

## **Determination of Consumer Expectations by Illustration of Spirulina as Marketing of Biotechnological Products**

O. Akpolat

Department of Chemistry, Faculty of Applied Sciences and Arts,  
Muğla University, 48000, Muğla, Turkey

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**Abstract:** The aim of the present study is to examine the knowledge, behaviors and expectations of the consumers about *Spirulina* as a biotechnological product. As known biotechnological products are in a wide range spectrum from food to health or from energy to environment etc. and the behaviors of the consumers used these types of products and their expectations about them have also big differences in the market. In the concept of determining or guessing of the behaviors and the expectations of the consumers previously, a questionnaire related the consumption of *Spirulina* conducted for a target group in Izmir in Turkey was evaluated statistically used SPSS11.5 software and the knowledge, behaviors and expectations of the consumers was determined by limitations of the study.

**Key words:** *Spirulina*, marketing, consumer, behavior, biotechnology, product

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### **INTRODUCTION**

Marketing of a product is the most important step following of the its production in general and it can be defined by economical sciences as the sum of all the functional steps except improving a new idea about a product, hard or soft, or a new one into its marketing to ending of sale of the product. Exception of the production all processes like market investigation, rivalry, feasibility, introducing a firm and its products into the market, pricing, service and evaluation of feed back information about the product collected by some polls are also related with marketing (Garih, 2005; Costa *et al.*, 2004). As to questionnaires related a product in the market investigation, the responds to the questions asked to the participants to determine consumers' knowledge, ideas and expectations of the product should be assessed very carefully statistically before the presenting of the product to the market (Timmerhaus and Peters, 1991).

Food consumption behaviour, like any complex human behaviour, will be influenced by many enter relating factors, like physical properties of the food (flavour, texture, odour), characteristics of the individual (personality, preferences, attitudes, perceptions, knowledge) or characteristics with the environment (availability, season, situation, culture). There have been a number of models proposed which seek to delineate the effects of likely influences. In general, many of these models are not quantitative and make few assumptions in providing some empirical test of the different factors and their relative importance (Olsen, 2001). As to some researchers, the beliefs and attitudes of individuals with regards to food products are strongly dependent on their cultural traditions and on their education and culinary habits and they may vary with information and some researches to be done on the effects of different types of information about nutritional qualities, or food ingredients and use, or the origin of raw material, or the manufacturing process, etc. suggest the possibility that these messages may also generate hedonic expectations and influence food acceptability (Caporale *et al.*, 2006). Some related investigators discussed also three theoretical models from met expectations research in the fields of organizational behavior and consumer psychology. Based on the fundamental arguments in the models, they termed the models: disconfirmation, ideal point and experiences only and three-dimensional

graphical and analytical representations of the models, with satisfaction being a function of expectations and experiences. They tested the models in the context of a new information system implementation in an organization, with expectations, experiences and system satisfaction measured for both ease of use and usefulness, the focal constructs of the Technology Acceptance Model (TAM) and they found that an experiences only model in which expectations had no measurable effect best explained the data for ease of use. The results for usefulness indicated a modified version of the experiences only model in which the positive effect of experiences becomes slightly stronger-i.e., more positive-as expectations increase (Brown *et al.*, 2008). To another researcher consumers do not ask for technologies, rather they seek products with specific benefits. Good flavor, convenience and health enhancing properties are key benefits in today's marketplace. Products with a new flavor, unique flavor combination or new recipe make up three of the top five supermarket new product successes. Over 80% of consumers indicate convenience is an important consideration in purchases and foods with added convenience are among top supermarket sellers. Fiber, beneficial fatty acids, lycopene, vitamin C and probiotic cultures are among the top functional foods covered by the media. Natural products without preservatives or additives are appealing to some. An increasing number of persons are also seeking products believed to be environmentally friendly or produced in a sustainable manner. The introduction of a food processed by a new technology may create concern among some people. The public is generally unaware of methods used or safe guards employed in processed food. Any risks associated with the new technology are imposed by the processor and perceived as beyond the control of the consumer. In the consumer's mind the risks may be unknown, delayed or potentially fatal. Some consumers are skeptical of technology and believe a low technology approach promotes health and environmental sustainability. For example, those who select organic foods are skeptical of technology and prefer a natural, low technology approach to health and environmental sustainability. Others are more open to innovation and believe new technology may reduce risks or provide benefits not previously available (Bruhn, 2007). Foods processed by novel and emerging food technologies, e.g., biotechnology, ionizing radiation, pulsed electric fields, ultraviolet laser treatment, etc. pose challenging problems for researchers interested in the factors responsible for consumer choice, purchase behavior and acceptance of these foods (Cardello, 2003).

In another study related optimization tools for design and marketing of new/improved products using the house of quality, it was declared that four sets of matrices are used to relate the voice of the customer to a product's technical requirements, component requirements, manufacturing operations and quality control panels. The tabulation of data needed by each of the four sets of matrices named house of quality is the customer requirements planning matrix and the matrix consists of 6 basic steps (Vairaktarikas, 1999). As understood from this study, the first one is the identify customer requirements. In another study about discussion of different marketing models, it is appointed that consumer products companies do not frequently apply optimization models because the profit improvements of the determination of the optimal level of a variable like price or advertising budget are small and heavily depend on hardly predictable competitive reactions but the models are more often applied for the differentiation of product attributes or prices to serve the needs of different segments and the allocation of a budget or effort across customers (Albers, 2000).

In a study (Eastirlin, 2006) the questions, At what stage of life are people happiest? and What are the factors responsible for the life cycle of happiness? or for example; Do the midlife when families are complete and many are close to the peak of their working carriers or the golden years of the retirement bring the happiness to human? were investigated. Answers to these types of questions are searched on theoretical or empirical work in psychology and the methodology of demography. An another work having been done on the behavioral economics of consumer brand choice an establishing a methodology is very interesting (Foxall and Schrezenmaier, 2003). In this study it was discussed what and how consumers maximize in the behavioral economics of consumption in marketing-oriented

economics and the study bases on matching analyses, relative demand analyses and maximization analysis. An another work of determining of local consumer behavior on food safety knowledge and practices in the home statistically conducted in Konya in Turkey is also interesting in terms of being a good guide for methodology, instrumentation, data collection, data analyses and reporting (Unusan, 2007).

As investigating of market for biotechnologically products, to date, the only three species of microalga have reached a viable commercial stage on a large scale international market, which are *Chlorella*, *Spirulina* and *Dunaliella*. This production is mainly directed at the health food market and is limited to a well defined and relatively small number of consumers. One of the other products and new developments is also *Haematococcus* widely used as a traditional feed in the aquaculture industry. The biomass of *Spirulina* produced is mainly sold to the health food market in the form of powder or pills. Attempts have been made by Proteous (a marketing company mainly associated Earthrise arms in the USA) to incorporate *Spirulina* into a variety of food products such as granola bars and various kinds of pasta. As in Mexico and China *Spirulina* powder is added to children's foods such as biscuits and chocolates etc. and another available product in a protein extracted from *Spirulina* is containing blue pigment phococyanin and marketing under the Lima Blue brand name mainly used as a colorant for the food market, as an edible dye for ice creams and as a natural dye in the cosmetic industry. A full account of applications of *Spirulina* in human nutrition and various therapeutic effects was also summarized by some references. They should be pointed out that none of these applications have been permitted by the USA-FDA as a proven claim for marketing and more experimental work has to be performed before such approval will be given. The main problem technically is that the pigment is light sensitive and special care has to be taken in handling the dye to protect it from bleaching. Cost of production is estimated to range from US\$ 6-12 per kg dry weight (Torzillo *et al.*, 2004). The first local production of *Spirulina* in Turkey was also conducted in Ege University-EBÝLTEM by corporation of EGERT-Ltd. Today this product under different brand names is produced by some local firms and is marketed by these firms or some exporters. The prices of these types of products change also in a wide range (<http://www.egert.com.tr>, 2006).

As the biotechnological products in the market are in a wide range spectrum from food to health, from energy to environment etc. and the knowledge, behaviors and expectations of the consumers used these products are also in big differences as known. The aim of the present study conducted on this context was to examine the knowledge, behaviors and expectations of the consumers about *Spirulina* as a biotechnological product and a questionnaire related with the consumption of *Spirulina* was carried out for a target group in Izmir in Turkey. It was evaluated also statistically used SPSS11.5 software and the knowledge, behaviors and expectations of the consumers was determined by limitations of the study (Gökten *et al.*, 2006).

## **MATERIALS AND METHODS**

A cross-sectional study of the knowledge, behaviors and expectations of the consumers was conducted in May 2006 in Izmir the city in West Anatolian of Turkey. In the study a 15-item written questionnaire detailed by Fig. 1 was prepared for 125 participants. It was divided into four sections.

- Demographic section
- Personal nourishment habits
- Health and food consumption
- Knowledge, behaviors and expectations about health foods

**FORM OF QUESTIONNAIRE FOR SPIRULINA**

1. The place of questionnaire  
a. On the street b. At home c. In pharmacy d. In campus e. Other
2. Gender  
a. Female b. Male
3. Age  
a. 18-25 b. 25-30 c. 30-40 d. 40-50 e. 50-
4. Education  
a. Preliminary school b. Middle school c. High school d. Faculty e. Master or doctor
5. Profession  
a. Civil servant b. Worker c. Self-employed d. House-wife e. Student
6. Which food consumed mostly  
a. Lump or cow meat b. Fish or chicken meat c. Vegetable and fruit  
d. Leguminous plants e. Pastry
7. Do you eat properly and healthily  
a. Very well b. Well c. Not badly not well d. Badly e. Very badly
8. Do you consume health foods  
a. Every day b. One or two times a week c. One or two times a month  
d. From time to time e. Never
9. What are the health foods you use  
a. Some vitamins b. Some vegetable foods c. Synthetic proteins  
d. Some fibrous foods e. Other
10. How do you inform about these types of foods  
a. From radio/TV b. From newspapers/magazine c. By internet  
d. By friend e. Never heard before
11. Why do you need to consume these types of foods  
a. For decreasing of bad effects of the lack of proteins, vitamins or etc. in traditional foods  
b. For their preventive effects on health problems c. To delay aging d. To lose weight e. Other
12. Which information is wrong about *Spirulina*  
a. Margarine b. Vegetable c. Aglea d. Organic food e. No information
13. What is *Spirulina* as a being a health food  
a. Spiraling is a type of aglea b. It is grown in ponds, cleaned and pressed as tablets  
c. It has no additives d. It has some proteins, vitamins and minerals e. It is useful for health
14. Do you think about *Spirulina* for future  
a. Now I use b. Certainly I use c. My using possibility is higher  
d. My using possibility is lower e. Never
15. How much money can you spend for these types of foods monthly  
a. 10-20 YTL b. 20-30 YTL c. 30-40 YTL d. 40-50 YTL e. 50 YTL or more

Identity no: .....  
Date: .../.../2006  
Time : .....

Fig. 1: Questionnaire for Spirulina (1 YTL  $\approx$  1.5\$)

Each questionnaire took  $\approx$  20 min to administer. Data were collected on weekends and weekday afternoons at different places and it was done by the investigator and two university students for their diploma project study. Each demographic group in the questionnaire was selected in equal percentage more or less and identity number of individuals was randomly assigned to. The items were explained when necessary and administered at one sitting as far as possible. The SPSS11.5 statistical package was used for all analysis. The analysis was frequency distributions for all groups, cross tables and one-way ANOVA (variance analysis) for multiple groups and t-test with independent samples for double groups.

## RESULTS

### Profile of Respondents

The results of the frequency analysis of the demographic structure of the participants based on the ratio of female and male of 1:1 approximately, 66:59, made by SPSS11.5 software have standard errors of means to be smaller than 0.015 for all items in the questionnaire and all frequency analysis was showed on the Table 1.

Examining the Table 1 it is understood that the percentage of the groups according to their ages are 13.6% for 18-25, 24.8% for 25-30, 29.6% for 30-40, 21.6% for 40-50 and 10.4% for 50-

Table 1: Results of frequency analysis to be done for all items in the questionnaire

01 Place	(%)	02 Gender	(%)	03 Age	(%)	04 Educati	(%)	05 Professi	(%)
Street	20.8	Male	52.8	18-25	13.6	Pre. Scho.	8.8	Civ. Serv.	23.2
Home	20.0	Femal	47.2	25-30	24.8	Mid. Scho.	11.2	Worker	20.8
Pharmacy	20.8	-	-	30-40	29.6	Hig. Scho.	30.4	Self. Empl.	18.4
Campus	20.0	-	-	40-50	21.6	Faculty	40.8	Hous. Wife	18.4
Other	18.4	-	-	50-	10.4	Upper	8.0	Student	19.2
No Answ.	-	No Answ.	-	No Answ.	-	No Answ.	0.8	No Answ.	-
06 Consum		07 Eat		08 Foods		09 Health		10 Inform	
Lump-Chick	24.0	Very Well	1.6	EveryDay	16.8	Vitamins	16.8	Radio/TV	20.8
Fish-Chick	18.4	Well	42.4	1-2 in week	16.0	Veget.Food	16.8	New/Magaz	24.0
Veget-Fruit	36.0	noBadnoWell	35.2	1-2 in month	11.2	Synt.Protei	5.6	Internet	8.8
Legu.Plant	2.4	Badly	20.0	Time-Time	18.4	Fibr.Food	17.6	Friend	24.0
Pastry	19.2	Very Badly	0.8	Never	37.6	Others	7.2	No heard	14.4
No Answ.	-	No Answ.	-	No Answ.	-	No Answ.	36.0	No Answ.	8.0
11 Need		12 Wrong		13 Spirulin		14 Think		15 Spend	
TrdFoodAid	20.8	Margarine	2.4	Algea	7.2	Now	4.8	20-Oct	40.0
Prev.Effect	19.2	Vegetable	25.6	Tablets	15.2	Certainly	1.6	20-30	32.8
DelayAging	10.4	Algea	24.0	No additives	5.6	High.Possib.	22.4	30-40	17.6
WeightCont	22.4	Organ.Food	25.6	ProtVitMin	2.4	Low.Possib.	59.2	40-50	4.8
Other	8.0	No Inform.	20.8	Useful	62.4	Never	11.2	50-	4.0
No Answ.	19.2	No Answ.	1.6	No Answ.	7.2	No Answ.	0.8	No Answ.	0.8

respectively. As to the distribution rate of the education level in the groups it is clear that the lowest level is 2% for undereducated people and the highest level is 30.8% for the people with high school degree and 48.8% for the people with university degree. Table 1 shows also the distribution of the knowledge, behaviors and expectations of the consumers on their life style, their diets, their consuming of health products especially *Spirulina*. For example, as the ratio of the participants to think their nourishment habits daily to be well or no bed-no well is upper 77.6%, the ratio of the participants to say their consuming to be vegetable and fruit is 36%, to be lump and chicken meat is 24% and to be fish and chicken meat is 18%. As to the respond on what is health product, as the ratio of the participants with no answer is 36%, the ratio of the participants to think that fibrous foods, vegetal foods and synthetic vitamins are health products is mostly. Looking at the responds of the participants to the question How much money can you spend for these types of foods monthly as the ratio of the participants saying to spend 10-20 YTL per month is only 40%, the ratio for saying 20-30 YTL per month is 32.8% and the ratio of the rest is 22.2%.

### Profile of the Knowledge, Behaviors and Expectations of Respondents Related Health Foods

In this part the cross-tables related with age and education level groups were formed by the answer of the respondents and symmetric measures nominal by nominal contingency coefficient were calculated. Table 2 and 3 show some selected results from the cross-tables.

Examining the Table 2 and 3 it is seen the distribution percentage of diets of the participant groups according to their age and education levels in each other. For example, as the ratio of all the participants to consume lump-chicken meat is 24%, this ratio is 23.5% for 18-25 age group, 29% for 25-30 age group, 24.3% for 30-40 age group, 22.2% for 40-50 age group and 15.4% for 50- age group, respectively. A similar situation can be seen between the diet habits and education groups.

One-Way ANOVA and independent samples t-test of the data: In the last part multi comparison of the data from the questionnaire was done by one-way ANOVA test under the confidence level of 0.95 and comparing of the data in double groups was carried out by t-test under the confidence level of 0.95.

Table 2: Some selected results related age groups from the cross-tables

Crosstab	06 Consume	Lump-chick	Fish-chick	Veget-fruit	Legu-plant	Pastry	No
03_Age 18_25	% within 03_Age	23.5	11.8	0.0	29.4	35.3	0
	% within 06_Consume	13.3	8.7	0.0	20.8	13.3	0
25_30	% within 03_Age	29.0	12.9	3.2	25.8	29.0	0
	% within 06_Consume	30.0	17.4	33.3	33.3	20.0	0
30_40	% within 03_Age	24.3	27.0	2.7	13.5	32.4	0
	% within 06_Consume	30.0	43.5	33.3	20.8	26.7	0
40_50	% within 03_Age	22.2	22.2	3.7	11.1	40.7	0
	% within 06_Consume	20.0	26.1	33.3	12.5	24.4	0
50_	% within 03_Age	15.4	7.7	0.0	23.1	53.8	0
	% within 06_Consume	6.7	4.3	0.0	12.5	15.6	0

  

Crosstab	08 Foods	Every day	1-2 in week	1-2 in month	Time-time	Never	No
03_Age 18_25	% within 03_Age	0.0	11.8	0.0	35.3	52.9	0
	% within 08_Foods	0.0	10.0	0.0	26.1	19.1	0
25_30	% within 03_Age	25.8	16.1	9.7	6.5	41.9	0
	% within 08_Foods	38.1	25.0	21.4	8.7	27.7	0
30_40	% within 03_Age	18.9	5.4	18.9	18.9	37.8	0
	% within 08_Foods	33.3	10.0	50.0	30.4	29.8	0
40_50	% within 03_Age	11.1	33.3	7.4	18.5	29.6	0
	% within 08_Foods	14.3	45.0	14.3	21.7	17.0	0
50_	% within 03_Age	23.1	15.4	15.4	23.1	23.1	0
	% within 08_Foods	14.3	10.0	14.3	13.0	6.4	0

  

Crosstab	11 Need	Trd food aid	Prev. effect	Delay aging	Weight contr.	Other	No
03_Age 18_25	% within 03_Age	35.3	5.9	17.6	0.0	5.9	35.3
	% within 11_Need	23.1	4.2	23.1	0.0	10.0	25.0
25_30	% within 03_Age	29.0	16.1	6.5	25.8	9.7	12.9
	% within 11_Need	34.6	20.8	15.4	28.6	30.0	16.7
30_40	% within 03_Age	18.9	21.6	8.1	29.7	5.4	16.2
	% within 11_Need	26.9	33.3	23.1	39.3	20.0	25.0
40_50	% within 03_Age	3.7	18.5	14.8	29.6	11.1	22.2
	% within 11_Need	3.8	20.8	30.8	28.6	30.0	25.0
50_	% within 03_Age	23.1	38.5	7.7	7.7	7.7	15.4
	% within 11_Need	11.5	20.8	7.7	3.6	10.0	8.3

Table 3: Some selected results related education level groups from the cross-tables

Crosstab	06 Consume	Lump-chick	Fish-chick	Veget-fruit	Legu-plant	Pastry	No
04_Edu PreSc	% within 03_Education	27.3	9.1	45.5	0.0	18.2	0
	% within 08_Foods	10.0	4.3	11.1	0.0	8.3	0
MidSc	% within 03_Education	14.3	14.3	28.6	7.1	35.7	0
	% within 08_Foods	6.7	8.7	8.9	33.3	20.8	0
HigSc	% within 03_Education	26.3	18.4	34.2	5.3	15.8	0
	% within 08_Foods	33.3	30.4	28.9	66.7	25.0	0
Facul	% within 03_Education	25.5	15.7	39.2	0.0	19.6	0
	% within 08_Foods	43.3	34.8	44.4	0.0	41.7	0
Upper	% within 03_Education	10.0	50.0	30.0	0.0	10.0	0
	% within 08_Foods	3.3	21.7	6.7	0.0	4.2	0

  

Crosstab	08 Foods	Every day	1-2 in week	1-2 in month	Time-time	Never	No
04_Edu PreSc	% within 03_Education	36.4	9.1	18.2	18.2	18.2	0
	% within 08_Foods	19.0	5.0	14.3	8.7	4.3	0
MidSc	% within 03_Education	21.4	14.3	7.1	7.1	50.0	0
	% within 08_Foods	14.3	10.0	7.1	4.3	14.9	0
HigSc	% within 03_Education	42.9	10.0	42.9	21.7	34.0	0
	% within 08_Foods	7.2	1.6	4.8	4.0	12.8	0
Facul	% within 03_Education	9.8	25.5	3.9	25.5	35.3	0
	% within 08_Foods	23.8	65.0	14.3	56.5	38.3	0
Upper	% within 03_Education	0.0	10.0	14.3	8.7	8.5	0
	% within 08_Foods	0.0	1.6	1.6	1.6	3.2	0

Table 3: Continued

Crosstab	11 Need	Trd food aid	Prev. effect	Delay aging	Weight contr.	Contr. other	No	
04_Edu	PreSc	% within 03_Education	0.0	45.5	0.0	45.5	0.0	9.1
		% within 08_Foods	0.0	20.8	0.0	17.9	0.0	4.2
	MidSc	% within 03_Education	0.0	14.3	0.0	42.9	7.1	35.7
		% within 08_Foods	0.0	8.3	0.0	21.4	10.0	20.8
	HigSc	% within 03_Education	21.1	13.2	13.2	23.7	10.5	18.4
		% within 08_Foods	30.8	20.8	38.5	32.1	40.0	29.2
	Facul	% within 03_Education	33.3	19.6	11.8	9.8	7.8	17.6
		% within 08_Foods	65.4	41.7	46.2	17.9	40.0	37.5
	Upper	% within 03_Education	10.0	20.0	10.0	30.0	10.0	20.0
		% within 08_Foods	3.8	8.3	7.7	10.7	10.0	8.3

### EVALUATION OF THE RESULTS

As examined the statistically analysis evaluation of the study firstly it should be understood that its results are satisfied in the confidence level of 0.95. The following results could be summarized from all the statistically evaluation of the study. These are acceptable for all the participants:

- The ratio of female and male is equal approximately
- The big groups consist of those of the persons in 25-30 age interval and they have high school and university degrees
- The distribution of the traditional food consumptions are being as vegetable and fruit, lump or cow meat, fish and chicken meat, pastry and leguminous plant in increasing rate
- As the most of the participants thinking to be health themselves, they say that those of 50% more or less do not take health foods and those of 30% only do take these type of foods
- Sixty percent of participants did not answer the questions related what to be health foods, that is, the big part of the participants has no information about them
- It is understood that the information sources of the participants on the health foods are the friends for the major answer group, the neighborhood, the newspapers/magazine, the radio/TV and the internet and the ratio of participants not to response or not to say no information is very higher as 20%
- Weight control, preventing lack of proteins, vitamins or etc. and health problems are the answers to the question Why to consume health foods in decreasing percentage. Here the weight control is the first line interestingly instead of nutrition or other health problems
- In the answers to the most interesting question What to be *Spirulina*, the ratio of the participants to say no information or vegetable or algae or organic food are equal approximately
- As the ratio of the participants to know the specifications of *Spirulina* among those of answering to the question What to be *Spirulina* correctly is very higher as 60%, the ratios of the participants to know how and where to growth *Spirulina* is very lower as 20%
- The ratio of the participants to say that my using possibility of *Spirulina* is lower and to say never is very higher as 60+10%
- The ratio of the participants to say the expenditure of only 20 YTL or less monthly is very higher as 40%.

As to given answers depending on the age and education groups of the participants they are:

- As the ratio of the participants to say that they use *Spirulina* certainly increases for the groups of the age of 18-25, 25-30 and 40-50 respectively, the ratio of the participants not to say that they use *Spirulina* certainly decreases for the following age groups. A similar situation can be also seen for the expenditure of health foods

- It would be understood that increasing of education level of the participants is an important factor on they have information related health products more correctly and on they think these types of products to be a necessity for the life

Finally it could be said that the results of these types of studies in their given limitations are a good guide for determining of the target consumer groups for the marketing of the products and also that the efforts related with the increasing of the marketing potential of the special products like *Spirulina* and others are needed more.

### **LIMITATIONS OF THE STUDY**

Because of the population of this study consisted of consumers in central Izmir, the results should not be generalized to all population or all ages or all people with the same education level or the entire country.

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