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FOOD SAFETY IN PORTUGUESE COMPANIES IN COVID-19 PANDEMIC CONTEXT

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Abstract

The Food Safety Management System (FSMS) seeks to ensure the quality of food products in the whole food supply chain. In Portugal, like in all European Union countries, enterprises working in the food sector have to fulfil several regulations of food safety and quality to assure those food products won't compromise consumers' health. The COVID-19 pandemic brought additional challenges for companies and their food safety systems. Governments also have decreed new (additional) hygiene measures to be implemented by companies and applied to workers when handling products, such as: use of masks, more frequent hand sanitization, the distance between workers, more frequent cleaning of surfaces, etc. The aim of this study is to assess the most important aspects/challenges caused by the COVID-19 pandemic in Portuguese food production companies.

The instrument used in this study was a survey voluntarily answered by 58 Portuguese companies acting in the food sector, by those responsible for the quality sector, or by those in management positions, using an online platform (Slido®). The data was collected in the period from May to August 2020, and the data analysis was made using an Excel database and spreadsheet functionalities.

The results showed that the HACCP (part or included in ISO 22000) is the most implemented food safety system in Portuguese companies (in above 50% of the companies included in the study). Also, 20% have International Featured Standards (IFS) certification, and 16% declare to have implemented the ISO 22000 standard. Among the different attributes available, the attribute selected by Portuguese companies as most influential (most scored) to affect the integrity of the companies' FSMS was the "temperature checking of workers", and the least influential was the "staff awareness". Furthermore, a great majority of the companies revealed that the FSMS include documents associated with response/incidents affecting food safety; that COVID-19 pandemic was identified as originating potential emergencies in the FSMS; and that the food safety teams were trained on how to react in case of a pandemic. Globally, companies' respondents also admit that their FSMS allowed reacting to the pandemic of Covid-19, providing additional training to their staff to implement supplementary personal hygiene procedures (as: handwashing, physical distance, …), reinforce the use of personal protective equipment (such as masks), or adjust the sanitation/cleaning practices associated with hygiene of the objects. According to the results, the market/retail was the sector of the food supply chain most affected due to pandemic Covid-19, and the Primary sector the least affected.

In conclusion, the companies are, in general, committed to implement and reinforce the measures related to the FSMS, even under difficult circumstances like those resulting from the COVID-19 pandemic.

***Key words**: Food safety systems, COVID-19, Pandemic, Portuguese companies, Survey.*

1. Introduction

Food safety is one of the food industry's main concerns. The Food Safety Management System (FSMS) seeks to ensure that the quality of food products is guaranteed

from the place of harvest, capture or production until the households where they are consumed, i.e., along the whole food supply chain. The concern is that food products are directed to the health and well-being of the consumer, ensuring that the food products will not have a health impact on the consumer when they are processed and/or consumed.
In 1997 the European Commission established the general principles of food safety legislation. Those principles cover the whole food chain, ensuring a high level of protection of public health, and consumers' safety, the free movement of food products within the internal market, and ensuring competitiveness between European industries, with the prospect of improved exports [1,2].

In Portugal, like in all European Union countries, companies have to fulfil several regulations of quality and food safety, to assure those food products are safe, i.e., that ingesting these food products can't damage consumers' health.

In 1998, Portugal incorporated into national laws (Law 67/98) [3] the establishment of general hygiene standards to which foodstuffs should be subject, and the arrangements for verification of compliance with these standards, a service set up to implement the self-control activities, based on the HACCP (Hazard Analysis and Critical Control Point) system 4]. Law 67/98 establishes that food companies must identify all phases of their activities to ensure food safety, and ensure that safety procedures are created, implemented, updated and complied with. As a member of the European Committee for Normalization (CEN), in 2005 Portugal adopted the European Standard ISO 22000 [5], as a national Standard [6]. This International Standard specifies the requirements for an FSMS, recognized as essential, to ensure food safety throughout the food chain.

Additionally to ISO 22000, other FSMS standards have been developed as International Featured Standards (IFS) [7] and British Retail Consortium (BRC) [8]. These tight regulations have to be guaranteed throughout the food supply chain, as: primary production, processing, distribution and retail sectors. These security guarantees are ensured by the certification of the quality systems implemented in each of the companies.

In any FSMS, one of the critical variables that are mandatory to be controlled is food contamination by biological agents, such as bacteria or viruses, which can deteriorate food products, or even worse, develop diseases in people through their consumption.

In the end of year 2019, a new virus emerged, later named as SARS-CoV-2, and on 30 January 2020 the Director-General of the World Health Organization (WHO) declared the outbreak of COVID-19 to be a Public Health Emergency of International concern and issued a set of Recommendations [9]. The COVID-19 disease was declared a pandemic by the WHO in April 2020 [10]. To support the food supply chain, the WHO has developed two main guidance documents [11,12]. One document addressed the food companies and the other the authorities responsible for national food safety systems.

According to Galanakis [13], food safety is recognized as a strongly affected dimension of food systems during the Covid-19 pandemic. However, the European Food Safety Authority (EFSA) referred that there is still no scientific evidence that food is a source or transmission route for SARS-CoV-2 virus [14].

This new pandemic brought additional challenges for companies and their food safety systems, to assure consumers that food products are safe. Therefore, Governments have decreed new (additional) hygiene measures, implemented by companies and applied to workers when handling products, such as: use of masks, more frequent hand sanitization, the distance between workers, more frequent cleaning of surfaces, etc.

The present study presents a detailed analysis of the data collected from the questionnaires to 58 Portuguese companies acting in the food sector, and intends to assess the most important aspects/ challenges caused by the COVID-19 pandemic.

2. Materials and Methods

The instrument used in this study was a survey answered by Portuguese companies in the food sector, to collect information about the different issues related to the food safety system that can be affected by the COVID-19 pandemic. The questions included in the survey, and also the questionnaire design was based on the FSMS referential and also on the WHO guidelines in the context of the COVID-19 pandemic.

The sample size consisted of 58 companies that voluntarily answered the questionnaire, by those responsible for the quality or by those in management positions, using an online platform (Slido®). Companies were contacted in advance to analyse the availability to participate in the survey. The data was collected in the period from May to August 2020.

The data analysis was made using an Excel database and spreadsheet functionalities.

The first group of questions intended to collect information to characterise companies, according to

their dimension, the position in the supply chain, or about the FSMS implemented. The second group of questions were about their preparation and reaction in terms of food safety to the pandemic. More details about the questionnaire organization and scales are described in the results and discussion section.

3. Results and Discussion

3.1 Characterization of the participant's companies in the present study

The initial questions intend to collect information to characterize the companies included in the present study.

Concerning the size of the companies, they have been categorised according to the number of employees, i.e., Small companies (≤ 50 employees), Medium companies (51 – 250 employees), and Big companies (≥ 250 employees). The major percentage (56,9%) of the companies were considered as small, 24,1% were medium, and just 19% of them were big Companies.

Food safety goes through several stages from primary food production, products' reception and handling, preparation, processing, storage, distribution and sale. Thus, one of the criteria for the companies to be included in the study was if they operate in at least one part of the food supply chain: primary production, food processing, storage/distribution, retail and wholesale.

The companies were asked to select, among different activity sectors, the option that better describes their activity or scope position in the supply chain. From the results (Figure 1), most of them (40%) are included in the Food processing sector. Almost the same percentage (~20%) belong to the primary production, storage/distribution, and wholesale/retail.

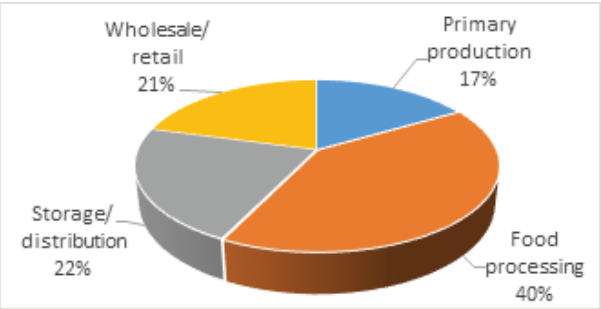

Figure 1. Percentage of Company's position(s) in the supply chain (n=96 responses)

The respondents also selected, among different categories of products, those that are produced, distributed or commercialised by their company. Figure 2 presents the results in percentage. As can be observed, all the different categories of products listed were selected. This means a large representativity of different products. The category most frequent is Fruit and vegetables (15%), followed by Meat and poultry (14%), and after Convenience food (e.g., ready-to-eat meals) with 11%.

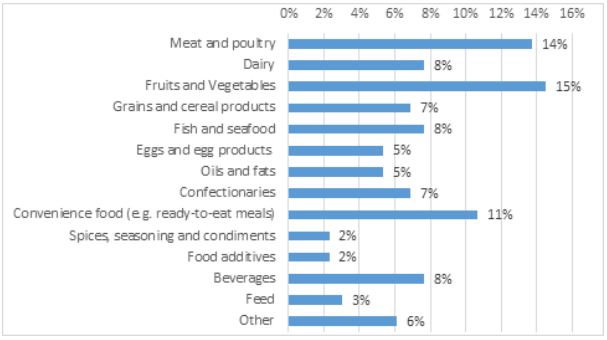

Figure 2. Company's product categories (n = 131 responses)

A detailed data analysis allowed us to conclude that a major percentage (42%) of the companies included in the study deals with (produce, or process, or sell ...) only one product. 32% of companies deal with two or more products. Just 11% of companies deal with more than five products.

3.2 Food safety issues in a Covid-19 pandemic context

Figure 3 presents the results reported by the participants about the food safety systems implemented/certified in their companies. The majority (52%) of the participants answered that their companies have implemented the HACCP (Hazard Analysis and Critical Control Point) food safety management systems. This is understandable because since 1998 this system is mandatory for Portuguese companies. Among others, the national regulations of self-control food safety system based on HACCP establish that food companies should make sure that people who handle food are properly targeted and informed and are trained in hygiene issues appropriated to their professional activity.

A significant percentage (20%) of companies have implemented/certified IFS food (International Featured Standards), and also 16% declare having implemented the ISO 22000 standard. These results indicate that the implementation of the ISO 22000 standard in the Portuguese companies should be reinforced, in order to improve their competitivity in the global market.

A very low percentage of companies declare to have implemented/certified BRC (British Retail Consortium) standard, or Global GAP (Good Agricultural Practice), or other food safety management system. Moreover, we believe that Portuguese companies that have implemented/certified BRC standard did it mainly because they export products to Great Britain.

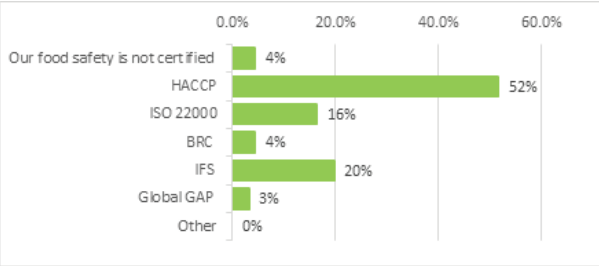

Figure 3. Implemented/certified food safety systems in the company (n = 91 responses)

One important information about the respondent's characterization (of those who answered the questionnaire) is their position in the company. As can be confirmed in Figure 4, a great majority (74%) are included in the control/quality team leaders. This suggests that respondents are accustomed to food security systems. Moreover, 16% are members of top management, and 10% belong to the production department.

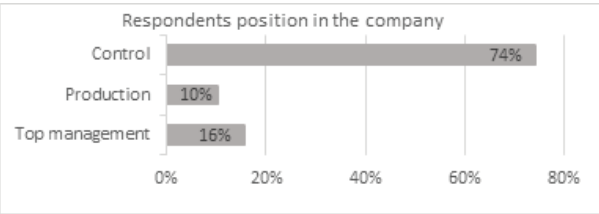

Figure 4. Respondents position in the company

The participants were asked to indicate their level of agreement (according to 5 levels) about 9 different statements related to the Food Safety Management System (FSMS) implemented in the companies where they belong. From the results presented in Table 1, we can conclude that the majority of the answers are globally "Agree" or "Strongly agree" with the of 9 statements.

In a more detailed analysis, for example: (statement 1) "… we have documents associated with emergency preparedness and response/incidents affecting food safety", Agree (32,8%) and Strongly agree (58,6%); or (statement 5) "During the pandemic of Covid19 we implemented more restrictive personal hygiene procedures (handwashing, physical distance, …)", Agree (34,5%) and Strongly agree (56,9%).

Regarding the companies included in the present study, we may point out that, due to the strength of their food safety systems, supported by the results from statements 1, 2 and 3, they could easily react to the pandemic of Covid-19, with measures like those described on statements 4 to 8 (staff training, more restrictive personal hygiene procedures, additional personal protective equipment, adjust sanitation/ cleaning practices associated with hygiene of the equipment and utensils).

The respondent's general opinion was that, during the covid-19 pandemic, the company's food safety system

Table 1. Agreement level [%] with different statements related to food safety

	Statement	Strongly disagree	Disagree	No opinion	Agree	Strongly agree
1	Within our FSMS, we have documents associated with emergency preparedness and response / incidents affecting food safety	1.7	3.4	3.4	**32.8**	**58.6**
2	Pandemic was identified as one of potential emergency situations / incidents within our FSMS	1.7	12.1	8.6	**48.3**	**29.3**
3	Food safety team in our company was trained how to react in case of pandemic	0	20.7	8.6	**41.4**	**29.3**
4	When pandemic of Covid19 was announced, we had to additionally train our staff	0	17.2	3.4	**55.2**	**24.1**
5	During the pandemic of Covid19 we implemented more restrictive personal hygiene procedures (hand washing, physical distance, …)	0	6.9	1.7	**34.5**	**56.9**
6	During the pandemic of Covid19 we had to purchase additional personal protective equipment (masks, gloves, protective clothing)	3.4	6.9	3.4	**31**	**55.2**
7	During the pandemic of Covid19 we had to adjust sanitation / cleaning practices associated with hygiene of the object	1.7	10.3	6.9	**41.4**	**39.7**
8	When pandemic of Covid19 was announced we had to invest in sanitation / cleaning equipment and utensils	5.2	25.9	8.6	**34.5**	**25.9**
9	During the pandemic of Covid19 food safety in our company was not compromised at any moment	1.7	6.9	6.9	**36.2**	**48.3**

wasn´t compromised at any moment. These results are in accordance with those presented by Djekic *et al.*, in [15], where authors mentioned that companies in different countries confirmed the implementation of more restrictive hygiene procedures during the pandemic and the need for purchasing more additional personal protective equipment. As presented in Table 1, similar results (concerns and procedures adopted) were observed for the Portuguese Companies.

At a next stage, and for seven different combinations of four possible factors that can affect the integrity of their food safety system, for each combination, the participants were asked to choose one most influential and one least influential. The results are presented in Figure 5, for each combination.

For combination (1), surprisingly, or not, the factor "Physical distance between workers" was scored

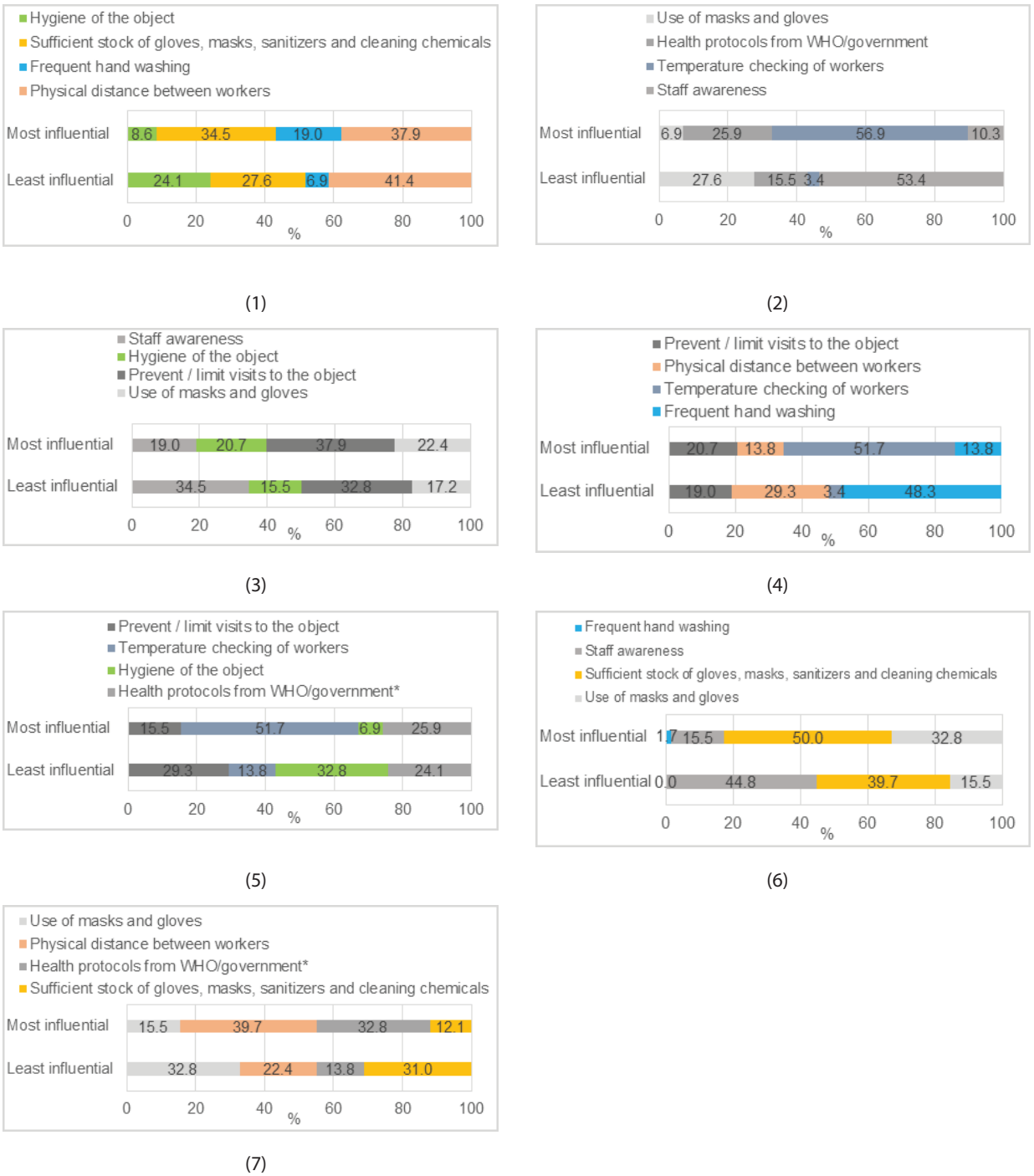

Figure 5. Most and least influential attributes that can affect the integrity of their food safety system

simultaneously as the most influential and the least influential. This reveals a divergence of opinions relative to the possible effect of the integrity of the food safety system, but also shows the most significant factor to the respondents. In combination (2) the most influential was the "Temperature checking of workers" and least influential was the "Staff awareness", both with scores up to 50%. In combination (3) there isn´t a clear distinction in the score of any attribute. In combination (4) the factor sored as most influential was the "Temperature checking of workers" (51,7%), similar to verified in combination (2), and least Influential was the "Frequent hand washing" (48,3%). We may highlight that, in combination (5) the factor sored as most influential was the "Temperature checking of workers" (51,7%), in combination (6) the "Staff awareness" was scored as least influential (44,8%) and the most scored was Sufficient stock of gloves, masks, sanitisers and cleaning chemicals (50%), and in combination (7) the attribute "Physical distance between workers" was scored as the most influential (39,7%) and sufficient stock of gloves, masks, sanitisers and cleaning chemicals, as the least influential (31%).

Table 2 compiles all votes/choices for the different attributes and from all 7 combinations, scored as "most influential" and "least influential" to affect the integrity of the food safety system. On the first column of Table 2 are presented the combination where the attribute appears. From the global results, it can be confirmed that the most frequently scored (chosen) as most influential was the "Temperature checking of workers", and the most frequently scored for least influential was the "Staff awareness".

Observing the results of Table 2, for the respondents the "Frequent hand washing" isn´t an attribute considered pivotal to affect the integrity of their food safety system.

Although the "Use of mask and gloves" attribute appears in 4 of the combinations (column 1), it didn't have the highest total choice. This means that this is not an important factor in affecting the integrity of their food safety system. Even more, the Most influential and Least Influential votes are almost equal (~50).

In [15], from the results of much more countries, the authors verified that Staff awareness and hygiene are the two most important attributes in combating Covid-19, and the least important the temperature checking of workers in a food establishment and health protocols from the World Health Organization.

Taking into account the discrepancy of results in relation to other countries, the hypothesis arises that Portuguese companies, when faced with the various statements related to the COVID-19 pandemic, have valued actions that they were not usually used to practicing, as is the case of measuring the temperature of workers, in detriment of what was already established, as is the case of staff awareness and hygiene.

From a list of extreme events, the participants were also asked to select those for which their company has a documented food safety emergency plan. In this question, multiple answers were allowed, Figure 6.

The document included in the safety emergency plan that more companies have (51) is the ingredient/packaging contamination. Also, a significant number of companies have documents to report other extreme events as: water contamination (32); energy failure (32), fire (29), or pandemic and other health issues (29). The present pandemic due to COVID-19 disease can be included in this last extreme event.

The extreme events less included in documents of the security emergency plans are the natural disaster (1) and bioterrorism (10). Moreover, it was also verified that 15 companies report that they have at least 7 of the documents listed.

Table 2. Answers frequency (votes) as Most and Least Influential attributes that can affect the integrity of the food safety system.

Combination	Atribute	Least Influential	Most influential	Total
1;4;7	The physical distance between workers	54	53	**107**
3;4;5	Prevent/limit visits to the object	47	43	**90**
2;3;6	Staff awareness	77	26	**103**
1;4;6	Frequent hand washing	32	20	**52**
2;3;6;7	Use of masks and gloves	54	45	**99**
2;5;7	Health protocols from WHO/government	31	49	**80**
1;6;7	Sufficient stock of gloves, masks, sanitizers and cleaning chemicals	57	56	**113**
2;4;5	Temperature checking of workers	12	93	**105**
1;3;5	Hygiene of the object	42	21	**63**

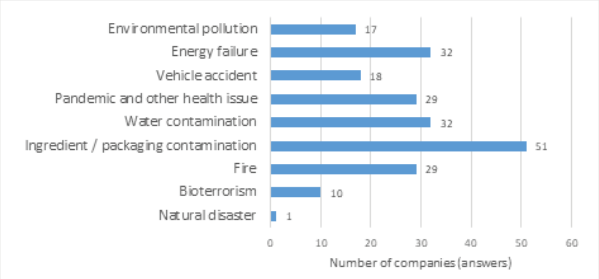

Figure 6. Number of companies having documents of safety emergency plan (N = 219)

Finally, it was also asked, in terms of food safety, within the food supply chain phases operated by their company what was the most affected and least affected due to pandemic Covid-19.

According to the results (Figure 7), 43,1% of the respondents consider that market/retail was the stage of the food supply chain most affected due to pandemic Covid-19. With the same proportion, 19% of the companies consider that "food processing" and "transport/distribution" were the stages most affected by the pandemic.
Concerning to the least affected, 32,8% of the participants answered that the "primary" stage was the least affected by the pandemic, followed by the "storage/warehouse" with 25,9% of the answers.

Although "market/retail" was considered the stage of the food supply chain most affected due to the pandemic, it should be noted that 41% of the companies included in the study belong to the "food processing" sector and only 21% are dedicated to the "retail" sector, as showed in Figure 1.

The results in this study, for Portuguese companies, are similar to those reported in [15], to the global of the multi-country companies, in which the Retailers were identified as the food supply chain link mostly affected by the pandemic, and the food storage facilities as least affected. However, in the Portuguese case, the primary stage was scored as the least affected (32,8%).

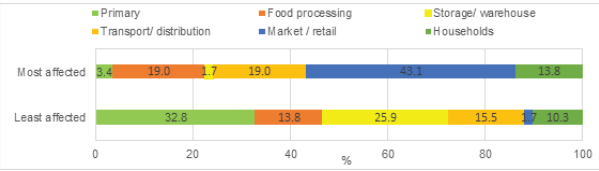

Figure 7. Percentage of answers that, in terms of food safety, considering the phase of the food supply chain were the most and least affected due to pandemic Covid19

4. Conclusions

- From the undertaken research, it is concluded that the HACCP is the food safety standard most implemented in Portuguese Companies (above to 50% of the companies included in the study). Also, 20% have IFS standard certification and only 16% declare have implemented the ISO 22000 standard. So, the implementation of the ISO 22000 standard in the Portuguese companies should be encourage, in order to improve their competitivity in the global market.
- From the results, the attribute selected as most influential (most scored) to affect the integrity of the companies' FSMS was the "Temperature checking of workers", and the least influential was the "Staff awareness".
- The results reveal that, to a great majority of the Portuguese companies operating in the food chain, the FSMS includes documents associated to response/ incidents affecting food safety; that COVID-19 Pandemic was identified as potential emergency in the FSMS, and that Food safety team was trained on how to react in case of a pandemic. Globally, the participating companies also admit that their FSMS allowed reacting to the pandemic of Covid-19, with additional training of their staff to implement more restrictive personal hygiene procedures (as: handwashing, physical distance, …), to reinforce the use personal protective equipment (as masks), or to adjust the sanitation/ cleaning practices associated with hygiene of the object.
- To the Portuguese companies, the market/Retail was the sector of the food supply chain most affected due to pandemic Covid-19, and the Primary sector the least affected.

Acknowledgement

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5. References

[1] Rodrigues da Costa I. C. (2013). *Food safety manual* (in Portuguese). Master thesis, Viseu agrarian superior school, Polytechnic Institute of Viseu, Viseu, Portugal.
[2] Rodrigues C., Guiné R., Correia P. (2015). *Food Safety Manual - From Origin to Consumption* (in Portuguese). <URL:https://www.booki.pt/loja/prod/manual-de-seguranca-alimentar-da-origem-ao-consumo/9789897231384/. Accessed 6 January 2021.
[3] Portugal Ministry Agriculture, Rural Development and Fisheries. (1998). *Law 67/98 on general hygiene rules to which foodstuffs must be subjected, as well as the modalities for verifying compliance with these rules* (in Portuguese).

<URL:https://dre.pt/pesquisa/-/search/197365/details/maximized. Accessed 6 January 2021.

[4] Notermans S., Zwietering M. H., Mead G. C. (1994). *The HACCP concept: Identification of potentially hazardous microorganisms*. Food Microbiology, 11, pp. 203-214.

[5] ISO. (2018). ISO 22000:2018: *Food safety management systems - Requirements for any organization in the food chain*. <URL:https://www.iso.org/obp/ui/#iso:std:iso:22000:ed-2:v1:en. Accessed 6 January 2021.

[6] Docsity. (2005). *NP EN 22000:2005 - Portuguese Standard for Quality Management and Food Safety* (in Portuguese). <URL: https://www.docsity.com/pt/np-en-22000-2005/4821002/. Accessed 6 January 2021.

[7] IFS Database. *IFS Food 6.1*. <URL: https://www.ifs-certification.com/index.php/en/standards/251-ifs-food-en. Accessed 6 January 2021.

[8] BRCGS. *Food Safety*. <URL:https://www.brcgs.com/our-standards/food-safety/. Accessed 6 January 2021.

[9] WHO. (2020). *WHO Director-General's statement on IHR Emergency Committee on Novel Coronavirus (2019-nCoV)*. <URL:https://www.who.int/director-general/speeches/detail/who-director-general-s-statement-on-ihr-emergency-committee-on-novel-coronavirus-(2019-ncov). Accessed 6 January 2021.

[10] WHO. *Coronavirus disease (COVID-19) pandemic*. <URL: https://www.who.int/emergencies/diseases/novel-coronavirus-2019. Accessed 6 January 2021.

[11] WHO, FAO. (2020). *COVID-19 and food safety: Guidance for food businesses: Interim guidance*. <URL:https://apps.who.int/iris/handle/10665/331705. Accessed 6 January 2021.

[12] WHO. (2020). *COVID-19 and Food Safety: Guidance for competent authorities responsible for national food safety control systems*. <URL:https://www.who.int/publications-detail-redirect/covid-19-and-food-safety-guidance-for-competent-authorities-responsible-for-national-food-safety-control-systems. Accessed 6 January 2021.

[13] Galanakis C. M. (2020). *The Food Systems in the Era of the Coronavirus (COVID-19) Pandemic Crisis*. Foods, 9, 523. <URL:https://doi.org/10.3390/foods9040523. Accessed 6 January 2021.

[14] EFSA. (2020). *Coronavirus: No evidence that food is a source or transmission route*. <URL:https://www.efsa.europa.eu/en/news/coronavirus-no-evidence-food-source-or-transmission-route. Accessed 6 January 2021.

[15] Djekic I., Nikolić A., Uzunović M., Marijke A., Liu A., Han J., Brnčić M., Knežević N., Papademas P., Lemoniati K., Witte F., Terjung N., Papageorgiou M., Zinoviadou G. K., Zotte D. A., Pellattiero E., Sołowiej G. B., Guiné F. P. R., Correia P., Sirbu A., Vasilescu L., Semenova A. A., Kuznetsova A. O., Brodnjak V. U., Pateiro M., Lorenzo M. J., Getya A., Kodak T., Igor Tomasevic I. (2021). *Covid-19 pandemic effects on food safety - Multi-country survey study*. Food Control, 122. DOI:10.1016/j.foodcont.2020.107800. Accessed 6 January 2021.