

## **5.1 MANUSCRITO 2: ALLEGATION OF HEALTHY FOOD AND ITS INFLUENCE ON CONSUMPTION: EXPLICIT AND IMPLICIT ATTITUDES**

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**Allegation of healthy food and its influence on consumption: Explicit and implicit attitudes**

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## Abstract

**Background:** Food choice is influenced by several factors, which are inherent to the intrinsic or extrinsic food characteristics. The nutritional food property, and, consequently, the health benefits provided by it, may affect this choice. Therefore, the aim of this study was to evaluate the influence of health allegation on food choices of adults explicit and implicitly, by adapting the Implicit Association methodology. **Methods:** The sample consisted of 208 individuals, from which 100 of them participated only in the words survey, and the another 108 participated in the explicit and implicit tests, and nutritional assessment. For explicit assessment, it was conducted the sensory acceptability analysis test in two sessions (blind and with information), to evaluate the influence of non-sensory characteristics. For implicit assessment it was performed Word Association Technique to make a survey of the words that were used in the implicit test, using as a tool the FreeIAT software. To evaluate the nutritional status, it was measured the weight, height, waist circumference and then calculated the Body Mass Index. To analyze the results, descriptive statistics was performed to observe the frequency, the mean  $\pm$  standard deviation, and additionally the t test and Spearman correlation test, adopting a 5% significance level. **Results:** In the explicit evaluation, it was observed that the health benefits information positively influenced on food choice ( $p < 0.01$ ). When assessing the healthy food information implicitly, it was clear that 43,52% ( $n = 47$ ) of participants had a strong preference for healthy foods. **Conclusion:** The results showed that knowledge about the nutritional aspects of food interferes with food choices explicitly and implicitly. Also, the FreeIAT program proved to be an excellent complementary tool for studies with consumers regarding food choices, being an innovation for researches in this segment.

**Keywords:** Implicit association; explicit measure; food choice; healthy eating.

## Introduction

Diet plays a crucial role in life quality and people's well-being, also acting in the prevention and control of diseases. Thereby, consumption of healthy food such as foods rich in vitamins, minerals, dietary fibers, poly, and monounsaturated fats help in the prevention of hyperlipidemia, obesity, and diabetes mellitus, as these influence the lipid profile, in the control of body weight, and glycemia<sup>1</sup>.

However, the act of feeding oneself pervades the biological reasons, because the food translates several meanings, reflecting social, economic and cultural aspects. Numerous factors influence on the food choices, such as the sensory properties (evaluated by the senses, such as taste, smell, sight, and touch), taking into account the intrinsic aspects of food (odor, flavor, appearance, texture, and others.). Also, the aspects extrinsic to food, such as economic issues (price, income, and advertising), health and nutrition (prevention or control of diseases), and family eating habits (cultural), also influence on food choices<sup>2</sup>.

Given the many factors affecting food choice, studies to define the aspects that influence the buying decision of a product are increasingly complex. The traditional sensory food analysis, which evaluates only the intrinsic factors, is insufficient to ensure that the product being developed meets consumer expectations. Thus, new methods have been developed for consumer studies, such as the Conjoint Analysis<sup>3</sup>, the Principal Component Analysis with the Preference Map technique<sup>4</sup>, the test application methodology of sensory acceptance test in sessions to evaluate the non-sensory characteristics<sup>5</sup>.

However, the new methodologies for consumer studies measure only the explicit attitude of the individual, being it conscious, controlled or reflective. So, the question is how far that attitude is real or feigned because the consumer can mask an acceptance or rejection of the product. This calculated behavior may be due to some constraint or even to be accepted in society.

In this context, it is essential to develop study methods with consumers already using implicit measures, besides the explicit already practiced. This implicit tool will allow to obtain more reliable information from consumers concerning food.

The implicit attitude has been studied by social psychologists, who, increasingly, have devoted attention to automatic processes in understanding the social and behavioral trials. Therefore, when trying to understand the attitudes, decisions, emotions and motives of consumers, the unconscious to automatic processes should be considered<sup>6,7,8,9,10</sup>.

To evaluate the unconscious human behavior, Greenwald, McGhee and Schwartz (1998)<sup>11</sup> developed the Implicit Association Test (IAT). Since then, the IAT has been used in various fields of study, such as implicit attitude toward smoking among children<sup>12</sup>, to mediate expectations to alcohol<sup>13</sup>, to measure attitudes and behavior of consumers concerning food brands, restaurants and drinks<sup>14</sup>, for implicit attitudes towards polyamory<sup>15</sup> and others. However, there was no application of this tool related to health and the choice of food.

The IAT is a computerized device where the participant is asked to associate the items/stimuli (words or images) displayed in the center of the computer screen to the categories (words) that appear on the top side of the screen. To associate the stimulus with the category on the left, the participant should hit the key "E", and to associate the category on the right one must hit the key "I". It is important that the participant associates as quickly as possible the stimulus to the category and make few mistakes because this technique evaluates the response time to stimuli in milliseconds<sup>16</sup>.

From the values of the response time of the participants, it is possible to calculate the conventional D Score, which measures the implied association<sup>11</sup>. Due to the variability in scores from the difference in the test performance ability, it was developed the D-Score (GNB Score), which is the result of the difference between the incongruent and congruent blocks (conventional score) divided by the standard deviation of the participant of all latencies of responses, in the two blocks.

A new alternative to the use of implicit association is the FreeIAT program, which is available free of charge, easy to handle and available in Portuguese. This program allows the inclusion of stimuli chosen by the researcher, which will depend on the subject matter. In addition to providing the response time of each participant, the average response time, standard deviation, other values, and especially the D score, value required to evaluate possible associations<sup>15</sup>.

Given the above, the aim of this study was to assess the influence of the health allegation in adult food choices explicit and implicitly, by adapting the Implicit Association methodology for studies on food and health.

## **Methods**

This is a quantitative, qualitative study of exploratory and transversal character.

## **Ethical approval**

This study was approved by the Ethics Committee of the State University of Southwest Bahia, by the protocol 274.122, taking into account the Resolution No. 466, of December 12, 2012, from the National Council of health<sup>18</sup>. Thereby, data collection only started after the approval of the project, also, after reading and signing a Free Consent Term and Clarification by the research participants. All participants were informed about the survey and invited to participate voluntarily.

## **Study participants and local**

Participated in this study 208 individuals, and 100 individuals participated only on the words collection, the other 108 participated in the explicit and implicit tests, and nutritional assessment. Participants were teachers, employees and students of the State University of Southwest Bahia (UESB), aged between 18 and 38 years. The sample was defined by convenience (non-probabilistic, intentional).

It was excluded people with physical disabilities that were not able to have fast hand movements, smokers, people with mental disabilities, illiterates, pregnant, with colds, denture prosthesis users and/or had any complications in the oral cavity that could influence the perception of taste.

The research was conducted in the laboratory of foods from UESB, Jequié campus, Bahia.

#### Personal information, socio-demographic and attitudes

A structured questionnaire was applied to 108 participants, which required some personal information (name, address and telephone number) to keep up with them during data collection. Also, there were questions about socio-demographic characteristics and attitudes (gender, age, race/color, marital status, education, religion, family income, physical activity).

#### **Explicit test**

For the explicit evaluation, 108 participants were recruited, and the sensory acceptance test was held in two sessions, aiming to evaluate the influence of non-sensory characteristics. The first session was the blind test, where food was served without any information about it, there was only the description of the food (name), and samples were encoded with random numbers with three digits. In the second session, it was performed the test providing information, so at that moment, the food was served with the information of the health benefits provided by it.

The food used in the test was dehydrated apricot, in compliance with the standardized sample size of 20 grams, which was served monodically in 50 ml disposable cups. The test was performed in individual cabins to prevent communication among participants, under white light and a acclimatized environment. Along with the samples, they

were given a 9-point hedonic scale form<sup>19</sup> for product evaluation, and water, for residual food taste removal between sessions.

Data from the hedonic scale were nominal, which range from disliked extremely to liked extremely. To facilitate understanding of these data, they have been transformed into numeric, in scores from 1 to 9, which were organized in two blocks: an accepting block, in which the scores ranged from 6 to 9; and the other, rejecting block, ranging from scores 1 to 5.

### **Word Association**

The Word Association Technique was applied to 100 adult individuals, to raise the words that were used in FreeIAT, avoiding possible biases. Participants of this step did not participate in the other tests because they could influence the results of the research. In this technique, the participant were given four stimuli words (tasty, unpleasant, healthy, unhealthy), being presented randomly and were asked to respond spontaneously with the first four images, associations, words, and feelings that came to their minds<sup>19,20</sup>.

The results of word association were evaluated qualitatively<sup>21</sup>. A search for recurring terms within each stimulus was performed. Seen this, the terms with similar meanings were grouped into the same category. They considered only the words listed for more than 10% of the participants<sup>19</sup>.

### **Implicit test**

For this step, 108 volunteers participated, which were the same from the explicit test. The implicit assessment was carried out in the FreeIAT program, Portuguese version<sup>15</sup>, with easy installation and management, and the configuration was set up for this search. The title of the text was Food and Health, being used only words, which were obtained in the Word Association Test. The first two categories were Healthy and not Healthy, which were followed

by the registration of the positive and negative stimuli. The other categories were Pleasant and Unpleasant, being registered the positive and negative stimuli.

After including the words used in the test, the quantity of trials of each block was set up. It was followed the number of 20 attempts in the training blocks (1, 2 and 4) and 60 attempts in association tests (3 and 5)<sup>22,23</sup>. In the training block 1, the word Healthy appeared as a category on the right and the word Not Healthy appeared as a category on the left, and the stimulus appeared monodically in the center of the screen. In block 2, the category that appeared on the right was Pleasant and category on the left was Unpleasant. Again, the stimulus appeared in the center of the screen. In block 3 of associations, categories appear in combination, given that on the right side appeared Healthy/Pleasant and on the left one appeared Unhealthy/Unpleasant. Therefore, the stimulus appeared in the center of the screen once more. In block 4, the category Unhealthy appeared on the right side, and the category Healthy appeared on the left side. In block 5, new associations were created, in which Unhealthy/Pleasant appeared on the right, and Healthy/Unpleasant appeared on the left.

### **Nutritional Assessment**

A nutritional status assessment was carried out for all 108 participants from the explicit and implicit tests. Weight, height and waist circumference (WC) was measured. The Body Mass Index (BMI) was calculated and classified according to the World Health Organization (WHO), as well as the WC complied with the WHO criterion<sup>24</sup>.

### **Statistical Analysis**

Statistical analysis were performed with the statistical software Statistical Package for Social Sciences (SPSS) version 21.0 and Evoc.

The described statistics were used to characterize the socio-demographic data and attitudes of the 108 participants from explicit and implicit tests, and nutritional assessment, using the frequency of each variable.

Data obtained from the explicit test were analyzed through descriptive statistics to observe frequencies, mean and standard deviation of scores obtained for the dehydrated apricot in the blind test and test with information. Also, the t-test for paired samples was conducted to evaluate the influence of health benefits information on consumer acceptance. It was adopted a 5% significance level.

To assess the frequency of words from the survey in the word association test, we used the Evoc software. They were not regarded the words mentioned by more than 10% of the participants. Words were divided into four categories, healthy, unhealthy, pleasant and unpleasant.

To assess the strength of association of the implicit measure, the score D results were in five groups. The first group comprised the values below 0 (opposite attitude for healthy food), consequently, the second group, values from 0 to 0.15 (there is no clear preference), the third group, values from 0.16 to 0.35 (weak association), the fourth group, values from 0.36 to 0.65 (moderate preference) and, finally, the fifth group, values over 0.65 (strong preference)<sup>22,25</sup>.

After this categorization, descriptive statistics was used to observe the frequency of the values obtained in FreeIAT.

The correlations from socio-demographic data and attitudes, from explicit and implicit measures, and from nutritional assessment were performed by the Spearman correlation coefficient. The level of significance used for the analysis was 5%.

## **Results and discussions**

The study population was homogeneous regarding sex, being 48.10% men (n = 52) and 51.90% women (n = 56). Most participants were between 18-28 years old (88.00%, n = 95), as described in Table 1.

Table 1: Socio-demographic characteristics and attitudes of 108 participants from explicit and implicit tests, and nutritional assessment.

The educational level of the sample was high, with 91.70% (n = 99) attended or were attending a graduate school. This finding may be explained by the research environment, which was a university. Contributing to this study, research conducted in a University reveals that 80.00% (n = 80) of participants were, at least, attending a graduate program<sup>26</sup>.

As described in Table 2, it can be seen that the information of health benefits from apricot positively influences the acceptance of the product. In the blind test, 30.60% (n = 33) of participants rejected the food (scores 1 to 5), after the benefits information, only 23.10% (n = 30) were still rejecting it. Furthermore, the mean score increased among sessions. In the blind test, the mean of the scores obtained was 6.20 ( $\pm$  1.85) and in the test with information was 6.57 ( $\pm$  1.90), reaching a significant difference between the measurements ( $p < 0.01$ ).

Table 2: Frequency, mean and standard deviation of the scores obtained for dehydrated apricot among sessions.

Studies performed on the influence of health benefits information on food choices have shown that this information positively influences the acceptance of food<sup>5,27</sup>. By performing the acceptance test in sessions, to evaluate the influence of health benefits information in exotic fruit juices, it was observed that the information positively influenced the acceptance of them<sup>5</sup>. Similar results were found for milk with a high concentration of melatonin, both the information of the presence of such substance and the benefits from it influenced positively in the acceptance of the product<sup>27</sup>.

According to Viana (2002), balanced diet influences on a healthy lifestyle in all age groups. Thereby, individuals are joining health promoting behaviors, with the choice of healthy foods to prevent diseases or to control chronic or acute diseases<sup>28</sup>.

However, studies on the behavior of individuals regarding healthy food choices only evaluate the conscious and controlled response with the aid of explicit test. However, the question is how much this explicit measure is reliable. During the test, the participant can control their reactions and expose what is favorable for them. In this way, one can hide one's answers, expressing what would be accepted by society. Therefore, the implicit measure is important to avoid possible biases, since it evaluates the uncontrolled and unconscious response<sup>29</sup>.

The implicit measure was assessed by FreeIAT<sup>15</sup>, adapted for research on food and health, being used the Words Association Technique, thus avoiding possible bias in the implicit test performance. The words from the survey are described in Table 3, as well as all in their corresponding categories.

Table 3: Categories and words used in the FreeIAT.

In the implicit test, it was used the value of the categorized score D22,25, revealing that 33.33% (n = 36) of participants had a moderate preference (0.36 to 0.65) for healthy food, giving positive words to this group, and 43.52% (n = 47) of participants had a strong preference (over 0.65) for healthy food, as described in Table 4.

Table 4: Frequency of Score values OF categorized, FreeIAT.

By using the FreeIAT test as a complementary tool for studies with consumers about healthy food, it was remarkable that they prefer healthy foods implicitly. With the explicit test, it was noticeable that after the information of health benefits provided by food, consumers start to accepting more such products.

Healthy eating habits is a fundamental requirement for health promotion and disease prevention. Furthermore, it enables the growth, development and maintenance of the human body with life quality. The choice of unhealthy foods is associated with an increase in non-communicable chronic diseases, such as obesity, high blood pressure, diabetes and others<sup>30</sup>.

From this perspective, young adult consumers in this study prefer the consumption of healthy foods by explicit and implicit attitudes. In contrast to this finding, Barreto, Steps and Giatti (2009) studied the healthy behavior of young people (18-29 years old) and found that the consumption of healthy foods was low<sup>31</sup>. So what differs this study from others is the use of an implicit measure, which ultimately mitigated the limitations of explicit measures and avoids possible biases.

In this study, it was observed that the age of the individual influences the preference for healthy foods, and a positive correlation between age and preference for healthy foods was observed implicitly ( $p < 0.05$ ), as shown in Table 5. Healthy food consumption is related to disease prevention, longevity, health promotion and quality of life, which means, with healthy aging<sup>32</sup>.

Table 5: Correlations among socio-demographic data and attitudes, explicit measure, implicit measure, and nutritional status.

Given consumers' concerns regarding food and health, they have sought information about food and the allegation of health benefits, aiming to improve life quality. Therefore, the food industry has invested in the production of foods with health allegations to reach this public<sup>33</sup>.

In industrialized foods, nutrition labeling is an important tool to assist consumers in healthier choices. However, consumers report having difficulties in interpreting and applying the information printed on the labels<sup>34</sup>. Furthermore, researches conducted to ascertain the

information on the labels of food products, according to the legislation, eventually they have found many irregularities, hindering, even more, consumers' choice<sup>35,36</sup>.

## **Conclusion**

Due to consumers concern regarding health, healthy eating has gained ground nowadays. Allegations of healthy foods and health benefits provided by foods positively influence acceptance explicitly, rationally, consciously and implicitly, that is, the automatic unconscious processes.

The FreeIAT program showed itself as an excellent complementary tool for studies with consumers about food choices, being an innovation for works in this segment.

Also, it is possible to notice that the knowledge about the nutritional aspects of food interferes with the food choices of individuals. Therefore, this factor of choice directly reflects on population health. So it is essential to monitor, and have reformulations of printed information in food labeling, thereby corroborating for healthy and conscious choices.

## **Abbreviations**

WC - Waist Circumference

IAT - Implicit Association Test

BMI - Body Mass Index

OPD - Optimized Profile Description

WHO - World Health Organization

SPSS - Statistical Package for Social Sciences

UESB - State University of Bahia Southwest

**Competing interests**

The authors declare that they have no competing interests.

**Authors` contributions**

Jamille Marinho Brazil participated in the conception and design of the study, contributed scientifically and intellectually for the execution of the study, performed data collection, statistical analysis and interpretation of results, in addition to writing the manuscript.

Maria Patricia Milagres participated in the conception and design of the study, contributed scientifically and intellectually for the execution of the study, critical review, and final approval.

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**Table 1:** Socio-demographic characteristics and attitudes of 108 participants from explicit and implicit tests, and nutritional assessment.

Variables	N	%
<b>Sex</b>		
Male	52	48,10
Female	56	51,90
<b>Age Group</b>		
18-28 years	95	87,90
29-38 years	13	12,10
<b>Race</b>		
Yellow	2	1,90
White	23	21,30
Brown	55	50,90
Black	28	25,90
<b>Marital status</b>		
Without a partner (a)	101	93,50
With partner (a)	7	6,50
<b>Education</b>		
Elementary School	1	0,90
High school	8	7,40
Incomplete superior	68	63,00
Graduated	19	17,60
Postgraduate	12	11,10
<b>Family income</b>		
Up to R\$ 724,00	12	11,10
R\$ 724,00 to R\$ 1500,00	33	30,60
R\$ 1500,00 to R\$ 3000,00	36	33,30
R\$ 3000 to R\$ 5000,00	14	13,00
Above R\$ 5000,00	13	12,00
<b>Physical activity</b>		
Yes	57	52,80
No	51	47,20
<b>Religion</b>		
Catholic	44	40,70
Protestant	39	36,10
Adventist	4	3,70
Spiritist	21	19,40

**Table 2:** Frequency, mean and standard deviation of the scores obtained for dehydrated apricot among sessions.

Food	Test Type	Scores (%)									Mean ( $\pm$ SD)
		1	2	3	4	5	6	7	8	9	
	Blind test	1,9	2,8	4,6	6,5	14,8	21,3	23,1	15,7	9,3	6,20 ( $\pm$ 1,85) <sup>A</sup>
<b>Damascus</b>	Test info	0,9	3,7	4,6	4,6	9,3	17,6	24,1	20,4	14,8	6,57 ( $\pm$ 1,90) <sup>B</sup>

(\*) Different letters indicate significant differences between the means involved, the level is 5% significance (t-test).

**Table 3:** Categories and words used in the FreeIAT.

<b>Positive Stimuli</b>	<b>Words</b>	<b>Negative Stimuli</b>	<b>Words</b>
	Fruits		Alcohol
	Water		Chocolate
<b>Healthy</b>	Greens	<b>Not healthy</b>	Soda
	Tea		Fried foods
	Vegetables		Cake
	Welfare		Malaise
	Tasty		Disgusting
<b>Nice</b>	Good	<b>Unpleasant</b>	Bad
	Delicious		Wishy-washy
	Candy		Bitter

**Table 4:** Frequency of Score values OF categorized, FreeIAT.

<b>Score D Categorized</b>	<b>Description</b>	<b>Frequency (%)</b>	<b>Frequency (n)</b>
< 0	Contrary attitude to the research object	10,18	11
0 a 0,15	There is no clear preference	4,64	5
0,16 a 0,35	Weak association	8,33	9
0,36 a 0,65	Moderate preference	33,33	36
>0,65	Strong preference	43,52	47

**Table 5:** Correlations among socio-demographic data and attitudes, explicit measure, implicit measure, and nutritional status.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Sex	-	0,066	-0,152	-0,048	-0,048	0,077	0,061	0,132	-0,071	0,002	0,537**	0,754**	0,483**	0,171
2. Age	0,066	-	0,013	0,269**	0,710**	0,033	0,257**	-0,081	-0,010	0,210*	0,242*	0,023	0,350**	0,272**
3. Race	-0,152	0,013	-	-0,049	0,025	0,071	-0,183	-0,155	-0,027	-0,002	-0,113	-0,089	-0,113	-0,079
4. Marital Status	-0,048	0,269**	-0,049	-	0,303**	-0,037	0,230*	-0,015	-0,116	0,192*	0,131	0,035	0,074	0,080
5. Education	-0,048	0,710**	0,025	0,303**	-	-0,015	0,227*	-0,057	0,057	0,191*	0,136	-0,086	0,243*	0,194*
6. Religion	0,077	0,033	0,071	-0,037	-0,015	-	0,105	-0,050	-0,152	-0,043	-0,015	0,143	-0,070	-0,115
7. Income	0,061	0,257**	-0,183	0,230*	0,227*	0,105	-	0,108	0,259**	0,100	0,211*	0,121	0,125	0,165
8. Physical Activity	0,132	-0,081	-0,155	-0,015	-0,057	-0,050	0,108	-	0,030	-0,069	0,177	0,263**	-0,043	0,028
9. Measure Explicit	-0,088	-0,006	-0,034	0,033	0,054	-0,101	0,241*	0,031	-	-0,023	-0,067	-0,038	-0,111	-0,081
10. Measure Implici	0,002	0,210*	-0,002	0,192*	0,191*	-0,043	0,100	-0,069	-0,017	-	0,111	0,060	0,108	0,100
11. Weight	0,537**	0,242*	-0,113	0,131	0,136	-0,015	0,211*	0,177	-0,077	0,111	-	0,638**	0,865**	0,840**
12. Height	0,784**	-0,005	-0,083	0,001	-0,077	0,097	0,118	0,244*	-0,038	0,073	0,629**	-	0,394**	0,133
13. WC	0,507**	0,321**	-0,154	0,166	0,212*	-0,053	0,143	0,001	-0,111	0,113	0,853**	0,394**	-	0,848**
14. BMI	0,205*	0,275**	-0,115	0,158	0,181	-0,095	0,185	0,052	-0,081	0,128	0,844**	0,133	0,848**	-

\* Correlation is significant at the 0.05 level; \*\* Correlation is significant at the 0.01 level (Spearman).