Chemical Composition of Rice and Analytic Hierarchy Process Technique in Preference of Consumer Rice Buying

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In this research, an evaluation is made for three types of rice by using analytic hierarchy process technique. According to criteria determined by 600 consumers and specialist the decision is made on the most appropriate rice types. In the experiement, moisture content and crude protein content of the seed samples were analyzed. Total ash content was determined according to ISO method. Lipid extraction from the seed samples was carried out and chemical composition of rice was determined.

Key Words: Chemical composition, Analytic hierarchy process, Rice.

INTRODUCTION

Rice is most popular food product consumed by everyone. The consumers are affected by many factors when purchasing rice. In markets where only one kind of rice is available, factors guiding the decision making process (brand, appearance, hygiene, *etc.*) compete and in markets where more than one type of rice is available both the kinds and the other factors are in effect.

In markets where three different rice types are available just as in Turkey, both the rice types and also the guiding factors affect the consumers when making their purchase decisions. Especially the fact that different rice types provide different advantages creates different purchase preferences in these markets. Even though the Turkish consumers like and choose the local type, Osmancik rice[1], due to the deficiency of the domestic production, the Calrose brand imported from the USA and the Kamolina brand imported from Egypt are also available in the market.

Since the rice imported from the above mentioned countries make up 50 % of the market volume in Turkey[2] there is great competition in the market.

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One purpose of this study is to find out the criterion used by the consumers of rice in the market in order to make their purchase decisions and the weight of each of these critereria. Another purpose of this study is to see why the consumer chooses certain type of rice in order to guide the rice producers when they want to make a certain change in their marketing strategies and which type of change would direct them to which type of consumer by finding out the criterion and different types of rice carrying the weight of each criteria differently.

In order to find out the determining factors in rice preference, first the factors affecting the rice purchase have been determined with the consumers and the producers. After that, the hierarchical structure has been created and comparison between the three types of rice (Baldo, Calrose and Kamolina) has been done by the consumers.

Analytic hierarchy process (AHP), has been offered by Emshoff and Saaty[3]. Vargas[4] has explained the AHP as a theory to be used in order to solve socio-political, economical and technological problems and has set the application area. As a result of the literature study, it has been seen that AHP has been used in order to solve the decision making problems in many different areas[5]. Analytic hierarchy process has been an effective method that is used in order to evaluate the different marketing techniques. Determining the target market, the new decision and the marketing mix[6], consumer decision[7], the needs of the consumers[8,9] are the marketing areas where the method is commonly used. Over 1200 study cases can be reached about this method that is applicable in a variety of areas[10]. At the same time, expert choice software program, used as the decision support system in analyzing complicated problems by many countries all around the world[10].

EXPERIMENTAL

The research materials have been collected from the rice consumers from different income and socio-economical levels living in Istanbul, Ankara and Izmir, Turkey.

Analytical hierarchy process: Analytic hierarchy process finding[3] a rich application area in the decision making theory, is a measurement theory. Instead of forcing people to use a method to make their decisions, giving them the chance to get to know their own decision making system, is a better decision making model allowing better decisions to be given[11].

Steps followed in the analytic hierarchy process are as follows[12]: (i) Making the list of goals, (ii) Making the list of needed criterion in order to accomplish the goals, (iii) Determine the (n) number of probable decision making alternatives, (iv) Determine the hierarchic model.

Hierarchy, simply put, explanation is made up of targets at the top level, criterion is needed in order to take advantage of the last alternatives. In some cases, the alternatives are also divided in sub category alternatives.

After the determined hierarchic structure, dual comparison matrixes are created in order to determine the relative importance levels of all the criterion, sub criterion

and alternatives. This task is based on the comparison of a criterion and a sub criterion. While the dual comparisons are applied, comparison scala, introduced by Emshoff and Saaty[3] is used. The effectiveness of the table has been shown by comparisons made with other scales and through other tasks[13].

In the created comparison matrixes, the priority of each element needs to be determined. In order to do this, the sum of each column of the comparison matrix needs to be found. Each element is divided by the sum of the column in order to find the normalized values[14].

The average of each row of the matrix that has been normalized, the priority vector is achieved. The priority vector is multiplied by the comparison matrix in order to create the all priority matrix.

In the following stages of the AHP model, the decision makers' consistency during the dual comparison is tested. In the method, the consistency ratio is calculated for the entire dual comparison matrix. The decision maker needs to look over the decisions for the ones with ratios higher than 0.1[15].

Moisture content: The seed samples were analyzed for their moisture contents according to the International Union of Pure and Applied Chemistry (IUPAC)[16] methods no. 1.122.

Crude protein content: The seed samples were analyzed for crude protein contents based on nitrogen analysis utilizing the Kjeldahl system according to the Association of Official Analytical Chemists International (AOAC)[17]. The crude protein was calculated using a nitrogen conversion factor of 6.25.

Total ash content: Ash content was determined according to the International Organization for Standardization (ISO)[18] method 749. The dried seed samples were ignited and incinerated in the muffle furnace. The temperature was gradually raised to 550 °C and the dried seed samples were ashed until constant mass was achieved.

Lipid extraction: The seed samples were dried before lipid extraction. Lipid extraction from the dry seeds was carried out by hexane extraction under the operating conditions specified in IUPAC[16] methods no. 1.121.

RESULTS AND DISCUSSION

Determining the factors affecting the product choice: One of the most important stages in the AHP technique is to determine the criteria affecting the decision. Therefore, according to the information obtained from the consumers, the criteria affecting the rice consumption are as follows:

Price (P): (a) High (H), (b) Average (Av), (c) Low (L)

Appearance (A): (a) Size (S), (b) Standard Product (SP)

Taste and cooking (T)

Hygiene (Hy)

In the criteria listed above, it is observed that the brand name and packaging are not listed. Actually these factors are also effective in rice consumption. However, since the three types of rice are all in different brands and different packaging,

it shows that these criteria are not the direct indicator for the consumers when they make their purchase decision. After the criteria are determined, the rice types offered to the consumers in the market: (1) Baldo, (2) Calrose, (3) Kamolina.

The general features of these rice types sold under the different brand names according to the determined criteria[19] are shown in Table-1.

TABLE-1
GENERAL FEATURES OF ALTERNATIVE RICE

	Baldo	Calrose	Kamolina
Price	2-2.2 $/kg	1.6-1.7 $/kg	1.5 $/kg
Appearance	Very good	Good	Good
Taste	Very good	Good	Average
Hygiene	Good	Very good	Average

According to the consumer preferences, suitable rice preference is placed on the top of the hierarchy as the target. On the second level, criteria that the consumers take in consideration while making their rice preference. On the lowest level of the hierarchy, the rice types available in the market are placed. In Fig. 1, the created 3-level hierarchic structure is shown.
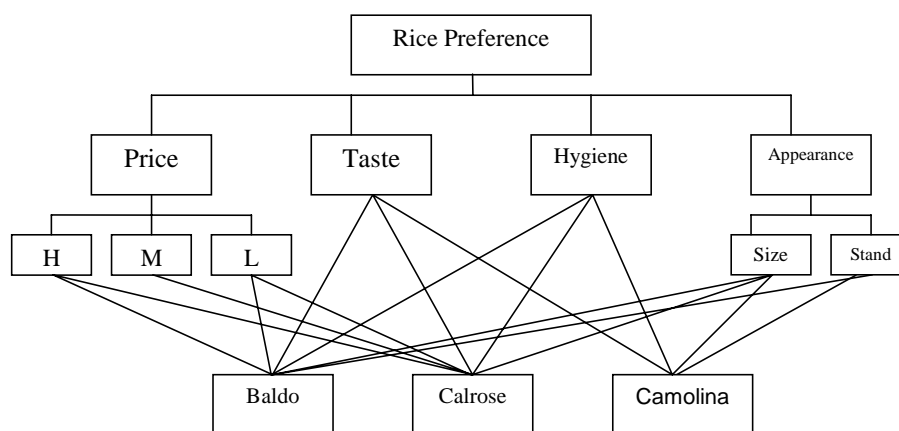

Fig. 1. Rice preference hierarchy

The stage after the hierarchical structure is determined is to determine the relative importance of each criterion in this structure. First the dual comparison of the criteria located on the first level of the hierarchic structure done by comparison scala. Since the decision makers are many, geometric averages of the comparison values are taken[20].

In the study, two different consumer groups have been studied. First group consisted of the people with monthly income lower than 1000 $ (Group 1) and the second group consisted of consumers with monthly income higher than 1000 $ (Group 2).

Consumers in Group 1 have been asked to compare the criteria located in level 1 of the structure using comparison scala. Table-2 has been achieved by evaluating the consumer comparisons by MS Excel through AHP technique.

TABLE-2
GROUP 1 CONSUMERS' RICE PREFERENCE

	Priority	Baldo	Calrose	Kamolina
Hygiene	**0.048**	0.25	0.68	0.07
Price	**0.625**	–	–	–
High	0.070	**0.73**	0.20	0.07
Average	0.140	0.10	**0.64**	0.25
Low	0.790	0.08	0.13	**0.79**
Taste	**0.210**	0.57	0.31	0.12
Appearance	**0.117**	–	–	–
Size	0.900	**0.56**	0.32	0.12
Standard product	0.100	0.27	**0.65**	0.08
	Priority	0.27	0.27	**0.46**

According to Table-2, it is observed that the price criterion is given 62.5 % importance by the consumers in Group 1 for rice preference, which is followed by 21 % for taste and 11.7 % to appearance. The importance given to hygiene was only 4.8 %. The most important criterion is price in rice preference for the consumers in Group 1 (62.5 %). The importance given to low price is a high rate as 79 % (Table-2). As the appearance of rice is given 90 % importance rate, the feature that rice is a standard product is given only 10 %. In the next stage, the consumers are asked to rate the features located in the hierarchic structure for the 3 types of rice products shown to them. When Table-2 is examined, it is determined that with 73 % Baldo rice is found to be overpriced by the consumers in Group 1 and Kamolina rice is selected to be low-priced rice. Consumers placed Baldo rice to the top as the largest sized rice (56 %) and Calrose rice has also received a high rate for being the standard rice within the rice selections offered to the consumers (65 %). It has been determined that as for hygiene, consumers have rated Calrose rice as the best one with 68 %. Consumers have chosen Baldo rice to be the top one in terms of taste with 57 %.

At last, in the evaluation conducted, it is determined that consumers in Group 1 have chosen Kamolina rice with 46 % and Baldo and Calrose rice are competing just as they are in the market with 27 % each.

All the comparisons conducted for Group 1 have also been conducted for Group 2 and Table-3 has been created. In Table-4, it is seen that Group 2 consumers in contradiction to Group 1 consumers have given a low rate as 4 % importance to price. Consumers in this group have given taste in rice preference (59 %). The criterion is followed by appearance with 27 % and with 10 % hygiene.

TABLE-3
GROUP 2 CONSUMERS' RICE PREFERENCE

	Priority	Baldo	Calrose	Kamolina
Hygiene	0.10	0.20	0.63	0.07
Price	**0.04**	–	–	–
High	0.14	**0.72**	0.22	0.07
Average	0.42	0.11	**0.60**	0.29
Low	0.44	0.07	0.18	**0.75**
Taste	**0.59**	**0.71**	0.23	0.07
Appearance	**0.27**	–	–	–
Size	0.69	**0.72**	0.21	0.06
Standard Product	0.31	0.20	**0.74**	0.07
	Priority	**0.59**	0.32	0.08

TABLE-4
CHEMICAL COMPOSITION OF RICE

	Moisture (%)	Crude oil (%)	Crude protein (%)	Ash (%)
Brown rice	15.5-16.0	2.0-2.5	7.0-7.5	1.0-1.5
Rice bran	13.0-15.5	18.0-18.5	13.0-13.5	8.5-9.0
Polished rice	15.0-15.5	0.5-1.0	6.0-6.2	0.5-0.8

Baldo rice has been preferred by 59 % of the consumers in this group. Baldo is followed by Calrose type rice with 32 % and Kamolina type rice with 8 %. Some chemical characteristics of rice are presented in Table-4.

With the conducted study, three types of rice available and chosen by the consumers based on which criteria by using the AHP technique, were determined. By using the survey form produced for this analysis, consumer preferences towards the available rice types in the market have been determined. As the income levels decrease in Turkey, product price has been determined as the most important consumption criterion. As the result of the consumer evaluations in Group 1, it is seen that Calrose and Baldo rice types are in a close race just as they are in the market. However, consumers located in this group have made their preference towards Kamolina due to its low price. As the income level increases, importance given to price decreases leaving its place to taste. It is observed that consumers in Group 2 have chosen Baldo type rice in spite of its high price. The fact that consumers from different income levels chose different types of rice will guide the producers in the market. When the companies evaluate the criteria that the consumers take in consideration based on the level of income group that they are in, they will be able to reach the consumer group suitable for their product. Besides, in terms of rice sector, this study will be a useful guide in determining the needs of the consumers that are not yet met and the consumer group that need to be targeted separately and determining the features of these groups. Finding out the reasons to why the competitor rice types are preferred by the consumers will also serve as useful guide to the producers.

When these evaluations conducted for rice, are also conducted for different product types in different sectors, it will guide the consumers during the decision making process as well as guiding the producers in order to affectively market the product by determining the consumer needs and expectations and identifying the target consumer group.

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