

Data Science to measure the consumer perception on food safety

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Abstract

Recent years the issue of food safety is becoming one of the most discussed topics not only in the circles of experts, but also to albanian consumers. Identifying the origin of the product is essential to have a high quality and safe system. According to FAO (WHO) "*access to quality and safe food is a fundamental individual right*". Guaranteeing this right is an important priority of the Government. In the area of food safety, veterinary and phytosanitary issues, more than two hundred of EU laws are adopted into national legislation and several major steps have been taken. Despite the updates made in legislation: Do the albanian consumers feel sure for the food they consume? Are they informed that ensuring the food safety is related to the establishment of a traceability system for each product? To answer this question, we created a questionnaire for consumers and gathered some preliminary information from consumers in the Tirana district. Preliminary conclusions by analyzing data collected from these surveys show that consumers

are increasingly concerned about the content of the products they consume and they require not only quality but above all food safety. However, these findings were not sufficient to provide accurate estimates for food safety perception of consumers. This is the reason why a study was undertaken at country level. Recognition and evaluation of this situation will serve us to understand the importance of food safety, as well as the elements that albanian consumers consider when classifying a safe food. To realize the main purpose of the work we created two questionnaires, one for consumers and one for traders / farmers. Data will be collected through these semi closed questionnaires in 12 counties of Albania. Analysis of data will be done through appropriate methods of Data Science. The choice of which method to use will be made after comparing the performance they have over our data and the knowledge that discovers each of them after the implementation on these data.

Keywords: food safety, food labeling, consumer, survey, data science.

1. Introduction

Food safety contains features and practices that should be implemented to ensure the safety of all food products. These practices include; rules and standards, inspections and controls of food and laboratory capacity. Food manufacturers are primarily responsible for ensuring the safety of their food products, but also processors and consumers have a role in this process. Food safety practices should cover the entire food chain, including the environment, primary production, processing, distribution, preparation of the product ready for consumption. The main goal of EU policy on food safety is to protect the interests and health of consumers while guaranteeing the good functioning of one single market. To prevent food-borne diseases are involved many sectors such as; public health, animal health, plant and agriculture. For a better prevention effective communication, exchange of information and coordination of actions is required from all the sectors. Agricultural production and food security is considered one of the strategic sectors of Albania.

This sector aims to ensure safe food of high quality based on international standards, further development of agricultural production and processing capacities, and also improvement of the food chain in the country. The food sector aims to meet the local demand for food, providing employment, reducing imports of agricultural products and increasing export capacities, integration into international organizations, improving rural life, sustainable development and finally why not an achievement of economic growth in Albania. Production of sufficient amounts of food while maintaining acceptable nutritional characteristics to meet the growing needs of the population remains one of the most humane but also more challenging activities for all food manufacturers.

Consumers seek for less expensive foods that pose no risk and believe that the food safety must be addressed at the farm or during processing. However how much information do the consumers require for the food products they buy? Does the food safety affects the consumer choice on food? How important is the origin, production and distribution of food to the consumer? Do all the agricultural products need a kind of labeling and tracing system? These are some questions raised during this study and to which we will try to answer by gathering information from the consumers and traders/farmers themselves.

2. Methodology and materials

The main purpose of this study is to recognize and evaluate the current situation in terms of food safety to the consumers food and in this context, analyze and confirm hypotheses related to food safety concerns.

For this purpose a survey was conducted with both consumers and farmers/traders. It is used a qualitative methodology of collecting and processing information, identifying and analyzing different variables in favor of building food safety statistics. The face to face interviewing method is used as it is considered as one of the most trusted methods of gathering information.

To conduct the study were used two types of questionnaires. One questionnaire addressed to the consumer and the other to the trader/farmer. A total of 70 people were interviewed, among which 50 consumers and 20 traders/farmers. Questions directed to the consumer are mostly about the food they consume and the food safety. The questionnaire used for traders/farmers includes questions about their clients and the product origins. Demographic questions are included as well on both

questionnaires to classify the respondents and help understand and analyze better their responses .

3. Actual situation of albanian consumer food safety

There are several features that a food product must have to ensure its safety. Earlier on this paper we mentioned labeling and food traceability system as main factors that provide to the consumer information about the food safety . Food must be accompanied by a production label production, which in fact is like a passport for the product. It provides useful information about the origin of the product, composition, microbiological composition, date of expiry. Traceability is the process of tracing and tracking food in all stages of production, processing and distribution [Muk14]. Traceability is defined at all levels of production, processing and distribution of food, raw materials, with vegetable or animal origin, animals that produce food or used in food production, including the tracing of any other substances used on food production. Local food business operators establish a database system to record all data and ensure the procedures which enable their identification at any time. These databases enable the identification of any food supplier who has supplied the business operator with specific food. Business operators save this information for three years and then pass it to the Ministry of Agriculture, Food and Consumer Protection at their request.

Many consumers are not aware of the existence of such system and they usually do not seek this kind of information when buying food products. The survey conducted showed that all the interviewed consumers (100% of them) buy at least one food product without labeling. A cause for this result may be that the Albanian consumers prefer buying meat, fish and vegetables from local farmers which most of them have no labels for the food they sell. Also

food labeling and traceability system is a cost for the business operator therefore traders/farmers who sell food without label offer it cheap and in a difficult economic situation most of buyers prefer to buy at a lower price. As many local studies indicate that the prices are rising but revenues and food expenses for most of Albanian families remain the same.

4. Results from the survey

The survey investigated the food purchasing behavior of a representative sample in Tirana district. Two questionnaires were addressed to different persons among which 67% were consumers and 33% traders/farmers. The results indicate that most of the consumers (68%) control the food products for labeling although all of them (100%) buy food products without labels. This indicates that although labeling is considered important by the consumers, it does not affect their purchasing behavior. A cause for that maybe the lack of information about the labeling importance among the consumers. An interesting fact is that interviewed males do control the food labels (77% of them) more than females (62%). The age of the interviewees was set to be from 15 to 80 years old considering the fact that they must be decision makers on buying food for the family. Interviewees were divided into four age groups to make the sample more representative. The four age groups give importance on controlling the food labels when buying food (>60%).

Most of adolescent consumers aged from 15 to 18 years old control the food labels (73,68%) the same happens with young adults aged 19 to 30, 75% of them control the labels when buying food. With the older interviewees the percentage gets lower, (63,16 % for group age 31 to 50 and 62,5% for the aged between 51 and 80 years old). These values show that younger consumers control the food labeling more than older ones. This maybe considered as an indicator that the

young consumers have a higher level of information on food labeling therefore they give more importance to it. Another hypothesis maybe that the younger consumers have less experience on buying and cooking food products so they need to know more about the food product they buy.

Generally respondents present themselves as consumers almost always careful to characteristics of food products as testifyies the habit of reading information reported on labels. On the other hand the purchase of products of excellence – those always labeled and branded – is yet a rare habit, at least in part, it can be assumed, for cost reasons. There are many Albanians who in their food consumptions, prove to be not oriented to quality but on saving, always choosing the cheapest offer without taking into account the source. It is without a doubt a quota of risen consumers during these years pressing economic crisis.

Table 1. Control of food label by age. Percentual values

Age of consumers	Control of food label		
	Yes	No	Total
15-18 years old	73,68	26,32	100,00
19-30 years old	75,00	25,00	100,00
31-50 years old	63,16	36,84	100,00
51-80 years old	62,50	37,50	100,00

They are numerous - especially among the respondents with higher education - those who favor the labeled and controlled food consumption: 80% with higher education control the food labels, 65% of medium education and 50% with low education level. As it is obvious regardless the education level, food labeling is a sensitive case for most of the consumers. Analogous results also for fish and meat consumption: as the education level gets higher the percentual of buying and consuming

uncontrolled fish and meat products gets lower. From 50% of interviewers with low level of education who buy fish and meat on casual shops, it decreases to 16% for the interviewers of medium education and only 7% for the interviewers with high level of education.

Table 2. Control of food label by education level. Percentual values

Food products habits	Answers	Education level		
		Low	Medium	High
Control food products labels	Yes	50,00	65,00	80,00
	No	50,00	35,00	20,00
	Total	100,00	100,00	100,00
Buy fish and meat on improvised shops	Yes	50,00	16,00	7,00
	No	50,00	84,00	93,00
	Total	100,00	100,00	100,00

This result analysis may say that , generally, to a higher level of education corresponds a greater attention to the food provenience, quality and labels control.

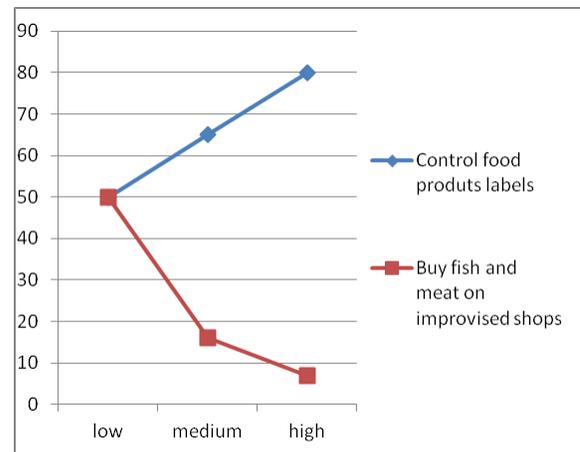


Figure 1. Relationship between level of education and food labeling control

The major part of the persons interviewed (84%) declare that spend for food products half of their

family monthly income, considering the fact that most of them (78%) declare themselves as families with medium economic standards this would leave to the conclusion that those consumers spend a lot for food. Considering also the traders/farmers answers, most of them confirm that their consumers buy regular fruits and vegetables (92%) and meat or animal originated products (85%). This confirms the habit of albanians to eat good and give great importance to the food they consume.

On the other hand for the families with economic difficulties, it is observed that most of them choose food considering the lower price more than the quality. Proof of this is the blooming in the albanian cities of shops, street vendors - especially fruit and vegetables – featuring low prices and poor quality. Analysis of the survey respondents partly confirms this issue, most of them declare to buy food –fruit and vegetables- on local or street vendors (60% of the interviewed) and the rest (40%) buy these products on regular markets or supermarkets.

Consumers are more sensitive when it comes to products of animal origin (meat,milk and their sub-products) , 52% of the respondents buy products at controlled markets and supermarkets, a considerable part of them tend to buy those products directly from the farmers (42%) which is explained by their freshness and only a few of the respondents (6%) buy to local shops or vendors.

Results gathered from traders interviewed also confirm there is more sensitivity on products coming from animals than fruits and vegetables. According to traders, 80% of the consumer does not require information or check for labels on fruits and vegetables and only 20% of them do. The opposite for products with animal origin, where only 14% of the consumers/buyers don't show interest of the products origin and labels

and 86% of them ask for the origin and controlled and/or labeled products.

Table 3. Control of label and origin according to traders. Percentual vaues

Control of label and origin	Yes	No	Total
Fruits and vegetables	20,00	80,00	100,00
Meat, milk and sub-products	86,00	14,00	100,00

In addition of food labeling problem, traders themselves confirm they sell food products without labels, at least most of them (87,50%) and only a small part (12,50%) do not sell products without labels. This means that the problem is not just informing consumers about the labels and tracebility importance to assure frood safety but also to raise awareness among traders about the food labeling and tracing.

Most of traders (81%) claim that consumers do not react to products without labels only (19%) of traders responded that labeling of products causes reaction.

Both of those observations support each other to explain traders behavior. As it can be presumed traders may take for granted the disinterest of consumers on food labeling so they do not consider relevant food labeling.

5. Data Science actual and future contribution

From the data collected and analysed this survey highlights some of the main problems that need to be solved to guarantee the food safety.

The very first problem ,according to results is the lack of information about importance of food labeling among the consumers and traders. A partial solution from state organs might be to organize open events or tv spots to inform the public and by reducing costs of product labeling for the food traders or producers. Another

solution is to build a secure system of traceability and that the product origin and its phases are included to the product label. Of course there are many other solutions and steps to be taken but here are mentioned a few.

These results show that many other surveys should be taken in a wide range, including a larger sample and more topics on food consumption and safety. Also information from websites, social networks could be very useful to help understand the consumers concerns on food safety and their needs for safe food. This could be a Big data search. Similar to other areas, the amount of “food safety related” data being generated by government, industry and academia is increasing rapidly [Wied15].

- Track and Trace monitoring
 - RFID chip technologies
 - Sensor-based technologies (Humidity, Temperature)
- More testing (targeted and untargeted)
- Social media
- Outbreak detection and genome sequencing
- GIS based data

Having the right data and applying the right data mining techniques on them, many other models maybe discovered and systems generating these models may be built. These models may result of a great importance to the food associations and local government organisms helping them make the right decisions and investments on food safety.

The construction and functioning of early warning systems will inevitably require the involvement of domain experts. However, with the help of data mining, we can relieve those experts from many time consuming tasks, and also complement their knowledge with new, interesting relations.

Using all of these steps of Data Science is also useful to traders/farmers and consumers as they may always refer to survey results and models

generated to understand the recent trends and situations on food safety.

6. Call to action and the future

What food producing and trading companies should do to get the most from the power of Data Science:

- Handwritten data on food products should be eliminated, use digital data instead [Wied15].
- Invest more in I.T systems and solutions, including data analysts.
- Demand better predictive analyses [Wied15].
 - Move from retrospective trouble shooting to prospective problem prevention
- Use structured and unstructured sources of food data
- Ask questions and question assumptions
- Train data scientists that can address food related issues
- Enter public-private partnerships that facilitate use of Data Science in food safety as well as food production, processing and distribution.
- Developing online platforms for global networking, databases for information sharing and tools to support food safety management.

Another practical facility that the use of Data Science provide for large food companies or other interested parties would be building a risk management system. Such a system would involve a process control approach with a flag system in place to signal where a new trend on food is developing. For example, green flags that indicate normal levels of activity would move to red if significant additional features are involved or combinations of contaminants occur or levels of contaminant exceed set

concentrations. This level of activity would ideally incorporate government and company laboratory or food safety information management system feeds.

Build of a digital food traceability system might be a great advantage as well, giving the food producers the possibility to track on real-time their product and discover early safety problems that might occur during production or distribution phases [ML16].

Conclusions

In recent years, Albania has made some achievements in the development of food industry. However, food safety problems, which could not only impact the Albanian food export trade and the sustainable economic development, but directly threaten the health and safety of customers, have become more critical. With the development of social economy and the improvement of technologies, the food quality control system has been progressively refined because of the implementation of the food quality authentication, the product quality supervision and the specific products certification referring to international practice, which has also significantly improved the quality of some products. Considering the lack of consumer information on food labels importance, identified by using Data Science, there is much more to do on this field. A labeling system needs to be established for all types of food products, especially for those with animal provenience.

Meanwhile, according to published industry standards, the development of food standards and quality inspection agencies have also been progressively refined to improve the food quality. Owing to promotion and implementation of the advanced quality management system, enhancement of the quality supervision and improvement of the laws and

regulation system, the Albanian food quality safety guarantee system would be more complete. Food traceability system has been considered as an effective means of protecting the interests of consumers and improving the food safety. If food enterprises want to have a place in the highly competitive international market, the Food Safety Traceability System, which gives enterprises a competitive advantage, must be established, and abilities of food-tracing and data analysis must be kept, for improving the food safety management level. Meanwhile, based on correct data, government regulators are expected to keep the over-all situation of food quality safe.

Data Science is without a doubt is a great partner on this field. By keeping record of digital data, gathering information through surveys or Big Data techniques, analyzing, generating models and building systems that use Data Mining, the quality control would definitely be more effective, thus bringing to a safe food.

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