough, bread dough
		SE	Pizza dough, pizza recipe, piroger (local food), piroger dough
Bakery Products	**Bread**	TR	Bread recipe, bread making, meat bread
		IT	Bread recipe, bread in houses, homemade bread, whole grain bread
		SE	Bread recipe, bake bread, gluten free bread
	Pastry	TR	Dough recipe, pastry recipe, easy pastry
		IT	No data
		SE	Pastry recipe, pastries and coffee breaks, easy pastry, bake
	Biscuit	TR	Biscuit recipe, biscuit cake
		IT	Ice cream biscuit, cookie dough, biscuit cake, biscuit
		SE	Biscuit recipe, chocolate biscuits, biscuits for cheese, cheese and crackers
	Cake	TR	Cake recipe, wet cake recipe
		IT	Apple pie/cake, chocolate pie/cake, pie/cake recipe
		SE	Cake recipe, cake bake, soft cookie, cake frying pan
	Pasta	TR	Pasta recipe, baked pasta, pasta with sauce
		IT	Pasta recipe, puff pastry, shortcrust pastry, zucchini pastry
		SE	Pasta with, pasta carbonara (local food), pasta recipe, chicken pasta
	Pizza	TR	Domino's pizza, pizza recipe, pizza dough, pizza hut
		IT	Pizza, pizzeria, pizza dough, pizza recipe
		SE	Pizza hut, pizza online, pizza recipe

education level, awareness, stock-up, disaster background, food culture, fear of hunger, transport, geographic properties, quarantine conditions, free time, food prices, governments & authorities statements, media, internet, food supply and security, anxiety, emotional eating, perceived stress, depression, increased case number, cooking practices and external eating activities (Akter, 2020; Ongan et al., 2020).

The correlation analysis can be important to determine the potential relationship between COVID-19 infection and public food interest in the selected country. In this context, government stringency index, daily confirmed case number and the RSV score of coronavirus can be indicator for the severity of the COVID-19, coronavirus related anxiety, perceived stress, concerns on the public and challenges in food supply. The highly positive correlation between stringency index and daily RSV scores of "yeast", "dough", "bread", "pasta" and pizza" in Turkey and Italy suggested that the trends of stringency index could be important on the search profiles of keywords' under the quarantine condition. Moreover, the absence of any correlation in Sweden demonstrated that the selected coronavirus related parameters could be play important role in the modulation of web based searches under the lockdown conditions. In addition, the days of highest RSV scores about bakery products were generally overlap with the days when stay at home requirement score was highest in all countries. It contributed to strength hypothesis of the study.

Coronavirus disrupted the food supply and it majorly influenced to global food security which included food availability, economic and physical food access, food utilization and food stability. In the study of Niles et al. (2020), the effect of outbreak on the food insecurity was evaluated. According to their results, 35.5% of the food insecure household were newly food insecure since outbreak and two-thirds of households eating less due to food insecurity (Niles et al., 2020).

The food price instability, some challenges in agricultural production, supply chain distributions and trade restrictions severely impacted access to food. Therefore, consumers can be frequently preferred cheaper and less nutritious foods (Laborde et al., 2020). In this study, the large increase in search volume of bakery products can be related to food insecurity and global food crisis.

Stoll et al. reported that there was a rapid increase in search queries about directly and local sourced seafoods due to disruption in seafood delivery (Stoll et al., 2021). According to findings in the study, the large increase in search queries about local bakery products (piroger, carbonara) in Sweden can be related to disruption in food supply.

On the other hand, there were some differences between actual consumption and Google Trends data. For instance, Laguna et al. reported that Spanish consumers preferred foods that are perceived as healthier and also reduced their purchases of sugary bakery goods during the lockdown practice (Laguna et al., 2020). Similarly, Blaszczyk-Bebenek et al. (2020) found that daily servings of bakery products decreased significantly (Blaszczyk-Bebenek et al., 2020). In another study, large increase in sales was reported in baking ingredients, fresh vegetables, fresh fruit and chocolate, while large decrease in sales was reported in the bakery products, fresh fish and salted snacks during lockdowns in the Italy (Scacchi et al., 2021). However, this study showed that stay at home restrictons in Turkey and Italy contributed to large increase in search volume of bakery products. This difference can be related to food supply, socioeconomic status of participants, cuisine culture, food security and government coronavirus response practices. Already, increased search queries of keywords do not mean that the search is done to eat to foods. Moreover, present study demonstrated that large increase in search queries of bakery product generally related to finding a recipe. In this point, it is not known that how many times the same recipe searched, how much search rate was available from quarantine areas, whether the recipe was applied or not, whether the product was consumed or not and how much porsion was consumed. Therefore, to determine the consumer preference of limited number of participants, food preference questionnaire can be better indicator than Google Trends data. Nevertheless, it should be not forgotten that there were risk in possibility of misrepresentation in food consumption survey.

In a study which included dietary habits of 820 adolescents from Italy, Spain, Chile, Colombia and Brazil, is reported that no effect of confinement process on the adolescents' dietary habits (Ruiz-Roso et al., 2020). However, the current findings indicated the potential relationship between lockdowns and the large increase in search volume of bakery products. Because Google Trends can not allow to determine its users' personal characteristics such as gender, age, educational level, socioeconomic status and etc. Some differences in specific groups can be appeared.

Although some limitations are available in Google Trends studies, infodemiological studies have vital importance to following of the public interest and concerns especially in the pandemic conditions (Effenberger et al., 2020; Onchonga, 2020; Yuan et al., 2020). During this process, the public interest to dietary supplements, functional foods, dietary habits and food interests were investigated by Google Trends. According to these studies, the public dietary habits about food security, finding recipe for home made food practice and search queries about immunity related items reflected to the web based searches (Günalan et al., 2021; Mayasari et al., 2020; White et al., 2021). In this context, Google Trends can be a useful tool in the planning of the future food choices researches.

Authorities and researchers have offered some guidelines about the optimal nutrition to strengthen immunity and to combat against new
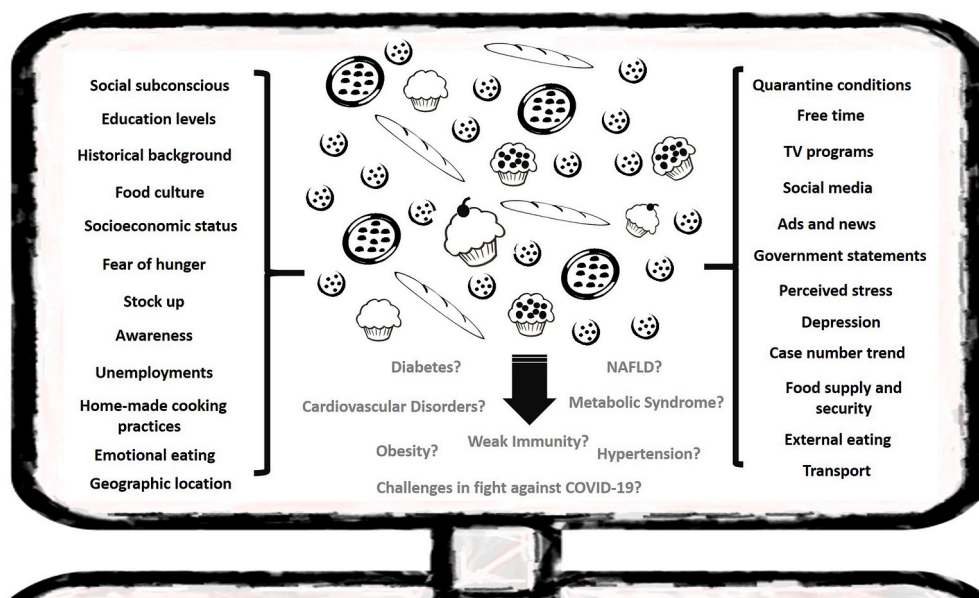
Fig. 3. Population-related and external factors that influence bakery product choices in the quarantine period of the era of COVID-19 and their potential impacts on the health in the future.

type of coronavirus (Ayseli et al., 2020; Barazzoni et al., 2020; de Faria Coelho-Ravagnani et al., 2021; Torlone et al., 2020). A poor diet in terms of fruit and vegetables can appear during quarantine due to disruption in food supply and food insecurity. Individuals can compensate the gap of the diet with high-carb and fat-containing foods such as baked goods. The overconsumption of the high-carb and high-fat products can indicate to the low grade inflammation and impaired gut microbiota (Fleit, 2014; Shi, 2019). The long-term consequences of this unhealthy nutrition habits carry the risk in terms of diabetes, obesity, cardiovascular diseases (Butler and Barrientos, 2020; Mattioli et al., 2020). In addition, the unhealthy eating habits can cause the weak immunity, severe COVID-19 pathology and mortality since inadequate intake of nutrients (Butler and Barrientos, 2020). To sum up, the effective factors and potential consequences for future of the public interests to bakery products during the quarantine period are schematized in Fig. 3.

This study focused on the public food interest in the quarantine days of the COVID-19 infection with infodemiological approach. Findings suggested that quarantine application can contribute to the internet search of public about the bakery products in various countries. Understanding of search queries about dietary choices will help to effectively combat against coronavirus. Large increase in search queries about bakery products can indicate to potential increasing of noncommunicable diseases in the future. According to followed data from open source data bank and search trends, the public should be informed about the outcomes of food choices in the quarantine regions.

Limitations

When evaluate the results of Google Trends analysis studies, several limitations should to be taken into consideration. Firstly, this study only included the search queries about selected foods in Turkey, Italy and Sweden. For more detailed analysis about the effects of coronavirus and quarantine on food interests, comprehensive studies with more countries and more keywords are required. Secondly, the findings in this study reflected to general interests of public to bakery products among the internet users in these countries. Some individuals in the public could be higher interest to healthy eating to fight against the COVID-19 infection. In this context, it could be also possible the increased adherence to the healthy eating habits in some regions of the country. For instance, in a questionnaire based cross-sectional study in Spain showed

that adherence to Mediterranean diet slightly increased while consumption of 'unhealthy' food higher increased during the confinement period (Sánchez-Sánchez et al., 2020). Thirdly, food culture is country specific and so commonly preferred foods can be change from country to country. Also, any food can be expressed with two names in one country, while one name can be enough to describe the same food in another country. In addition, the RSV score of plural or singular form of foods can be different. Therefore, there is likely to be missing data in the analysis. Lastly, increased search queries of keywords do not mean that the search is done to eat to foods.

Implications for gastronomy

This study provides some evidence about the role of coronavirus pandemic under quarantine conditions on the food choices from infodemiological perspective. According to our results, public frequently searched recipe of bakery products under the confinement period of COVID-19 outbreak. In addition, large increase in interest to local foods was reported. It could be important to determine the public interest to country specific culinary applications and specific products in the outbreak. For instance, piroger and carbonara, were highly searched in Sweden.

Declaration of interests

The author declared that no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijgfs.2021.100359.

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