STATISTICAL STUDIES ON CONSUMER'S PERCEPTION OF FRUIT

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Abstract: *The purpose of this paper is to demonstrate that an important criterion in determining consumers' fruit choice is not only the sensory properties, but consumer's previous information acquired on fruit which can be turned into beliefs and preferences. The starting point consists of the following aspects: to establish the frequency of consumption of fruit, to determine fruit varieties associated with the colour preferred by consumers; to identify the considerations according to which a person would choose a certain type of fruit and to analyse consumer's feedback on product sensorial properties, to study consumer's attitudes in the choice of a fruit and to understand the influence of colour on consumer's choice of fruit.*

1. Introduction

Consumer's response to a given fruit depends on the positive or negative response to its sensory properties, the knowledge and opinions about it and a behavioral component, involving intentions to consumption of some fruit. [1]
Cross-overs between the vision and the taste pathways occur to create color and taste associations [2]. Thus, we can state that the choice of a fruit depends on crossmodal correspondences between several factors. *"Crossmodal correspondences have been defined as a tendency for a sensory feature, or attribute, in one modality, either physically present or merely imagined, to be matched (or associated) with a sensory feature in another sensory modality"* [3]
Crossmodal associations among taste, flavor or odour and other sensory dimensions have been reported in many papers regarding food product acceptance ([4-11]), where this term is used to refer to compatibility effect between some attributes, such as colour and different other qualities of food product.
As non-verbal elements, food colours can influence consumer's sensory and hedonic expectations. Also, if these expectations are high, consumers may be interested in consuming these food products [12-15].
We have tried to answer the question *"Why are colors so important for consumers?"*. First of all, fruit colour is important because it shows the presence of beneficial substances for the human body. Thus, fruit contains bioactive substances (such as phytochemicals) that have beneficial properties [16] and also produce bright colors in fruit [17]. For example, fruit of green colour (such as green kiwi fruit, green aples, avocados, limes) contain high antioxidant activity [18].

The phytochemicals responsible for orange colour in fruit are carotenoids which are involved in immune responses of organisms [19]. Flavonoids together with β-cryptoxanthin are responsible for the light orange to yellow colour of fruits (such as peach, papaya or orange) and they possess antiviral, anti-inflammatory, antihistamine and antioxidant properties [20]. Red-purple colour of fruit (such as grapes, prunes, berries, raspberries and cranberries) is caused by anthocyanins which are very important in preventing carcinogenesis and mutagenesis [21]. Also, red fruit (such as raspberries, cherries, strawberries) are rich in antioxidants such as lycopene and anthocyanins, which reduce the risk of several types of cancer [17].

Secondly, colours have important physiological properties. Thus, colours which are in the red area of the colour spectrum, such as orange and yellow, tend to make consumer think of warmth and energy. Colours which are in the blue side of the colour spectrum such as blue, purple and green are often described as calm, cool but sometimes they induce feelings of sadness or indifference. [22]

Last, but not at least, colour interferes with judgments of flavour identification and influences the pleasantness and acceptability of foods [23]

2. Matherials and methods

The main objective of this survey is to identify the messages that fruit colour convey to consumers. The basic tool in this survey is the use of a questionnaire which reflects the objectives set out above. The questionnaire consists of simple questions, arranged in a logical order, which attempted to discover the main characteristics of local consumers, focusing on certain statements regarding respondents' perception of fruit.

Participants were 81 (19 male, 62 female), in the age range 18–40 years (mean 22.37 years). Participants were recruited from the students of the Faculty of Food Engineering, Stefan cel Mare University of Suceava, Romania, in April 2014.

Focus group session (FGS) [24] and **repertory grid method** (RGM) [25-27] are used in this study in order to establish the features of fruit which are relevant to fruit consumers and to determine what fruits colour may affect fruits consumers' perception.

The fruit brought into discussion by the questionnaire are chosen among fruit frecvently purchased from the Romanian supermarkets or fruit markets, as follows: apples, pears, bananas, oranges, grapes, cherries, strawberries, berries, plums and kiwi fruit.

A focus group interview is a qualitative research tool designed to get the perceptions of consumers [28]. Conducted by a researcher who introduces the topic, the focus group interview consists in discussions which start with general questions and continues with the more specific ones.

The repertory grid method is used to study consumers' beliefs concerning colour influence on the perception of different types of fruit.

Statistical analysis is conducted to process the interpretation of results obtained by questionnaire. The analysis is based on principal component analysis (PCA) and hierarchical cluster analysis (HCA) of a set of opinion questions. The data regarding the acceptance of the fruit under investigation are evaluated using variance analysis (ANOVA), followed by the test of averages (Tukey, p -values < 0.05). Statistical analysis is performed using the program XLSTAT™ (Trial version 2014.3.04, Addinsoft©, U.S.A.) and Data Analisys in MS Excel 2010.

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3. Results and discussion

In the survey, participants are firstly asked to report information on demographics and purchasing fruit habits.

Therefore, respondents are asked about their height (m) and weight (kg) to determine the Body Mass Index (BMI). The results are given in figure 1.
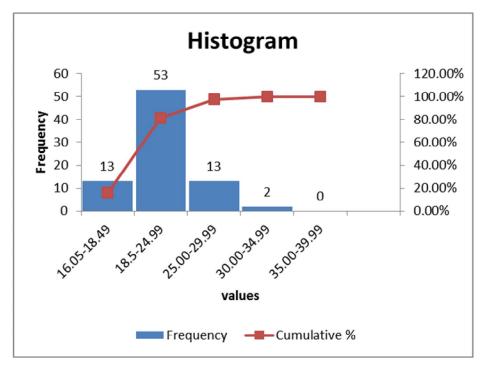

Fig. 1. Body Mass Index (BMI) for respondents

Using BMI categories, we have found out that 16.05% of respondents are underweight (i.e. BMI index is less than 18.5), 65.43% of respondents have normal weight (BMI is between 18.5 and 24.9), 16.05% of respondents are overweight (BMI is between 25 and 29.9) and 2.47% of respondents are in the first grade of obesity (BMI is between 30 and 34.99).

The focus group interview aims at object questions regarding fruit consumption habits. The results of the questions: "*Are you a frequent fruit consumer? How often do you eat fruit*?" are given in the fig. 2.

One can easily observe that 60.5% of respondents consume fruit several times a week.
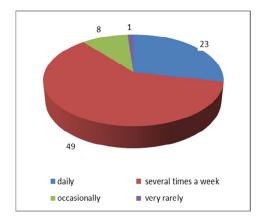

Fig. 2 The frequncy of fruit consumption

The results of the question "*Where do you generally purchase fruit from*?" are given in the fig. 3.

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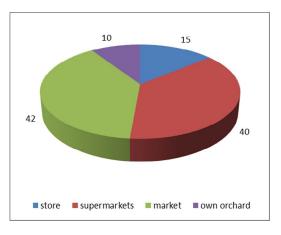Food and Environment Safety, Volume XIII, Issue 3 – 2014, pag. 228 – 237
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Fig. 3 Locations where respondents generally purchase fruit from

One can remark that about 49.38% prefer to purchase fruit from markets and supermarkets. The results of the question "*What is the main criterion you choose a*

certain type of fruit?" are given in the fig. 4.

From fig. 4(a) one can remark that the main reason for which consumers choose a certain type of fruit is its content rich in vitamins. In terms of why consumers would choose fresh fruit, one can notice that among the top preferences on the variety of fruit are apples, followed by grapes and berries. The values are very close in terms of the fruit variety preference, not only for the first three classes (apples, grapes and berries), but also for other fruit set in the questionnaire.

From fig. 4(b) one can remark the biplot graphic based on principal component analysis (PCA) for the most important factors (F1 and F2) show inter-unit distances among units as well as display variances and correlations of the variables aimed at [30].
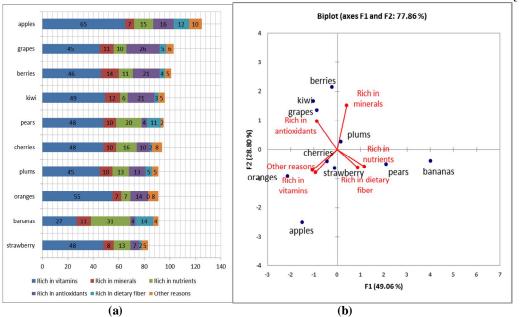

(a)

(b)

Fig. 4 (a). The main consumers' reasons to choose a fruit (b). PCA for these reasons

The variation of the parameters studied implies the existence of two factors and the percentage of variability represented by the first two factors is high (77.86 %). The first factor (F1) explains 49.06 % of the total variance with significant parameters "rich in vitamins" and "rich in nutrients".

The second factor (F2) explains 28.8 % of the total variance with significant parameters "rich in minerals" and "rich in antioxidants".

The results of the question "*How do you like to eat the following fruit?*" are given in the fig. 5.
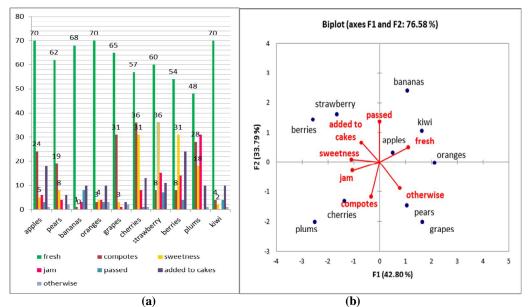
(a)   (b)

Fig. 5 (a). The form consumers prefer to eat fruit (b). PCA for these consumers' preferences

From fig. 5(a) we remark that 53.5% of consumers surveyed prefer to eat fresh fruit. From fig. 5(b) one can remark the biplot graphic for the most important factors. The variation of the parameters studied implies the existence of 2 factors and the percentage of variability represented by the first two factors is high (76.58 %). The first factor (F1) explains

42.8 % of the total variance with significant parameter "*fresh fruit*". The second factor (F2) explains 33.79 % of the total variance with significant parameters "*passed fruits*" and "*compotes*".

The results of the question "*What colours do you associate with the fruit presented?*" are given in the fig. 6.
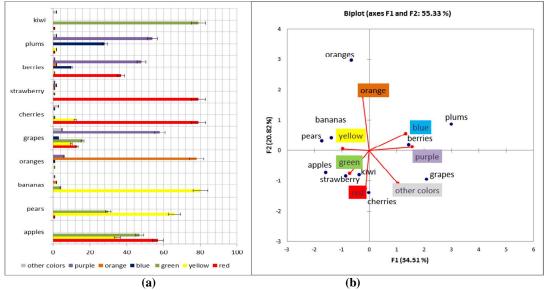

(a)   (b)

Fig. 6 (a). The colour associated with fruit (b). PCA for associatins of colours to fruits

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From fig.6 (a) we remark that yellow is the most popular colour of fruit (21.30%), followed by red (18.3%) and green (18.08%). From fig. 6 (b) one can remark the biplot graphic based on principal component analysis (PCA) for the most important factors (F1 and F2). The variation of the parameters studied implies the existence of 2 factors and the percentage of variability represented by the first two factors is medium (55.33 %). The first factor (F1) explains 34.51 % of the total variance with significant parameters "*purple*" and "*blue*". The second factor (F2) explains 20.82 % of the total variance with significant parameters "orange" and "red".The question "*How much do you like this fruit?*" was rated on a Likert scale, marked with 5 descriptors, where the quantifications of descriptors are the following: "*dislike much*" was quantified with 1 point, "*dislike moderately*" with 2 points, "*neither like nor dislike*" with 3 points, "*like moderately*" with 4 points, and "*like very much*" with 5 points.

The average of scores given by consumers regarding the palatability of every fruit is presented in the fig. 7. Data sets are evaluated using standard descriptive statistics (average, standard deviation) and one-way analysis of variance (ANOVA). We have observed that strawberries, cherries, grapes, oranges and berries are consumers' favourite fruit. Significant differences between individual samples are determined using ANOVA (*p-value* < 0.05).
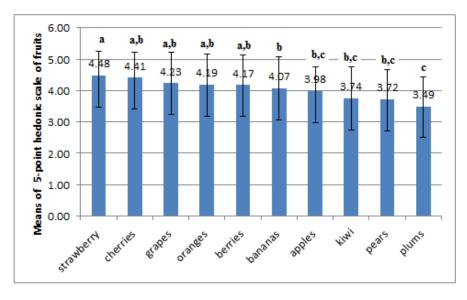

Fig. 7 Mean values of consumers' responses to quantification of fruit palatability
Means with common superscripts did not differ significantly (*p-value* < 0.05).

As regards palability of fruit, we remark that three groups of fruit can be formed: the first one contains strawberry, cherries, grapes, oranges and berries which obtained scores between 4.48 poins (nearby "like very much") and 4.17 (nearby "like moderately"), the second group contains cherries, grapes, oranges,berries, bananas, apples, kiwi and pears which obtained scores between 4.23 (nearby "like moderately") and 3.72 points, and the last one which contains apples, kiwi, pears and plums which obtained scores between 3.98 (nearby "like moderately") and 3.49 points.

One can remark from fig. 8 that the variation of the parameters studied implies the existence of 2 factors and the percentage of variability represented by the first two factors is very high (92.61 %). The first factor (F1) explains 88.87 % of the total variance and the second factor (F2) explains 3.74%. All the fruit under investigation can be seen as significant parameters of the first factor F1, while for the second factor F2, the significat factors are "*apples*" and "*strawberries*".
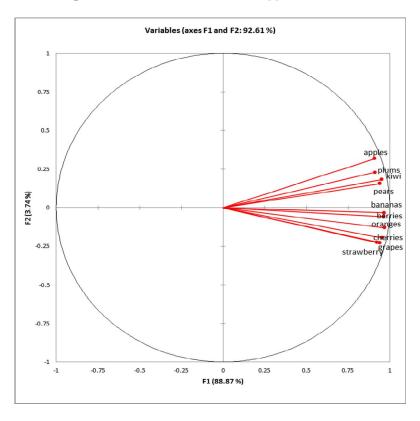

Fig. 8 PCA for consumers' responses to fruit palatability

In the following statement respondents are asked to complete a word association task as a useful qualitative methodology commonly used in psychology and sociology [30]. Requirement results of the task "*Assign words refreshing, exotic, seasonal, grown in our area, fresh, healthy with the fruit: apples, pears, bananas, oranges, grapes, cherries, strawberries, berries, plums and kiwi fruit*" are given in the fig. 9. Most respondents replied that they consume fruit because they are *healthy, fresh* and *grown in our area*.

From fig. 9(a) we remark the number of word associations with the fruit discussed above. All fruit types are considered as being healthy and fresh. Apples, pears, grapes, cherries, strawberries, berries and plums are regarded as seasonal and grown in our area fruit, whereas bananas, oranges and kiwi are considered exotic fruit.

In order to group the fruit sharing similar features of proposed words, a hierarchical cluster analysis (HCA) is performed and the resulting dendrograms are shown in the fig. 9(b). Three groups have been identified: the first group (exotic fruit), the second group (*refreshing, fresh and healthy fruit*) and the third group (*seasonal and grown in our area fruit*).

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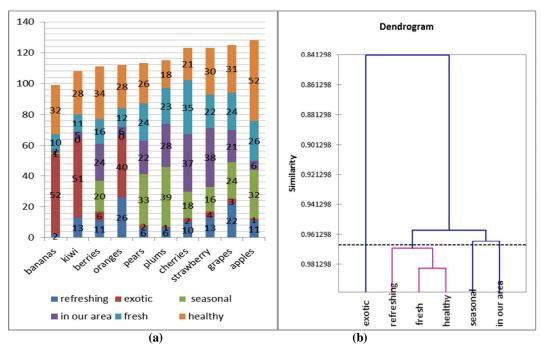234

Fig. 9 (a) Results of word association task (b). Hierarchical cluster analysis (HCA) for word association
Words: refreshing, exotic, seasonal, grown in our area, fresh, healthy
Fruit: apples, pears, bananas, oranges, grapes, cherries, strawberries, berries, plums and kiwi fruit

The results of the question *"What aspects do you like most of the following fruit?"* are given in the fig. 10 where the numbers of responses regarding the aspects of fruit sensorial analysis (taste, odour, flavour, texture and colour) are represented.
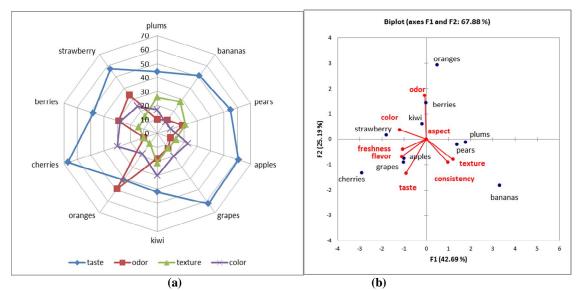

Fig.10 (a) Profile of consumers' perception of sensory analysis (b). PCA of consumers' perception

From fig.10 (a) we remark that taste is the most appreciated sensory characteristic of fruit for all the fruit taken into consideration, except for oranges which are appreciated first of all for their odour.

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From fig. 10 (b) one can remark the variation of the parameters studied which implies the existence of 2 factors and the percentage of variability represented by the first two factors is medium (67.88%). The first factor (F1) explains 42.69 % of the total variance with significant parameters "texture", „colour", „freshness flavour"and "taste". The second factor (F2) explains 25.19 % of the total variance with significant parameters "odour" and "taste".

4. Conclusion

In conclusion we can remark the following aspects of fruit consumption: most respondents consume fruit several times a week; about 50% of them prefer to purchase fruit from markets and supermarkets; the main reason for which consumers choose a certain type of fruit is its content rich in vitamins; more than 50% of the consumers surveyed prefer to eat fresh fruit; yellow, red and green are the most popular fruit colours; strawberries, cherries, grapes, oranges and berries are the most appreciated fruit for their taste; respondents consume especially *healthy, fresh* and *grown in our area* fruit and taste is the most appreciated fruit sensory characteristic for all the fruit brought into discussion, except for oranges which are appreciated mainly for their odour.

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