Comparative Analysis of Consumer, Producer, and Expert Perceptions of GM Agricultural Products

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Abstract

Background/Objectives: The purpose of this study is to compare and analyze the differences between producers and experts based on consumers' perceptions of GM agricultural products. Methods/Statistical analysis: To this end, we analyzed how consumers, producers, and experts' perceptions differ with group-specific comparative analysis data on genetically modified agricultural products previously investigated. Findings: As a result of the analysis, it was found that consumers thought genetically modified agricultural products and foods were generally harmful to the human body compared to producers and experts, and fear was also great. When analyzing consumers' perception of whether a genetically modified food labeling system is needed through additional analysis, consumers think it should be marked on the product through a genetically modified food labeling system, but they usually purchase it without checking whether it is marked. Improvements/Applications: Through comparative analysis of consumer perception, a strategic plan for changing consumer perception was proposed along with institutional supplementation of the genetic modification labeling system in the future.

Index Terms

Genetic Modification (GM), Genetically Modified Crop (GMO), Consumer Perception of Genetically Modified Agricultural Products, Genetically Modified Food Labeling System

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I. INTRODUCTION

Unlike in the past, materials are becoming richer due to the emergence and development of ICT. Various foods incorporating ICT technology are emerging, and recently, many changes have been made due to the emergence of data, network, and A.I, which are key technologies of digital transformation[1-3].

Smart farm technology and gene modification technology using smart technology have positive aspects, but on the contrary, they have negative aspects.

Genetically modified (GM) agricultural products and foods can be said to be the biggest alternatives to future food shortages. In fact, GM crops and foods are approved as safe food, but consumers still fear stability.

In particular, in Korea, the food self-sufficiency rate is 47%, but most of the flour, corn, etc., excluding rice, depend on exports. In this situation, we confirm the current situation of consumers' perception of genetically modified agricultural products and food, which are alternatives to food shortage, and suggest alternatives that can raise consumers' perception.

In addition, an empirical analysis was conducted on how consumers perceive genetically modified crops and food labeling agents.

II. PREVIOUS STUDIES

A. Genetically Modified (GM) Agricultural products and food products

Genetically modified agricultural products and foods refer to artificially recombining genes or creating genetically modified organisms and foods with genes or traits that cannot appear by conventional breeding methods[4].

Existing studies have introduced it as one of the ways to solve the food problem through the development of such genetic modification technology[5]. In particular, the agricultural and food industries are benefiting a lot from mass production through resistance to pests and herbicides, reducing production costs of food, and improving taste and quality through such genetic modification technology [6].

On the other hand, consumers acquire a lot of information and react sensitively to risks such as contamination of foreign genes used in genetic modification, compared to limited recognition of the benefits of agricultural products and food through these genetic modification technologies[7-8].

B. Labeling System for Genetically Modified Crops (GMOs)

Previously, the U.S. did not introduce a mandatory labeling system for GMOs, but the mandatory labeling system has been implemented since 2016, and the GMO labeling system has already been implemented in Europe since 2001. In addition, since 2017, the Food Sanitation Act has been revised to display genetically modified foods[9].

III. RESEARCH METHODS AND PROCEDURES

This study compared and analyzed the perception of GMOs by consumers, producers, and experts using group-specific comparative analysis (2015) data on GMO agricultural products in KSDC DB shown the Figure 1. [10].

Fig. 1. KSDC DB

First, data was collected from KSDC DB. The collected data was made into data that could be analyzed through a cleansing process. After that, the data were analyzed and the results were derived. It goes through five steps to visualize and utilize the derived results shown the Figure 2[11-13].

Fig. 2. Analysis process

In this study, analysis was performed using R, an analysis tool, for data analysis[14-15].

IV. RESEARCH RESULTS

A. Group-specific perceptions of (Genetically Modified Organism: GMO)

1. Comparison of perceptions of consumers and

producers

In order to compare consumers and producers' perceptions of GMOs, six questionnaire items were compared by group through t-test shown the Table 1.

Table 1. THE RESULTS OF THE T-TEST OF THE CONSUMER AND PRODUCER GROUPS

Questionnaire items.	p-value
What do you think about the effects of genetically modified agricultural products on the environment and the human body?	<2.2e-16
Do you think the potential risk of genetically modified agricultural products on the human body is very high?	<2.2e-16
Has the risk of GM agricultural products and foods on our human body been scientifically sufficiently proven?	=2.388e-12
Are GM agricultural products and foods scary and frightening because they threaten our food safety?	<2.2e-16
Can genetically modified foods be harmful to the human body because they can have properties that are not found through conventional food safety tests?	<2.2e-16
Don't you doubt the safety at all in light of your experience using GM-related foods or agricultural products?	=8.551e-05

As a result of the analysis, consumers showed more negative perceptions than producers in all items, and significant results were also shown in differences in perceptions with producers.

```
> con.lm <- lm(con$v9.1~con$v9.5, data=con)
> summary(con.lm)

Call:
lm(formula = con$v9.1 ~ con$v9.5, data = con)

Residuals:
    Min      1Q  Median      3Q     Max
-2.35297 -0.21628 -0.07958  0.78372  1.92042

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  2.66949    0.10833   24.64  < 2e-16 ***
con$v9.5     0.13670    0.03065    4.46 9.13e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.7782 on 998 degrees of freedom
Multiple R-squared:  0.01954,   Adjusted R-squared:  0.01856
F-statistic: 19.89 on 1 and 998 DF,  p-value: 9.125e-06
```

B. Relationship between Genetically Modified Food Labeling System and Purchase

According to an analysis of the questionnaire items on the genetically modified food labeling system perceived by consumers, the chi-square value is less than 0.05, so I think it should be marked as genetically modified food, but it can be seen that people usually purchase it without checking whether to display genetically modified food shown the Table 2.

Table 2. THE RESULTS OF THE T-TEST OF CONSUMERS AND EXPERTS

Questionnaire items.	p-value
What do you think about the effects of genetically modified agricultural products on the environment and the human body?	<2.2e-16
Do you think the potential risk of genetically modified agricultural products on the human body is very high?	<2.2e-16
Are GM agricultural products and food scary and frightening because they threaten our food safety?	<2.2e-16
Can genetically modified foods be harmful to the human body because they can have properties that are not found through conventional food safety tests?	=8.206e-14
Don't you doubt the safety at all in light of your experience using GM-related foods or agricultural products?	=6.984e-08

2. Comparison of perceptions between consumers and experts

In order to see the difference between consumers and experts by group, five questionnaire items were compared by group of consumers and producers through t-test shown the Figure 3.

	Make sure to check and buy it	Buy genetically modified foods without caring	I buy it without checking	I don't know genetically modified food labeling	Row Total
Mark it with the same image as the current one	20	54	143	41	258
Letters (texts) as in the present	11	87	80	29	207
There's no need to mark it	2	13	13	4	32
Mark both with marks and characters (text)	39	82	180	91	**392**
I don't understand	1	20	80	48	149
Column Total	73	256	**496**	213	1038

Fig. 3. Research Model

V. CONCLUSION

In this study, the difference in perception of genetically modified agricultural products and foods by group was verified. The verification results showed that consumers had a negative perception of genetically modified foods compared to producers and expert groups.

As in previous studies, consumers still have a strong negative perception of GMO, and strategic and policy alternatives are needed to change this perception. In order to solve this negative perception, state-led GMO knowledge education is necessary.

In particular, it is necessary to deliver accurate knowledge of GMO and other genes in science and biology textbooks in elementary, middle and high schools. In addition, there is a need to advertise through media such as SNS and blogs to reduce consumer rejection. Finally, as a result of the analysis of the GM labeling system, it was found that consumers considered GM marks and information labeling important, but they did not check them well.

Therefore, it seems necessary to change the mark to stand out immediately or to promote the display system. In the future, further research is needed to verify with variables that can control negative perceptions by adding psychological variables to change the perception of GMOs.

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