

PROCESS OF VARIANCE ANALYSIS-MONO-FACTORIAL ANOVA METHOD APPLIED TO STUDY OF DRINKS WITH MILK AND FRUIT JUICE ADDITION

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Abstract

Three drinks based on milk with apple, orange and grapefruit juice with following proportion: 1:1, 1:2 and 2:1 were analyzed. In the initial phase was used sensory analysis by applying the rank in order test and based on it the products to the panelists best reacted were established. The sensory analysis is a method widely used in the alimentary products evaluation and in the successful development of new products. For one session of tests there were served approximately 9 samples, three at a time for the three variants of products. The samples were served immediately after their preparation in order to reduce the loss of flavor and to avoid the risk of taste and color alteration. The tested products were coded using 4 letter codes which mark the product with a settled ratio. After this, the analyze sheets were carried out by each sheet board, where each sensorial feature was evaluated using a scale from 1-9. Significant in the organoleptic feature - for the coloured shade the elementary system of colours was used (NCS system), choosing according with each set the corresponding variant. The data of the sensory analysis were statistically processed though the mono-factorial ANOVA method. ANOVA or the process of variance analysis analyzed the variation of a variable related with the influence factors. This procedure allows the testing of statistical assumptions regarding the parameters of a model. Variance analysis also allows to estimate variance components of a variable and determine the significance of factors of influence. Through statistical processing of the obtained data from the sensory analysis was established that significant differences does exist between the drinks assortments. The present study emphasized the most appreciated products: the drink with milk and apple juice addition in an 1:2 ratio and the drink with milk and orange and graph-fruit juice addition in equal proportion.

Keywords: mono-factorial ANOVA method, sensory analysis, cow milk, fruit juice

1. INTRODUCTION

Among food animals, food milk is the most complete and most easily assimilated by the body, is one of basic foods in human nutrition, especially during growth, because it contains all substances necessary for growth and normal development of body. Under the nutritional aspect, milk is considered as an excellent source of calcium, which ensure high quality protein and water soluble and fat soluble vitamins [2]. The fruit juices have an important role in babies and children alimentation because they insure mineral salts, vitamins and sugars to the growing organism [6]. Also, for the elders, the fruit juices ease the digestion and prevent the aging. The sensory analysis is a method widely used in the alimentary products evaluation and in the successful development of new products [1]. Sensorial characteristics have a great impact on consumers

determining the acceptance/non-acceptance towards an alimentary product and thus the decision of buying [3]. Therefore the sensory analysis is one of the most commonly used and also the most efficient method in the food production [5]. Three drinks based on milk with apple, orange and grapefruit juice were analyzed. The data of the sensory analysis were statistically processed though the mono-factorial ANOVA method. Factorial ANOVA is used when the experimenter wants to study the effects of two or more treatment variables. In practice, there are several types of ANOVA depending on the number of treatments and the way they are applied to the subjects in the experiment. ANOVA or the process of variance analysis analyzed the variation of a variable related with the influence factors. This procedure allows the testing of statistical assumptions regarding the parameters of a model. Variance analysis also allows to estimate variance components of a variable

and determine the significance of factors of influence.

2. MATERIALS AND METHODS

The test took place in a Sensory analysis laboratory of the Faculty of Food Science and Engineering Galati at 20.4 ÷ 20.6°C and 51 ÷ 52% relative humidity.

Three drinks based on milk and apple, oranges and graph fruits (with proportions of 1:1, 1:2 and 2:1) were analyzed. The tested

products were coded using 4 letter codes which mark the product with a settled ratio as it can be seen in table 1. A complete description of each sensorial characteristic was conferred to the panelists, according to the table 2.

Table 1. The codification of drink samples with milk and fruit juice addition

Assortment of drinks		Drink codes
Drinks with addition of milk and apple juice ratio of :	apples juices : milk = 1 : 1	SMLU
	apples juices : milk = 1 : 2	SMLJ
	apples juices : milk = 2 : 1	SMLD
Drinks with addition of milk and orange juice ratio of :	oranges juices : milk = 1 : 1	SPLU
	oranges juices : milk = 1 : 2	SPLJ
	oranges juices : milk = 2 : 1	SPLD
Drinks with addition of milk and graph juice ratio of :	graph juices : milk = 1 : 1	SGLU
	graph juices : milk = 1 : 2	SGLJ
	graph juices : milk = 2 : 1	SGLD

Table 2. The description of the sensorial attributes for the drinks with addition of milk and fruit juice

	Attribute	Definition
Smell	Acid	Smell related to the acidity of the fruit
	Apple, orange, graph-fruit	Fresh apple smell
	Fruit	Fruit smell, other than apple
	Artificial	Tasteless, unnatural
Aspect	White	The sample stage is white-black or colored
	Nuance	The sample stage is yellow-red
	Intense color	Pure color or the sample stage is white and/or black
Flavor	Acid	Flavor related to the acidity of the fruit
	Sweet	Elemental taste produced by the aqueous solutions of some substances (sucrose)
	Bitter	Chitin of caffeine flavor
	Apple, orange, graph-fruit	Fresh apple, orange, graph-fruit flavor
	Fruit	Any fruit, other than apple
	Artificial	Tasteless (characterizes a product which has a very poor flavor)

Four sensorial characteristics (smell, aspect, flavor and fullness) were evaluated on a continuous scale of 15 cm dimension, split in

9 segments which have at the lower part a reduced intensity and at the upper part a high intensity as shown in the figure 1.

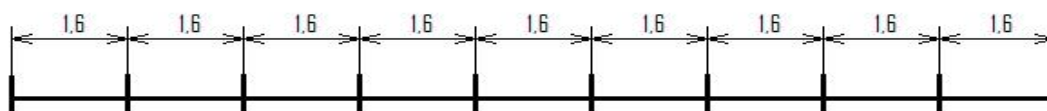


Figure 1. The scale used for the evaluation of the sensorial attributes at the drinks with milk and fruit juice addition

For the sensorial evaluation of the drinks with addition of milk and fruit juices there were used eleven trained persons between 20-25 years as panelists. They have shown interest in the analysis, had capacity to concentrate. The panelist are consumers of milk and fruit juice.

The panelists are required to evaluate products by saying what they like or dislike at the level of a specific attribute. At the end of the test the panelists were updated by receiving details towards the identity of the consumed products together with nutritive, technological, physiological and functional details about each product.

The samples were served immediately after their preparation in order to reduce the loss of flavor and to avoid the risk of taste and color alteration.

Relevant for the organoleptic characteristic color shade, the basic color system (NCS) was used in the following alternatives: for the drinks with milk and apple and orange juice addition, was used the circle of colors of the basic system (NCS color circle); in what regards the drinks with milk and graph-fruit juice addition, was used the triangle of colors of the basic system NCS (NCS color triangle) [8].

The data of the sensory analysis were statistically processed though the mono-factorial ANOVA method.

3. RESULTS AND DISCUSSIONS

For one session of tests there were served nine samples, three at a time for the three variants of products.

The test was a rank in order test and according to it the taster had to rank several samples after the intensity of a sensorial attribute [7].

In the initial phase was conducted the rank in order test and based on it the products to which the panelists best reacted were established.

The results obtained after the evaluation of the 9 samples applying this test (table 3) underline the following aspects:

- the most appreciated drink was the drink with a milk-apple juice ratio of 2:1;
- in what regards the drinks with milk and orange and graph fruit addition, the most appreciated ones were the drinks having the orange juice, graph fruit juice and milk ratio of 1:1.

Table 3. The sample points obtained applying the rank in order test

Panelists	Sample points								
	SMLU	SMLJ	SMLD	SPLU	SPLJ	SPLD	SGLU	SGLJ	SPLD
1	1	3	2	1	2	3	2	1	3
2	2	3	1	3	2	1	2	1	3
3	2	3	1	1	2	3	1	3	2
4	3	2	1	1	2	3	2	3	1
5	2	3	1	1	3	2	2	3	1
6	2	3	1	1	2	3	3	1	2
7	2	3	1	2	3	1	1	2	3
8	1	3	2	1	3	2	1	3	2
9	3	2	1	3	2	1	2	3	1
10	2	3	1	1	2	3	1	3	2
11	1	3	2	1	2	3	1	3	2
Total points	21	31	14	16	25	25	18	26	22

After the first phase followed the sensory analysis for the three drinks best appreciated by the panelists based on an analysis sheet

which contained 4 sensorial characteristics (smell, aspect, flavor and fullness). The evaluation of each sensorial attribute led to varying results (table 4) gathered from all 11 panelists.

Table 4. The score point variation

Characteristic		Sample points		
		SMLD	SPLU	SGLU
Smell	Acid	1-6	2-7	3-8
	Apple, orange, graph-fruit	3-8	3-7	3-8
	Fruit	1-6	1-7	1-8
Aspect	Artificial	1-3	1	1-3
	White	1-5	1-4	1-6
	Nuance	1-4	1-7	4-5
Flavor	Intense color	1-5	1-8	1-6
	Acid	1-7	2-7	2-6
	Sweet	2-7	1-6	1-5
	Bitter	1	2-7	4-8
	Apple, orange, graph-fruit	3-8	3-8	4-8
	Fruit	1-7	1-7	1-7
	Artificial	1-8	2-9	2-8

The mono-factorial ANOVA method was applied in the final stage. Through statistical processing of the obtained data from the sensory analysis was established that

significant differences does exist between the drinks assortments, as shown in tables 5, 6 and 7.

Table 5. ANOVA single factor method applied for the drink with milk and apple juice addition

Source of variation	SS	Df	MS	F	P-value	F crit
Between groups	10.285714	2	5.142857143	24.92307692	6.512E-06	3.55455715
Within groups	3.7142857	18	0.206349206			
Total	14	20				

Table 6. ANOVA method applied for the drink with milk and orange juice addition

Source of variation	SS	Df	MS	F	P-value	F crit
Between groups	3.428571	2	1.7142857	2.918918919	0.079808803	3.5545571
Within groups	10.57142	18	0.5873016			
Total	14	20				

Table 7. ANOVA method applied for the drink with milk and graph-fruit juice addition

Source of variation	SS	Df	MS	F	P-value	F crit
Between groups	0.285714	2	0.1428571	0.1875	0.830627712	3.5545571
Within groups	13.714285	18	0.7619048			
Total	14	20				

4. CONCLUSIONS

The present study emphasized the most appreciated products: the drink with milk and apple juice addition in an 1:2 ratio and the drink with milk and orange and graph-fruit juice addition in equal proportion.

5. REFERENCES

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