

## **A study on changes in the food service industry about keyword before and after COVID-19 using big data**

Sukjoon Jung

*Ph.D., Department of Business Administration in Hospitality and Tourism, Graduate school,  
Honam University, Korea  
rosemari129@hanmail.net*

### **Abstract**

*In this study, keywords from representative online portal sites such as NAVER, Google, and Youtube were collected based on text mining analysis technique using TEXTOM to check the changes in the restaurant industry before and after COVID-19. The collection keywords were selected as dining out, food service industry, and dining out culture. For the collected data, the top 30 words were derived, respectively, through the refinement process. In addition, comparative analysis was conducted by defining data from 2018 to 2019 before COVID-19, and from 2020 to 2021 after COVID-19. As a result, 8272 keywords before COVID-19 and 9654 keywords after COVID-19, a total of 17926 keywords, were derived. In order for the food service industry to develop after the COVID-19 pandemic, it is necessary to commercialize the recipes of restaurants to revitalize the distribution of home-use food products that replace home-cooked meals such as meal kits. Due to the social distancing caused by COVID-19, the dining out culture has changed and the trend has changed, and it has been confirmed that the consumption culture has changed to eating and delivering at home more safely than visiting restaurants. In addition, it has been confirmed that the consumption culture of existing consumers is changing to a trend of cooking at home rather than visiting restaurants.*

**Keywords:** *Eat out, Food service industry, COVID--19, Keyword analysis, Big data*

### **1. Introduction**

After the COVID-19 outbreak, visiting dining out is rapidly being replaced by non-face-to-face dining. This is because mobile food transactions, which were active mainly among young people in their 20s and 30s, while emphasizing social distancing and non-face-to-face services, are now common to the middle-aged generation and food delivery services are becoming commonplace [1]. In addition, as the number of single-person households increases and COVID-19 spreads nationwide, the so-called 'homeconomy (home+economy)', in which all economic life takes place at home, appears, and the non-face-to-face service industry is booming [2].

Instead of going directly to the restaurant, consumers order food from the restaurant using platforms such as Baedal Minjok, Yogiyo, and Coupang Eats, and also utilize Coupang's Coupang Wow, Rocket Flash, and

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Corresponding Author: rosemari129@hanmail.net

Tel: \*\*\* - \*\*\*\* - \*\*\*\* Fax: +82-504-010-1685

Ph.D., Department of Business Administration in Hospitality and Tourism, Graduate school, Honam University, Korea

Baemin Mart of Baedal Minjok. As a result, more and more consumers are buying fresh ingredients at home rather than going to the supermarket [3]. Due to social distancing, consumers were restricted from eating out and shopping offline, and the proportion of shopping using online and mobile platforms, a so-called ‘untact economy’ consumption type, increased significantly [4]. Through big data analysis, we intend to compare and analyze trends in the restaurant industries that change before and after the outbreak of COVID-19 and present or improve future response strategy directions. Section 1 explains the background and purpose of research on the dining out culture of the food service industry. Section 2 describes the research method. Section 3 explains the results of big data research on the dining out culture of the food service industry. Section 4 describes that as a conclusion.

## **2. Research Method**

The purpose of this study is to discover ways to create a safe dining out culture environment centered on lifestyle quarantine in line with the trends of the food service industry that has changed since the outbreak of COVID-19, establish the direction of the dining out culture improvement project, and improve the effectiveness of the project. Through big data analysis, the food service industry trends before and after the COVID-19 outbreak recognized by consumers are comparatively analyzed, and then the dining out culture is improved or the food service industry's response strategy is suggested in the future.

This study is a big data analysis using text-mining, a “process or technology to find new and useful information from unstructured text data” in order to understand consumer behavior and changes in the food service industry before and after COVID-19. TEXTOM is useful software for network analysis as it searches and collects data from portal search sites, provides related keyword rankings, and provides matrix information according to the frequency of appearance of search keywords [5]. Based on the big data analysis technique using TEXTOM, blogs, cafes, news, intellectuals, and web documents provided by NAVER, Daum, and Google were used as analysis channels. As for the key words for data search, the frequency of consumers' search was investigated, focusing on the food service industry, the dining out culture, and the restaurant culture.

The data collection period was analyzed for changes in the food service industry trend before and after COVID-19 by using search frequency data from January 01, 2018 to October 31, 2019, before COVID-19 and after COVID-19 From January 01, 2020 to December 31, 2021.

## **3. Result**

A total of 8272 keywords were derived as a result of excluding duplicate words after crawling, which is the work of collecting data related to the dining out, food service industry, and dining out culture before COVID-19. Based on 8272 keywords, the top 30 keywords with the highest search frequency among keywords related to this study were derived and applied to this study. As a result of analyzing the frequency, before COVID-19, it appeared in the order of ‘Eat out’, ‘Foodie’, ‘Korean wave’, ‘Korean food’, ‘Hotel’ additional TF-IDF analysis was conducted. TF-IDF analysis is a value calculated by multiplying TF, which is the frequency of words including keywords, by IDF, which is the frequency of documents, and considering the TF-IDF weight, which indicates the importance of keywords [6]. As a result of TF-IDF analysis, it appeared in the order of ‘Menu’, ‘Food’, ‘Hotel’, ‘Korean food’, and ‘Cooking’. In the case of ‘Menu’, ‘Food’, ‘Hotel’, ‘Korean food’, and ‘Cooking’, which show high TF-IDF values, keywords are deeply related to the food service industry before COVID-19, which show that they are consistent with the TF-IDF analysis results. In other words,

although the ranking of the search frequency and the TF-IDF value is different, it shows that it is important in terms of the weight of the core keyword.

**Table 1. Dining out culture keyword before COVID-19**

Rank	Word	Frequency	TF-IDF	Rank	Word	Frequency	TF-IDF
1	Eat out	10599	1909.11	16	Education	925	2077.05
2	Foodie	8322	2432.24	17	College	886	2147.34
3	Korean wave	4474	2207.54	18	Corporation	829	1826.43
4	Korean food	2409	3439.15	19	Cooker	799	1830.75
5	Hotel	2132	3479.91	20	Café	790	2205.34
6	Food	2114	3822.08	21	General	781	1948.56
7	Menu	1891	4888.50	22	Restaurant	755	1885.24
8	Tourism	1751	2956.33	23	Industry	704	1763.71
9	Research	1450	3054.78	24	Interview	696	1984.53
10	Cooking	1405	3114.99	25	Association	639	1713.67
11	University	1370	2776.29	26	Restaurant business	616	1617.88
12	Management	1190	2217.21	27	Major	606	1755.17
13	Development	1082	2826.70	28	Doctor	572	2032.50
14	Department	1027	2431.79	29	Cuisine	571	1541.29
15	International	937	2142.25	30	Economy	550	1343.62

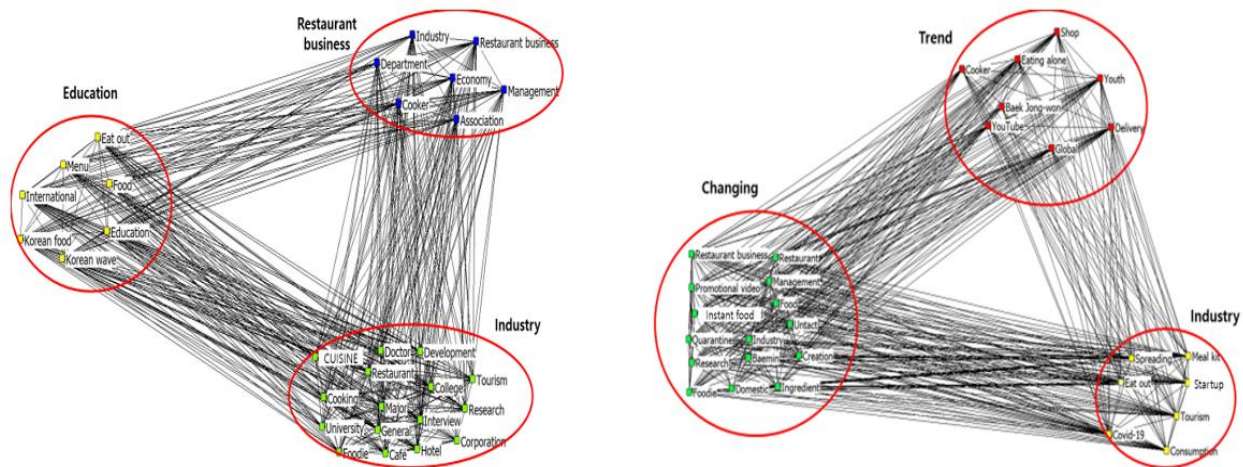
A total of 9,654 keywords were derived as a result of excluding duplicate words after crawling data related to dining out, food service industry, and dining out culture after COVID-19. Based on 9654 keywords, the top 30 keywords with the highest search frequency among keywords related to this study were derived and applied to this study. The top 30 keywords and word search frequencies are shown in Table 2.

As a result of analyzing the frequency, after COVID-19, it appeared in the order of 'Eat out', 'Foodie', 'Consumption', 'COVID-19', and 'Food', and additional TF-IDF analysis was conducted. As a result of the TF-IDF analysis, it appeared in the order of 'COVID-19', 'Food', 'Spreading', 'Restaurant', etc. In the case of 'COVID-19', 'Food', 'Spreading', and 'Restaurant', which show high TF-IDF values, are words that are deeply related to changes in the food service industry after COVID-19, which show that they are consistent with the TF-IDF analysis results. In other words, although the ranking of the search frequency and the TF-IDF value is different, it shows that it is important in terms of the weight of the key keyword.

**Table 2. Dining out culture keyword after COVID-19**

Rank	Word	Frequency	TF-IDF	Rank	Word	Frequency	TF-IDF
1	Eat out	16821	2965.17	16	Startup	1217	3037.19
2	Foodie	11523	3521.71	17	Industry	1203	2607.62
3	Consumption	7305	2932.31	18	Baek Jong-won	1114	2518.52
4	COVID-19	4410	8623.91	19	Eating alone	1089	2800.91
5	Food	3667	6085.50	20	Restaurant business	1083	2400.41
6	Spreading	2817	5460.87	21	Instant food	1075	2256.46
7	Meal kit	2741	4472.97	22	Ingredient	1023	2616.65
8	Management	1853	3371.61	23	Shop	932	2410.52
9	Untact	1837	3558.01	24	Baemin	921	2808.15
10	Restaurant	1713	4506.64	25	YouTube	894	2977.69
11	Quarantine	1647	3762.28	26	Youth	874	2662.61
12	Delivery	1537	2887.81	27	Domestic	845	2064.04
13	Research	1381	3258.77	28	Creation	845	2150.85
14	Global	1344	3215.30	29	Promotional video	770	2330.26
15	Tourism	1317	3152.45	30	Cooker	761	2165.83

As a result of analyzing the word frequency and TF-IDF before and after COVID-19, the word frequency rankings of 'Eat out', and 'Foodie' are the same, but before COVID-19, 'Korean wave' is the same. It was confirmed that the frequency of keywords such as 'Tourism', 'Education', 'Restaurant', 'Food', and 'Research' as high, and after COVID-19, keywords such as 'COVID-19', 'Untact', 'Quarantine', 'Delivery', 'Eating alone', 'Instant food', 'Ingredient', 'YouTube', and 'Meal kit' were newly added. Based on the above data, it can be seen that the trend of the food service industry after COVID-19 has changed to a trend that prefers instant food that can be eaten at home by delivering food from one's home or using social media such as YouTube, rather than visiting restaurants directly due to social distancing. After COVID-19, it can be confirmed that unlike before, consumers are more interested in social distancing and quarantine caused by COVID-19 and search.



**Figure 1. CONCOR analysis about before COVID-19**      **Figure 2. CONCOR analysis about after COVID-19**

CONCOR (CONvergence of iteration CORrealion) analysis is a form of cluster analysis that groups highly related nodes into one group by considering the relationship between nodes in similar positions in the overall network structure. CONCOR analysis was conducted before and after COVID-19, and as a result of the analysis, it was divided into three clusters, respectively, as shown in Figure 1 and Figure 2.

In the CONCOR analysis before COVID-19, the first cluster was determined as an educational cluster related to the dining out culture. Due to the Korean Wave, overall awareness of Korean food has increased, and it has been confirmed that more people are looking for Korean food internationally. The second cluster was designated as a cluster of restaurants related to the dining out culture. Cooker, economics, and management, words related to the food service industry, occupy the cluster. The third cluster was defined as an industrial cluster of restaurant industry. Consumer perception of the food service industry can be confirmed through tourism, hotels, fields, and doctor, and educational industry aspects to become cooker can be confirmed through university, college, and departments.

In the CONCOR analysis after COVID-19, the first cluster was identified as a cluster of changes in the food service industry due to COVID-19. In the food service industry, consumers began to find HMR, which is easy to untact, such as instant food, in that the industry directly finds restaurants due to COVID-19. The second cluster defined the cluster name as a trend. The dining out culture has changed, such as eating alone and delivery, and the trend of the dining out culture has changed due to the development of media outlets that can be easily made at home such as 'YouTube', and 'Baek Jong-won'. Third, the cluster name was set as the industry of dining out culture. As the non-face-to-face food service industry grows through COVID-19 and spread, it has been

confirmed that there is a new growth in the food service industry to satisfy consumers, such as startups, meal kits, and consumption.

In other words, before COVID-19, it was confirmed that consumers' perceptions related to the dining out culture were related to the food service industry as education, food service industry, and industrial cluster. However, after COVID-19, words related to changes in the dining out culture and industry caused by COVID-19, such as changes in the food service industry, trends, and industry, were identified. As trends and consumer perceptions change before and after COVID-19, it has been confirmed that new meal kits and start-ups to satisfy consumers are developing.

#### **4. Conclusion**

This study collected keywords from representative online portal sites such as NAVER, Daum, and Google based on text mining analysis techniques using TEXTOM to check changes in the food service industry before and after COVID-19. The collection keywords were selected as dining out, food service industry, and dining out culture, and the collection period was selected from January 1, 2018 to October 31, 2019, before COVID-19, and from January 1, 2020 to December 31, 2021. In the collection process, duplicate keywords were excluded by crawling the search frequency of online portal sites, and as a result, 8272 keywords were derived before COVID-19, 9654 keywords after COVID-19, and a total of 17926 keywords were derived. The results of the study that conducted a comparative analysis using the big data analysis technique on the search frequency before and after COVID-19 are as follows.

First, keywords that were frequently searched before COVID-19 were keywords such as 'Restaurant' and 'Café'. Through this, looking at the trend of the food service industry before COVID-19, it can be seen that consumers' consumption patterns and lifestyle tend to visit restaurants directly. However, looking at the newly added keywords after COVID-19, it can be seen that keywords such as 'Delivery', 'Eating alone', 'Instant food', 'Baemin', 'Baek Jong-won', 'YouTube' and 'Meal kit' were added. Through this, it was confirmed that the trend of the food service industry after COVID-19 was to prefer HMR (Home Meal Replacement) foods that can be easily cooked at home, such as meal kits and instant food, rather than visiting restaurants in person. And as a result of analyzing the search frequency before and after COVID-19, unlike before COVID-19, Corona-related keywords such as 'COVID-19', 'Untact' and 'Quarantine' accounted for a high frequency, which can be seen that the COVID-19 pandemic greatly affects the change in the restaurant industry.

Second, as a result of CONCOR analysis before and after COVID-19, education, restaurant business, and industry clusters of dining out culture were identified before COVID-19, and after COVID-19, changing, trend, and industry clusters were identified. The biggest change before COVID-19 was that before COVID-19, consumers' perceptions related to the dining out culture appeared overall in the food service industry as education, food service industry, and furthermore, it had a direct impact on the Korean wave. However, after COVID-19, words related to changes in the dining out culture and industry, such as changes in the food service industry. In particular, due to the development of new media, channels and cooking foods that tell you how to cook and eat at home have developed.

The practical implications presented by this study through comparative analysis of search frequency conducted before and after COVID-19 are as follows.

First, the trend of the food service industry has changed since COVID-19. Rather than visiting restaurants in person, consumers have confirmed that the frequency of 'Eating alone' at home, ordering delivery through platforms such as 'Baemin' and simply cooking at home using HMR foods such as 'Meal kit' and 'Instant Food' has increased. It has also been confirmed that people tend to watch videos of social media platforms at

home and make and eat food through keywords such as ‘Baek Jong-won,’ ‘Ingredient’, and ‘YouTube’, which were derived after COVID-19. In other words, in order for the food service industry to develop after the COVID-19 pandemic, it is necessary to commercialize the recipes of restaurants to revitalize the distribution of home-use food products that replace home-cooked meals such as meal kits.

Second, after social distancing caused by COVID-19, consumers are interested in quarantine and vaccination to avoid exposure to the COVID-19 virus, which can be confirmed by high-frequency keywords such as ‘Quarantine’ and ‘COVID-19’. In other words, there is a need for a plan to ensure quarantine and allow consumers to safely access food in restaurants without being exposed to COVID-19.

Third, it was confirmed that the existing consumer culture of consumers is changing the trend of cooking at home rather than visiting restaurants. To this end, it is necessary to release a new meal kit only for those companies that have different competitiveness from those that specialize in meal kits such as fresheasy and SSG, which are existing companies.

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