Attribute preferences of GMF among the prospective buyers

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Abstract

This research paper aims to explore the attribute preferences of the consumers with respect to the genetically modified foods in Indian markets. The conjoint approach is used to analyze the preferences of the consumers for the genetically modified food. The responses of 130 consumers are collected. The customers were requested to rate the different profiles of the genetically modified foods included in the questionnaire. The consumers are selected using non probability judgmental sampling method. The paper found that the choice **Medical Alternatives** is found to have the highest positive cardinal utility followed by **NutritionValue, Juices in product attribute** followed by the fruits and vegetables. The utility is found to be negative in case of the choice Pulses. In case of processing type the consumers have positive utility with organic processingas compared to non-organic processing. Similarly, in case of production location the consumers have positive utility with domestic location of processing as compared to imported GMF. In case of pricing the consumers have positive utility with reasonable prices as compared to high prices of GMF. The graphical representations of the estimated cardinal utilities of all the choices are given below:

Key words: genetically modification, attributes, cardinal utility.

1. Introduction

Genetically Modified Food is also known as genetically engineering (GE) or biotechnological products. Biotechnological process or genetically engineering helps to lessen public starvation. Food industry, from seed creators through to the consumers are changed by the genetically engineering, biotechnology or genetically modification. The processes of genetically modification of Food or genetically engineering foodstuffs are the result of the laboratory progression. Specialists in the genetically modification,obtain genes from one species and interleave them into another one to obtain a most wanted attribute or feature in a particular product. Genetic engineering (GE) is the formula in which creature has been altered by the transplanting. That method of modification isdifferent from the conventional way of choosing the breeding animals and plants to acquirepreferredquality. Genetically engineering is not solitary creature of modification process of the products and plants; in reality it is adevice that can be applied for much purpose. There are number of survey that definesgenetically modified food process and its today's requirement not only in domestic country (India) but also in the foreign countries. After independence the India was facing many problems related to the food stuff or food resources. Genetically engineering is the most important process of that is concern with the alteration of the food. Large scale series of food products are involve in food chain of the market, there is a huge variance in the put down and specialized circle. The function of genetically modification in cultivation and food production is mostly seen as the future of food system with economic as well as social consequences. If we will see in the history, that technology developed in 20th century and at that time technological development modification turn out to be the matter of major policy debates in many supporters countries. Major issue of that debate was not only basics requirement of the society but also provide the health, environmental, economical as well as nutrients benefit. Genetically modification process work as a needles with uncertain nature to bring the acceptable benefit in the field of the food industry. With the help of genetically modification in the field of food industry many problems in the area of disease can be scouted out such as related to vitamins, allergic problems so on. According to the large scale of data genetically modification became of basic need of the industries to accomplish the demand of public.Recent biotechnology has carried a lot of alterations in the field of science and technology.

Modern biotechnology goes hand in hand with educational, societal, and community policy controversies, the progress of hypothesis and techniques enable scientists to modify the genetic policyof all living organisms practically. Science edification is used to increase the scientific and technological literacy in each and every one. Youthgeneration required to be notified, not only regarding the practical applications of biotechnology process, but also the basics requirements to realize the societal and moralinsinuations so that they can make shrewd personal options and contribute positively in public debate in the future. Genetically modified food or genetically engineering food became a need today's public. Consumers are ready to buy these products if these products contain attributes that is related to social, environmental & health. In health value consumers contain that genetically modified product must be contain Nutrients value, Antioxidant value, Medical Alternatives, Pesticides free and so on. Price of the genetically product must be reasonable, product location is another one most important attribute of the GM food; way how to make the product modified is being considered by the consumers or the process of genetically modification. Product location and type of the product are major attribute to be considered by the consumers at the time of purchasing product or food.

2. Review of literature:

(Boesh2013): aimed of the study was to determine the attributes of milk that force a processor's provide choices and possibilities for separation based on these creation attributes. Results of the study showed that the technological phases of the product, as well as the value and country of source, dominate the purchasing decision. Researchers found that ecological and community attributes

were major aspect for the consumers. (Michael Burtonet.et al 2003) research paper presented the reports that examined the clauses under which public of the Australia were willing to buy genetically engineering products .On the bases of the study researcher found the different attitude of the consumers towards the special attributes of the genetically modified product. Outcome of the study declared that Australian consumer gave preferences to the price, quantity of the genetically modified products and old age consumers were more interested to purchase genetically modified product (Hossian et.al 2004) study analyzed the attributes of the genetically modified food that affect the consumers purchase decision .Study declared the relationship between customer's willingness and product attributes towards genetically modified food. That study gave preference to the price, economic and demographic attributes while purchasing genetically modified product or American consumers were in favor of GM Food.(Moser et.al 2011): research paper focused on the consumers demand for the genetically modified food with special attribute preferences on the bases of the ranking method. That study considered lot of attributes such as price, health, environmental issue and freshness of the food. According to the study consumers were more interested to purchase only those genetically modified product which were fresh. It means freshness of the product was more valuable attribute as compared to other attributes of the product or food. (Daniloska 2010): research explained the different attribute of the product that was genetically altered. Consumers who were interested to purchase GM Food more focused on the environmental, social factors and process of genetically altered products before purchasing. Genetically modification or genetically engineering was mainly concerned with the technology and material used in modification food product. Result of the study mainly concerned with the superiority of the product, healthiness and diversity in the food that they were consuming. Consumers of the GM Food were more aware about the eco friendly, safety, origin place and mark on the food that were available in the market. On the bases of that paper attributes are main elements of the genetically modified food.(Fernqvist & Ekelund, 2014) study stated that numerous requirements of belief related to attributes, vigorousness of food creations was gaining major concentration by the community bodies and by the consumers. Research pointed out   in conclusion that healthiness of food products represents a benefit for a public as well as for the society .Communicating the attendance of the attribute is not enough to confine. Other aspect of the genetically modified product must be containing other attributes such as taste, freshness of the food ECT. (Raghunathan, et al., 2006). Study discussed about the increasing attributes preferences among the consumers and study concluded with the help of survey that possibility to increase the effectiveness of credibility attributes was represented by the opportunity of rotating the credence attribute into experience or explore. (Caswell & Mojduszka, 1996). Provided another important solution towards the attributes of genetically modified food, when food creation brought accurate picture of the product feature that product contain or by the special references (labeling) of the genetically modified product (Cavallo et 2017). Presented in his study that consumers were facing the problem related to the product attributes and its reliability. For that problem researcher conducted a large scale survey and found that if consumers of GM food got the strong attributes of the food by additional trustworthy information and given information explained factual knowledge about the genetically engineering product consumer were easily became in the favor of the GM Food. (Frenkel Ter et.al,2000) research paper expressed the intention of the consumer for purchasing certain branded or non-branded product from the market. For that researcher conducted a survey that created a link between end user values, product quality and assistances. Result of the study described that consumer gave importance to the attributes to the genetically modified foodand international market segmentation was the major focus area.(Sanchez et,al 2009) study was related with the effect of wine consumption with considered the attributes. Results of the study found that wine attributes were different users to users. On the bases of survey or data collection it was clearly defined that age attribute matters a lot but generally users consumed the drink for the sensory pleasure and some were consuming due to social status. (Ewing et .al 1999) study investigated perceptions of the users towards the product attributes in magazine advertising for a exact product category. Results explained the link between traits for three selected brand names and respondents' rating was collected from the attributes besidethe evaluative criteria for the category of the **product.**

3. Research Methodology

The objective of the study is to explore the attribute preferences of the consumers with respect to the genetically modified foods in Indian markets. The conjoint approach is used to analyze the preferences of the consumers for the genetically modified food. The conjoint questionnaire is designed using the SPSS software, which is a random selected of the possible profiles of the different choices of the selected attributes of the genetically modified food. The responses of 130 consumers are collected. The customers were requested to rate the different profiles of the genetically modified foods included in the questionnaire. The consumers are selected using non probability judgmental sampling method. The responses are collected from the customers with different demographic profiles.

4. Data Analysis and Interpretation

The consumers are buying the GM Food because of the different differences required to be explored. This section of the chapter examines the preferences of the buyers of the GM Food in the Indian market with the respect to different selected attribute. In the study the different attributes are trying to identified and included in this study. The objectives of this analysis are to explore the preference of the customers for buying GM Foods from the market. The GM Food is one of the latest developments in food industry. This new development also changes the food habits of consumer across the globe. There is need to understand the perception of the Indian consumers towards the GM Food. In order to fill this objective Conjoint analysis is decided to apply for the analysis. Conjoint analysis helps in explaining the preference of the consumers for the different attributes of GM Food. The conjoint analysis start with the identifying the most preferred attributes of the GM Food. The identify factor of GM Food are – Health Benefit, product type, processing, production, prices. These attributes are found to be measure attributes on the basis of literature survey and discussion with customers. The next step of conjoint analysis is to identify the different choices available with the attribute having more number of choices; however other may have less choice. The combination of the attributes of the GM Food along with the selected choices, however other may have fewer choices. The combination of the choices within each attribute is known as conjoint layout. In this study Conjoint layout representing the different selected attributes along with selected choices of GM Food is shown below in the table:

Table: Conjoint Layout

Attributes	Health- Benefits	Product	Processing	Production Location	Prices
Choices	Nutrients value	Juices	Organic	Domestic	Reasonable
	Antioxidant value	Fruits			
	Medical Alternatives	Vegetables	Non-Organic	Imported	Slightly-High
	Pesticides free	pulses			

With the help of above mentioned selected attributesand choices of GMF, a questionnaire (for conjoint approach) is developed for the data collection in the study. This conjoint questionnaire includes the different profiles consisting of the different choices of the GMFattributes. This questionnaire is used in the survey conducted for the data collection from the 100 consumers of GMF having the regular habit of consuming the GMF. The consumers selected for the study were requested to provide their ratingsfor the different mentionedprofiles of GMF with given combination of choices ofGMF attributes. The ratings of the GMFprofiles are on a scale of 1 to 100, where 1 represents the least preferred profile of GMF and 100 represents most preferred profile of GMF. The details of the GMF profiles selected for the conjoint questionnaire is shown below:

Profile Number 1

Card ID	Health Benefit	Product	Processing	Production Location	Price	Rating
1	Antioxidant Value	Fruits	Organic	Domestic	Reasonable	
2	Antioxidant Value	Juices	Non Organic	Imported	Slightly High	
3	Nutrition Value	Juices	Organic	Domestic	Reasonable	
4	Antioxidant Value	Pulses	Non Organic	Domestic	Slightly High	
5	Pesticide free	Vegetables	Organic	Imported	Slightly High	
6	Medical Alternatives	Fruits	Non Organic	Imported	Reasonable	
7	Pesticide free	Juices	Non Organic	Imported	Reasonable	
8	Pesticide free	Fruits	Organic	Domestic	Slightly High	
9	Medical Alternatives	Juices	Organic	Domestic	Slightly High	
10	Medical Alternatives	Pulses	Organic	Imported	Slightly High	
11	Nutrition Value	Fruits	Non Organic	Imported	Slightly High	
12	Antioxidant Value	Vegetables	Organic	Imported	Reasonable	
13	Pesticide free	Pulses	Non Organic	Domestic	Reasonable	
14	Nutrition Value	Vegetables	Non Organic	Domestic	Slightly High	
15	Nutrition Value	Pulses	Organic	Imported	Reasonable	
16	Medical Alternatives	Vegetables	Non Organic	Domestic	Reasonable	

The multiple regression model with different dummies as the independent variables is applied. In the regression model the estimated average of the ratings collected from the GMF consumers is considered as dependent variable and different choice of GMF attributes are assumed to be different independent variables. The multiple regression model is shown below:

$$Ratings_i = \alpha + \beta_{1i}X_{1i} + \beta_{2i}X_{2i} + \beta_{3i}X_{3i} + \beta_{4i}X_{4i} + \beta_{5i}X_{5i}$$

Where, ratings is the dependent variable and the dummies of the choices of the GMF attributes are considered as independent variables in the regression model. The results of the regression model are shown below:

Table: Regression model for conjoint

Dependent Value	Independent Value	Reg. Coefficients	T statistics P-value	F State P-Value	R2
Customer Rating	Constant	10.038	11.800(0.000)	8.724 (.008)	92.9%
	Antioxidant Value	-1.350	-1.499(.184)		
	Medical Alternatives	.131	.145(.889)		
	Pesticide free	-1.823	-2.024(.089)		
	Fruits	-.131	-.196(.851)		
	Vegetables	-.451	-.556(.598)		
	Pulses	-1.547	-2.219(.068)		
	Non-Organic	-1.914	-3.332(.016)		
	Imported	-3.123	-5.545(.001)		
	Slightly High prices	-1.483	-2.583(.042)		

The result of multiple regression model used in the study assuming the ratings as dependent variable and GMF attributes choices as independent variables is shown above. The results indicate the estimates of regression coefficients as the differential cardinal utilities of selected choices of GMF attributes considered in regression model. For example, in case of *Health Benefits*, there are four choices (*Nutrients value, Antioxidant value, Medical Alternatives and Pesticides free*). The first choice of Health Benefits the nutrients value is considered as a reference choice. In the regression analysis it is found that the choice ***Antioxidant value***have the regression coefficient of -1.350. This indicates that the perceived cardinal utility of antioxidant value is 1.350 less than the cardinal utility of the reference choice i.e.*Nutrients value.* This also indicates that the first choice is more preferred by the consumers of GMF as compared to second choice. The F-Statistics of the regression model is found to be 8.724 with p value of 0.008, which indicates that the multiple regression model applied in the study is having reasonable statistical fit. The R square of the model is found to be 92.9 percent which indicated that 92.9 percent of the variance in consumers of GMF rating can be explained with the help of regression model. Let a, b, c, d and e represents the cardinal utilities of the different choices of the attributes of GMF considered in the study. The cardinal utilities of all the considered choices of the attributes of GMF in the conjoint layout can be estimated with the help of following equations:

For the attribute "Health Benefits"

$a_1+a_2+a_3+a_4=0$

$a_2-a_1=-1.350$

$a_3-a_1=0.131$

$a_4-a_1=-1.823$

For the attribute "GMF Product"

$b_1+b_2+b_3+b_4=0$

$b_2-b_1=-0.131$

$b_3-b_1=-0.451$

$b_4-b_1=-1.541$

For the attribute "Processing"

$c_1+c_2=0$

$c_2-c_1=-1.914$

For the attribute "Production Location"

$d_1+d_2=0$

$d_2-d_1=-3.123$

**For the attribute "Prices"**

$e_1+e_2=0$

$e_2-e_1=-1.483$

The cardinal utilities of the selected choices of the GMF attributes in the conjoint layout calculated with the help of above mentioned mathematical equations are mentioned below:

Attributes	Choices	Utilities	Remark
Health Benefits in genetically modified food	Nutrition Value	0.761	
	Antioxidant Value	-0.590	
	Medical Alternatives	0.892	Highest in Health Benefit
	Pesticide free	-1.063	
Product type	Juices	0.532	Highest in Product type
	Fruits	0.401	
	Vegetables	0.081	
	Pulses	-1.015	
Processing type	Organic	0.957	Highest in processing

	Non-Organic	-0.957	
Production Location	Domestic	1.562	Highest Positive
	Imported	-1.562	Highest Negative
Pricing	Reasonable Prices	0.742	Highest in Price aspect
	Slightly High prices	-0.742	

The results of conjoint analysis indicate that in case of the attribute *Health Benefits* of consuming GMF, the choice **Medical Alternatives** is found to have the highest positive cardinal utility of 0.892 followed by the next positive cardinal utility in case of **Nutrition Value** (0.761). However, in case of the choice **Antioxidant Value and Pesticide free** the cardinal utility is found to be negative (-0.590 and -1.063 respectively). This can be concluded from the results that the consumers of GMF shareholders are happier to take the benefits of medical alternatives and nutrition value. This may be due to the reason that consumers of GMF may consider them a remedy of medicines and get the nutrients from this form of food. The relative importance of the Health benefits of GMF is found to be 20 percent. Similarly, in case of GMF product category the choice **Juices** is found to have the highest positive cardinal utility of 0.532 followed by the fruits (0.401) and vegetables (0.081). The utility is found to be negative in case of the choice Pulses (-1.015). This can be concluded from the results that the consumers of GMF are happier if they buy the GMF in the form of juices, fruits and vegetables. They are not happy in buying GMF in the form of Pulses. The relative importance of the GMF product category is found to be 15 percent which is lower as compared to the health benefits as estimated. In case of processing type the consumers have positive utility with organic processing (0.957) as compared to non-organic processing (-0.957). Similarly, in case of production location the consumers have positive utility with domestic location of processing (1.562) as compared to imported GMF (-1.562). In case of pricing the consumers have positive utility with reasonable prices (0.742) as compared to high prices of GMF (-0.742). The graphical representation of the estimated cardinal utilities of all the choices are given below:

Table: Cardinal Utilities of different choices of GMF attributes
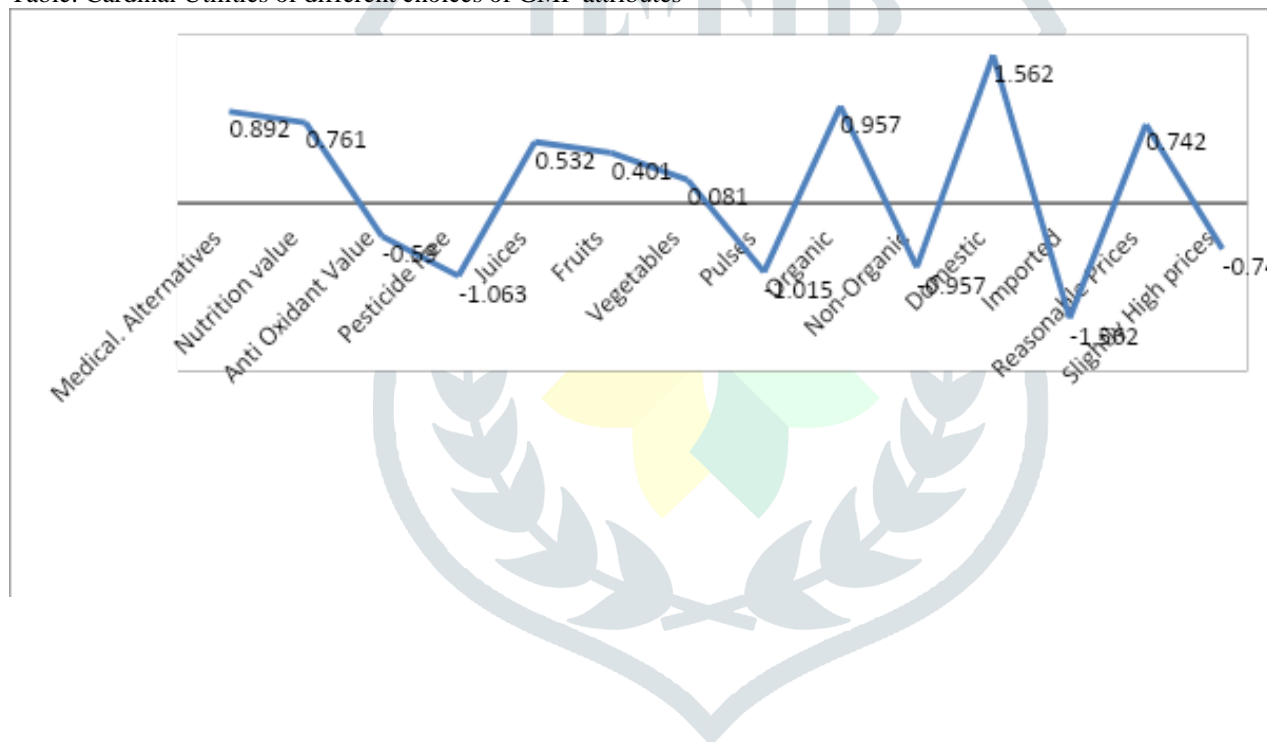
The relative importance of the different GMF attributes is shown below in table:
Table: Relative Importance of GMF attributes

Health Benefit in genetically modified food	1.955	20%
Product Type	1.547	15%
Processing type	1.914	19%
production	3.124	31%
Pricing	1.484	15%
	10.024	100%

The results indicate that the most important attributes of GMF is Production location (31.17%) followed by its health benefits (19.5%) and processing type (19.09%) and product type (15,43%). However, the least important attributes of GMF is found to be the pricing (14.8 %).

5. Discussion and Conclusion

The genetically modified food is a new gift of the technology to the people. The genetically modified food provides different benefits to the consumers as mentioned earlier. It is concluded in the study that in case of the attribute *Health Benefits* of consuming GMF, the choice **Medical Alternatives** is found to have the highest positive cardinal utility followed by the next positive cardinal utility in case of **Nutrition Value**. However, in case of the choice **Antioxidant Value and Pesticide free** the cardinal utility is found to be negative. This can be concluded from the results that the consumers of GMF shareholders are happier to take the benefits of medical alternatives and nutrition value. This may be due to the reason that consumers of GMF may consider them a remedy of medicines and get the nutrients from this form of food. The relative importance of the Health benefits of GMF is found to be 20 percent. Similarly, in case of GMF product category the choice **Juices** is found to have the highest positive cardinal utility of followed by the fruits and vegetables. The utility is found to be negative in case of the choice Pulses. This can be concluded from the results that the consumers of GMF are happier if they buy the GMF in the form of juices, fruits and vegetables. They are not happy in buying GMF in the form of Pulses. The relative importance of the GMF product category is found to be 15 percent which is lower as compared to the health benefits as estimated. In case of processing type the consumers have positive utility with organic processing as compared to non-organic processing. Similarly, in case of production location the consumers have positive utility with domestic location of processing as compared to imported GMF. In case of pricing the consumers have positive utility with reasonable prices as compared to high prices of GMF. Further the most important attributes of GMF is Production location, health benefits, processing type and product type However, the least important attributes of GMF is found to be the pricing.

References

Boesch, I. (2013). Preferences of processing companies for attributes of Swiss milk: A conjoint analysis in a business-to-business market. Journal of dairy science, 96(4), 2183-21

Caswell, J. A., & Mojduszka, E. M. (1996). Using informational labeling to influence the market for quality in food products. American Journal of Agricultural Economics, 78(5), 1248-1253.

Daniloska, N. (2010). Мњнацментотвоагробизнисот и неговитефункции. ЕкономскиРазвој-Economic Development, 12(1-2), 97-112.

Fernqvist. & Ekelund, L. (2014). Credence and the effect on consumer liking of food–A review. Food Quality and Preference, 32, 340-353.

Hossain, F., & Onyango B. (2004). Product attributes and consumer acceptance of nutritionally enhanced genetically modified foods. International Journal of Consumer Studies, 28(3), 255-267.

Hossain, F., Onyango, B., Schilling, B., Hallman, W., &Adelaja, A. (2003). Product attributes, consumer benefits and public approval of genetically modified foods. International Journal of Consumer Studies, 27(5), 353-365)

James, S., & Burton, M. (2003). Consumer preferences for GM food and other attributes of the food system. Australian Journal of Agricultural and Resource Economics, 47(4), 501-518.

Moser, R., Raffaelli, R., & Thilmany, D. D. (2011). Consumer preferences for fruit and vegetables with credence-based attributes: a review. International Food and Agribusiness Management Review, 14(1030-2016-82774), 121-142

Puth, G., Mostert, P. and Ewing, M. (1999), "Consumer perceptions of mentioned product and brand attributes in magazine advertising", *Journal of Product & Brand Management*, Vol. 8 No. 1, pp. 38-50.

Raghunathan R., Naylor, R. W., & Hoyer, W. D. (2006). The unhealthy= tasty intuition and its effects on taste inferences, enjoyment, and choice of food products. Journal of Marketing, 70(4), 170-184.

Roseti, L., Parisi, V., Petretta, M., Cavallo, C., Desando, G., Bartolotti, I., & Grigolo, B. (2017). Scaffolds for bone tissue engineering: state of the art and new perspectives. Materials Science and Engineering: C, 78, 1246-1262.

Vriens, M., & Hofstede, F. T. (2000). Linking Attribute, Benefits, and Consumer Values. *marketing research*, *12*(3).

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http://131.220.45.179/ojs/index.php/fsd/article/view/941/804
https://onlinelibrary.wiley.com/doi/abs/10.1111/ijcs.12424
https://scholarworks.uark.edu/aeabuht/9/
https://www.jstor.org/stable/40472929?seq=1#page_scan_tab_contents