NEW PRODUCTS DEVELOPMENT: A MARKETING STUDY OF A POPSICLE PRODUCED WITH WHEY

Desenvolvimento de Novos Produtos: Um Estudo de Marketing sobre Picolé Produzido com Soro de Leite

ABSTRACT

This study aimed at identifying the sensory acceptance and preference of customers for a chocolate popsicle produced with whey. Specifically, it sought to i) identify the acceptance and purchase intent of consumers after tasting the popsicle under four different concepts; ii) to select the best concepts; and iii) to identify potential market segments. As for the methodology, the study was a quantitative and qualitative research using techniques of sensory analysis, semi-structured questionnaires and in-depth interviews. Quantitative data were analyzed using descriptive and multivariate statistics. For qualitative data, content analysis was used. The results showed that the concept "chocolate popsicle made with whey" stood out, followed by the concept "chocolate popsicle made with essential amino acids". They both had good sensory acceptance and purchase intent, but the consumers preferred the concept "whey". As for market segmentation, two groups were extracted: the first and largest group was named "healthy and conscious consumers" and the second "hedonic consumers". It was identified that the best segment for the product is the group 1, since the term "whey" is already known and valued by this public. Thus, conveying the product as popsicle with "whey" might be an appropriate strategy for this segment.

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Recebido em: 13/06/2016. Aprovado em: 25/05/2018.
Avaliado pelo sistema *double blind review*
Avaliador científico: Paulo Henrique Montagnana Vicente Leme
Doi: 10.21714/2238-68902018v20n1p001

RESUMO

A pesquisa buscou identificar a aceitação e preferência sensorial dos consumidores para um picolé de chocolate feito com soro de leite. Especificamente, buscou-se: 1) identificar a aceitação e intenção de compra ao provar o picolé sob quatro conceitos diferentes; 2) selecionar os melhores conceitos; e 3) identificar segmentos de mercado potenciais. Quanto à metodologia, tratou-se de uma pesquisa quantitativa e qualitativa utilizando as técnicas de análise sensorial, questionários semiestruturados e entrevistas em profundidade. Os dados quantitativos foram analisados com estatísticas descritivas e multivariadas. Para os dados qualitativos, utilizou-se a análise de conteúdo. Como resultados, o conceito "whey" foi o que mais se destacou, seguido pelo conceito "aminoácidos essenciais". Ambos tiveram boa aceitação sensorial e intenção de compra, porém o conceito "whey" foi o preferido dos consumidores. Quanto à segmentação de mercado, dois grupos foram extraídos: o primeiro e maior grupo foi chamado de "consumidores saudáveis e conscientes" e o segundo de "consumidores hedônicos". Identificou-se que o melhor segmento para o produto é o grupo 1, visto que o termo "whey" já é conhecido e valorizado por esse público. Logo veicular o produto como picolé com "whey" pode ser uma estratégia apropriada para esse segmento.

Palavras-chave: Comportamento do Consumidor, Análise Sensorial, Teste de Conceitos, Gelados Comestíveis, Chocolate.

Keywords: Consumer Behavior, Sensory Analysis, Concept Tests, Edible Ices, Chocolate.

1 INTRODUCTION

Food products have an important role in everyday life since their functions for humans are greater than simply supplying vital necessities (LUCCHESE; BATALHA; LAMBERT, 2006). In this sense, the effort spent trying to understand consumer behavior is noble, as it provides the necessary understanding of how to plan products and marketing programs that fulfill customer needs and expectations (FERRELL; HARTLINE, 2006).

According to Rezende and Avelar (2012), the food industry has assumed an unprecedented dynamism, since processing and distribution of food have gone through intensive innovations, leading to changes in eating habits. Thus, consumers today are presented with a great deal of information; in addition, supplies in the market are even greater, leaving consumers in privileged decision-making position. In this sense, the food market must evolve into a consumer-oriented market (DAGEVOS, 2005).

Within the food industry, the dairy industry is among the one that most innovates and delivers to the market new and differentiated products. Whey is a byproduct of considerable importance for this industry, given its production volume and nutritional composition (BALDASSO, 2008). Yet, its disposal in wastewaters without proper treatment represents a major source of environmental pollution due to the high amount that is disposed and its high organic matter content (KOUTINAS *et al.*, 2009).

Retaining on average 55% of milk nutrients (ABREU; GAJO, 2012), whey has considerable use potential (ROCHA, 2013), for example: production of dairy beverages, ricotta cheese, powdered whey and powdered whey proteins, lactose, incorporation into desserts, toppings, cookies, etc. Thus, whey-based products compete with many other products for market shares (SMITHERS, 2008).

The production of popsicles made with whey could represent a viable option for a better usage of this byproduct. Thus, manufacturers could take advantage from the consumer behavior studies, development of new products and market strategies for effectively place this product on the market.

Thus, the research problem that guided this study was given by the question: can whey be used for manufacturing popsicles from the consumer standpoint? Considering that issue, the aim of this study was to assess the viability of introducing on the market a chocolate popsicle essentially produced with whey, by analyzing the consumers sensory preferences and purchase intent and identifying possible market segments for the product.

As for the theoretical gap, this paper aims at applying food sensory analysis to marketing research as a way to better help the understanding of food consumer behavior and marketing segmentation. Therefore, by tying two areas of knowledge (marketing and food science and technology), the present study contributes to scientific advancement in both areas in an interdisciplinary way. As pointed out by BONGONI *et al.* (2013), traditionally research on consumer behavior and in food science and technology have been addressed from different perspectives. This fact imposes a paradox given that food engineers and technologists need information from social scientists, and that social scientists need the technical information on food that can be communicated clearly to consumers.

The managerial justifications of this study considers: 1) the development of popsicles with whey might present to popsicle and dairy products manufacturers an alternative to environmental problems, adding value to the product by turning expenses into revenues; 2) there is a possibility of reducing production costs, since whey is cheaper than milk; 3) whey is likely to have a good nutritional appeal because of its high protein and carbohydrate and low fat contents; and 4) this research could help popsicle manufacturers and researchers to develop a product with smaller chances of failure in the market.

2 REFERENTIAL

In this session, the theoretical underpinning that supported this study is presented. At first, the concepts of food consumer behavior and purchase intent are described; next it is presented some important thoughts regarding market segmentation and new product development and; lastly, the concepts of milk whey are described.

2.1 Food Consumer Behavior and Purchase Intent

Consumer behavior is shaped by internal and external incentive (BLACKWELL; MINIARD; ENGEL, 2009). For the food industry, Eertmans, Baeyens and Van den Berg (2001) exemplify that the perception of aroma and flavor are considered internal stimuli, which are influenced by appearance, texture, sound, and temperature, which in turn affect the taste of a food. External stimuli are related to packages, labels, nutritional information, sociocultural influences, and even food availability that may affect the choice of products.

Steenkamp (1993) proposes a model of the three most important determinants of food consumer behavior: 1) food inherent properties – including physical and chemical properties, nutrient content, physical appearance and shape, proportion of macro nutrients, amount of fiber, energy value and quantity of specific substances; 2) consumer-related factors – such as biological factors (e.g.: age, sex, body weight), psychological and personality factors, and finally; 3) environmental factors – which

include sociocultural, economic and marketing factors. The author points out that any detailed analysis of the behavior of food consumption should consider all three types of determinants.

Food trends also affect lifestyle and consumption, with some trends being popular and enduring, while others are short-lived. As discussed by Dagevos (2005), it is important to improve the understanding of sociocultural and socio-psychological influences on consumers' food choice and purchase intent. According to the author, identity, principles and values should also be taken into account, since consumers may have interest in issues such as environmental pollution, animal welfare, manufacturing processes, producer integrity, fair trade procedures, among others.

In this sense, Dagevos and Van Ophem (2013) present the concept of "food consumer value", which is consumer-centered and incorporates both the physical characteristics of the products as well as emotional associations evoked by the brand, place, moment of consumption, ethical concerns about certain production practices, among others. Thus, in addition to being fundamental for consumer choices, value is also key to marketing strategies, since it is seen as essential for the competitiveness and success of companies (LINDGREEN; WYNSTRA, 2005). Therefore, studies on purchase intent of consumers are crucial to the success of a product on the market.

Magalhães and Damacena (2006) define purchase intent as a set of factors that lead a person to behave in a certain way, generating a tendency to act about a given product or service, brand or specific company, in a situation and particular moment, leading (or not) to the actual purchase. Namely, purchase intent means that consumers could buy a product over and over again after having appraised it (TARIQ; RAFAY; MUSARRAT, 2013). It should be noted that the purchase intent and the purchase itself are different concepts, as Ferrell and Hartline (2006) point out: "A consumer may intend to purchase a new car, for example, but several factors may hinder the effective acquisition. He may postpone the purchase because of unforeseen circumstances, such as illness, job loss (...), or perhaps simply because he changed his mind".

In the managerial level, purchase intent has substantial importance, because companies aim to increase sales of their products in order to maximize their profits (TARIQ *et al.*, 2013), and, complemented by Ferrell and Hartline (2006), understanding the processes that consumers and companies use to make purchasing decisions is the necessary first step in developing mutually long-term beneficial relationships.

2.2 Market Segmentation and New Product Development

Despite all the differences inherent to consumers, there are certain common patterns of consumption and purchase intent, which lead to segmentation. Kotler (2011) defines market segmentation as the market division into distinct groups of buyers with different needs, characteristics and behaviors. To Ferrell and Hartline (2006), the concept can be understood as a group (or groups) of individuals or institutions with similar needs that can be met by a product (service) or product (service) category.

Within the food industry, the characteristics, attitudes and consumption habits of the consumers are often used as basis for segmentation (MÜLLER; HAMM, 2014). Good market segmentation helps the company reach the right customers who have greater buying interest and it may also encourage companies to develop new products to meet these requirements of the customers (NIE; ZEPEDA, 2011; PENG, 2010).

In this regard, New Product Development (NPD) is recommended as suitable strategy to build competitive advantage and financial success for firms (COSTA; JONGEN, 2006). For the authors, NPD can be seen as an organizational process in which information about the market and its actors are gathered, disseminated, assimilated and returned in the form of a new product, taking as its starting point the consumers needs.

No product will be successful if no one tries it and it will not survive without repeated tests by consumers (ILORI; OKE; SANNI, 2000). It is a generically accepted fact that many food products introductions on the market fail. These high failure rates are largely given by the fact that the consumers preferences and eating habits exhibit a slow pace of change (COSTA; JONGEN, 2006). Furthermore, food innovations are often rejected by consumers as a result of a "neophobia" (BARRENA; SÁNCHEZ, 2012).

Nonetheless, it is unwise to assume that all consumers share the same preferences or aversion degree towards products. Thus, consumers are known to maintain at the same time, a tendency to get closer (neophilia) and to avoid (neophobia) new food products (VAN TRIJP; VAN KLEEF, 2008), thereby creating an atmosphere of ambivalence, in which some innovations are faced with opposition and distrust while others easily become part of the daily routine (GRUNERT; VALLI, 2001).

As the fear of failure results in low rates of innovation in the industry (ILORI *et al.*, 2000), it is extremely important to food products developers to remain aware to the consumers needs. A unique product that fills a consumer need will be successful in most cases (STEWART-KNOX; MITCHELL, 2003). In this regard, the dairy sector is one of the most innovative within the food industry, always seeking to create value for consumers through new products and line extensions. In this sense, whey (a by-product of this industry) has remarkable market potential for product innovations.

2.3 Milk Whey: Concepts, Positive and Negative Aspects

Whey, also known as milk whey, cheese whey, or in Portuguese "*soro de leite*", is a by-product of the dairy industry. It represents the watery portion of the milk that separates from the curd during conventional manufacturing of cheeses (BALDASSO, 2008).

In the cheese production process, milk is a 100% converted into cheese. In order to produce one kilo of cheese, approximately 10 liters of milk are used, which results in 9 liters of whey containing approximately half of the milk solids, especially lactose, soluble proteins and minerals (RIBEIRO, 2001). Retaining about 55% of milk nutrients, whey contains most of the vitamins present in the milk and its whey proteins have an exceptional biological value, which exceeds that of egg proteins in approximately 15% (ABREU; GAJO, 2012; SMITHERS, 2008).

Whey proteins present high digestibility and excellent composition and bioavailability of essential amino acids, which are necessary for humans and must be obtained from food (SGARBIERI, 1996). Therefore, whey has a high nutritional value, currently being seen by the industry not as a by-product, but as a rich and varied composed of proteins with chemical, physical, nutritional and functional properties (PRAZERES; CARVALHO; RIVAS, 2012).

Even with the various possibilities of whey utilization analyzed over the past few years, about half of world production is not yet exploited, being discarded as effluent into water systems or directly in the ground, resulting in an alarming source of environmental pollution, as well as a considerable loss of food energy and great economic loss (BALDASSO, 2008).

Due to its high organic content, whey is the major source of pollution generated by the dairy industry. The pollutant load is about 100 times greater than domestic sewage. Consequently, a solution to this problem has become urgent, prompting governments and other regulatory authorities to restrict and / or prohibit the disposal of untreated whey, incurring on effluent treatment costs for industries (SMITHERS, 2008).

Although the whey pollution power is somewhat well known, this by-product is also an excellent source of raw material for the food industry, and with the continuous development of technologies and increasing environmental responsibility by the industries, whey image is rapidly changing from "gutter to gold" (SMITHERS, 2008).

3 METHODOLOGICAL APPROACHES

This paper is characterized as a qualitative / quantitative descriptive study. According to McDaniel and Gates (2003), the combined use of qualitative and quantitative research provides a better understanding of opinions, judgments and evaluations by participants. Malhotra (2001) complements saying that this combination can provide a rich understanding that can help to formulate marketing strategies.

The quantitative stage of this paper was composed by popsicle consumers in the city of Lavras, Minas Gerais – Brazil, and it was divided into two separate stages. The first stage – that took place on Sensory Analysis Laboratory of the University of origin of the authors – aimed at selecting the best concepts for the product.

In doing so, four concepts for the product were developed. Such concepts were elaborated by the authors considering the literature review on milk whey, as well as considering discussions with professors on the dairy sector of the university.

It is important to highlight that the product formulation for all four concepts were exactly the same. In this sense, the idea was to vary the information conveyed to the consumer in order to see how such concepts would be perceived by the sampled respondents in order to identify what would be the best way to market a popsicle added of milk whey. The four concepts were:

1) **Chocolate popsicle** – this concept was included on the research to act as a control group; in this sense, no other information regarding the concept was given to the research participants; they were only informed that they were trying a chocolate popsicle.

2) **Chocolate popsicle made with whey** – the idea behind this concept was to inform the research participants that they were tasting a popsicle produced with whey. In doing so, the participants were informed that whey is a raw material derived from milk, widely used in the food industry, rich in proteins and low in fat and cholesterol,

containing antioxidants that helps the immunity system and controls the sugar levels.

3) Chocolate popsicle made with essential amino acids – since amino acids are the subcomponents of proteins and since milk whey is rich is soluble proteins, the idea behind this concept was to highlight the nutritional value of a popsicle that was enriched with essential amino acids (that is, the proteins contained on whey). For that, research participants were informed that essential amino acids are all amino acids that are not produced by the human body and must be acquired through food. Without their intake, the body could not any synthetize proteins, which would result in slowed growth rates and disruption of vital functions.

4) Chocolate popsicle made with "*soro de leite*" – this concept uses the Portuguese nomenclature for whey; which is *soro de leite*. Participants were informed that *soro de leite* is a by-product resultant from cheese manufacturing, and it is being recognized as high value-added ingredient present in many food products available in the market, which contains proteins, lactose, minerals and vitamins. Delivering essential nutrients and preventing diseases such as cancers, ulcers, and hypertension.

It is worth emphasizing that such expression in Portuguese (*soro de leite*) has a negative connotation in the minds of the Brazilian consumers; As Baldasso (2008) pointed out, *soro de leite* is associated to a by-product rejected from the dairy industry or even animal feed. As for its English sibling: whey; it has a totally different meaning and connotation in the mind of the average Brazilian consumer, which could be explained by a twofold reason: 1) lack of knowledge of the English language and/or 2) associate the word "whey" with food supplement for athletes and fitness enthusiasts, and even to a premium product.

The research participants were asked to first read the popsicle concept, then taste the sample and finally answer the sensory evaluation and purchase intent questionnaire. Samples were delivered one at a time in a randomized order to avoid the so-called "demand effect" (CHARNESS; GNEEZY; KUHN, 2012) – which is the psychological impression that the first sample tasted better than the second, which in turn is better than the third and so on. The research *corpus* for this stage was composed of 139 tasters, number that is above the minimum of 50 tasters suggested by Minim (2013), which were selected through non-probabilistic accessibility sampling (AAKER; KUMAR; DAY, 2001), on September 30th and October 01st, 2014.

The second stage consisted on bringing to market the two best concepts found on the previous stage, aiming to identify the preferred concept of the consumers, the purchase intent and possible market segments. The 158 individuals who comprised the sample for this research step were selected in places of great circulation of people (main square of the city, a gym, a language school and a university cafeteria) also through non-probabilistic accessibility sampling during December 06th, 07th and 09th, 2014.

Firstly, the participants were asked to analyze the popsicles packaging prototypes and read the concepts of each. Such prototypes were used in order to contextualize consumers by supposing that the sampled products were available for retail; the packages were identical varying only the information for each concept.

After these preliminary steps, consumers were asked to taste the two sampled concepts, which were delivered separately and in a random array. In the sequence, they were asked to answer a semi-structured questionnaire on preference of concept, purchase intent, willingness to pay and market segmentation. The total *corpus* of the quantitative stage (sum of stpes 1 and 2) was of 297 participants.

The variables of the questionnaire were created following a Likert-type scale, which were tabulated and processed using the following software: SPSS; SISVAR (FERREIRA, 2011) and SENSOMAKER (PINHEIRO; NUNES; VIETORIS, 2013). Descriptive (frequency distribution, crosstabs, and t test) and multivariate statistics (cluster analysis and parallel factor analysis) were used for the analysis.

The qualitative stage of this study aimed at supplementing the findings of the quantitative stage to better identify potential market segments. The research subjects were from the popsicle industries, food additives industry, university professors, researchers and technicians who work in the dairy field.

The *corpus* was comprised by 16 respondents, being: four popsicle manufactors, five researchers from Cândido Tostes Dairy Institute (ILCT); one researcher from Embapa Dairy Cattle; one researcher from Embrapa Food Agribusiness, a professor from Federal University of Juiz de Fora (UFJF), a researcher from University of Winsconsin (UW), an expert on dairy market from milkpoint.com portal, and two professionals of the food additives industry. It is noteworthy that just as in the quantitative stage, a non-probabilistic accessibility sampling, where the number of respondents was defined by saturation criteria, was used (GUERRA, 2006).

Data collection proceeded through a semi-structured interview guide, where the questions were sent to respondents in an attachment via email, and when possible were conducted in person. After the interviews transcriptions, it was proceeded a content analysis (BARDIN, 2010) for the interpretation and categorization of data.

4 RESULTS AND DISCUSSION

Firstly it is presented the results concerning the selection of the best concepts and further, the results obtained in market research with consumers linked to the results obtained in the interviews.

4.1 Selection of the Best Concepts for Chocolate Popsicles Made with Whey

Most of the 139 consumers who participated in this step of the research were women (65%); 85% were between 19 and 30 years old, 33% claimed to have an income between 4-8 minimum wages, followed by 30% with an income between 2-4 minimum wages and at last, 64% are enrolled in undergrad school, 10% have finished high school and 20% are enrolled in or have completed graduate school.

Regarding popsicle consumption in hotter months, 23% claimed to consume it more than once a week, 31% once a week, 35% once or twice per month and only 11% consume popsicles less than once per month. However, in colder months, it was noticed the seasonality of the product, since more than half of consumers (53%) claimed to have popsicles less than once a month.

According to the Brazilian Association of Ice Cream Manufacturers [ABIS] (2009), as soon as temperatures rise, so does the consumption. Brazil produces annually more than 950 million liters of popsicles and ice cream and 70% of this amount is consumed during the summer. According to Eduardo Weisberg, president of ABIS, the reason for this seasonality is cultural: *"Unfortunately, Brazilians believe that having ice cream in the winter is bad, causing colds, and the flu. It is a wrong idea; the colder weather does not cause any harm to health."* Therefore, changing this paradigm is extremely important. Even though Brazil is the fourth ice cream and popsicle producer in the world, the consumption it is only 5.2 liters per capita per year when compared to 20 liters in Europe (FINAMAC, 2013).

For the best concepts selection, the Paired t-test was used regarding the overall impression attribute in the consumer level. The results are shown in Table 1.

Significant differences were detected ($p < 0.01$) when pairing the concept "Chocolate Popsicle" with the other concepts (pairs 1, 2 and 3). This result shows that when the consumer tasted a chocolate popsicle without any description of the product, differences in sensory acceptability were detected when compared to products with a concept description.

As for the pairs 4 and 5, the concept "*soro de leite*" was paired with the concepts "essential amino acids" and

TABLE 1 – Paired T-test for the popsicle concepts regarding overall impression

		p-value[1]	means	std. deviation
Pair 1	Chocolate vs. *Soro de Leite*	0.002**	7.2464 7.5362	1.1193 1.0405
Pair 2	Chocolate vs. Essential Amino Acids	0.000**	7.2464 7.6232	1.1193 1.0051
Pair 3	Chocolate vs. Whey	0.000**	7.2426 7.7941	1.1122 1.1030
Pair 4	*Soro de Leite* vs. Essential Amino Acids	0.302[ns]	7.5362 7.6232	1.0405 1.0051
Pair 5	*Soro de Leite* vs. Whey	0.003**	7.5294 7.7941	1.0395 1.1030
Pair 6	Essential Amino Acids vs. Whey	0.086[ns]	7.6250 7.7941	1.0106 1.1030

[1] p-values for the hypothesis test of mean difference equals to zero. ** significant at 1% probability. [ns] not significant at 5% probability.
Source: research data

"whey". In pair 4 (*soro de leite* vs. essential amino acids) no significant difference was detected, indicating similar overall impression means for the concepts. However, pair 5 (*soro de leite* vs. whey) showed a significant difference ($p < 0.01$), indicating different sensory acceptance means. At last, pair 6 (essential amino acids vs. whey) did not present significant difference, which indicates similar overall impression means for these concepts.

The parallel analysis of factors shown in Figure 1 makes clear the results shown on the previous paragraphs, displaying that the samples had different sensory acceptance by consumers, and yet the concept "chocolate" is far from the sensory attributes and shows few consumers (vectors) facing towards its direction. It is also noted that the sensory attributes are concentrated in the upper right corner of the figure, region in which the concept "whey" is anchored.

Drawing a vertical axis through the zero point, it is observed that most of the consumers are concentrated on the right side of the axis, region in which the concepts "whey" and "essential amino acids" are anchored, a fact that indicates a higher consumer acceptance for these concepts over the two others.

As for the purchase intent, the concepts that presented better results were "essential amino acids" and "whey", respectively. Regarding the concept "essential amino acids", 79.2% of consumers claimed that they would probably or certainly buy the product, as to the concept "whey" this percentage was 83.2%. This result is proved by the average price that consumers were willing to pay for each product, since the concepts with higher purchase price were also "essential amino acids" R$ 2.00 and "whey" R$ 2.24.

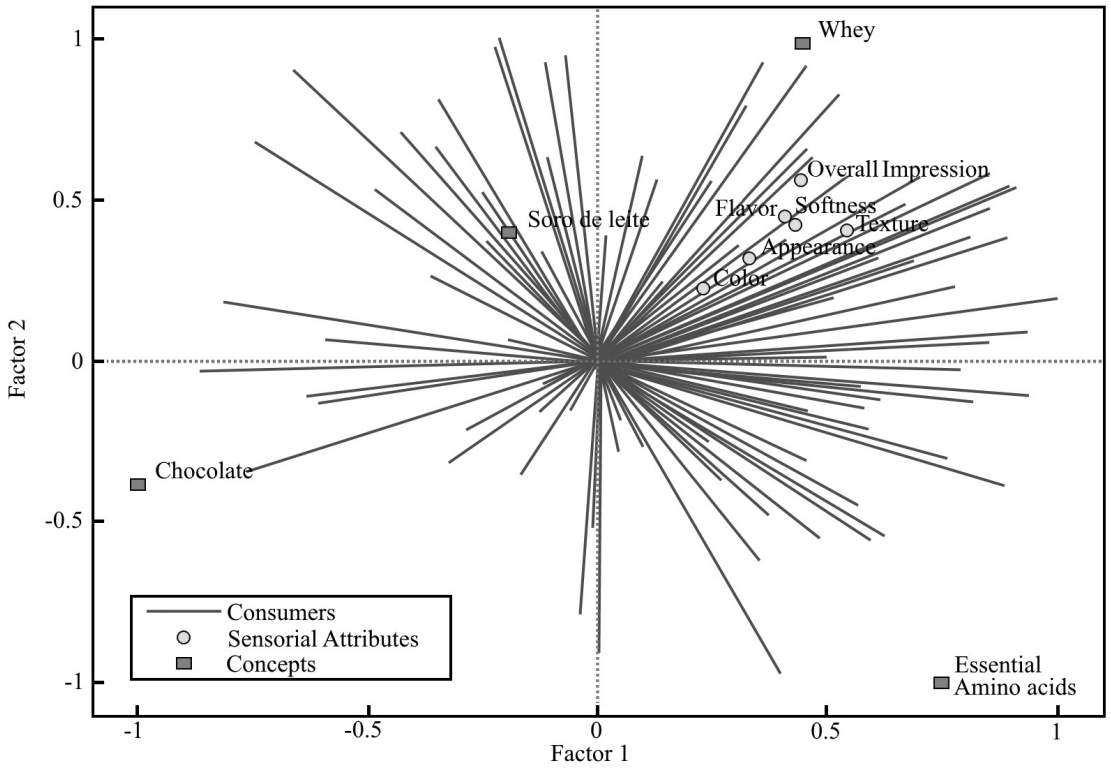

FIGURE 1 – Parallel factor analysis of sensory acceptance attributes for the popsicles concepts
In Figure 1 each vector represents a consumer; the length of each vector represents the consumers acceptance towards the concepts. The squares represent each concept and their respective position according to the consumers´ overall impression. The circles represent the sensorial attributes and their respective position according to the consumers overall impression.
Source: research data

There has been a considerable difference when comparing the average purchase price for the concepts "chocolate" (R$ 1.81) and "whey" (R$ 1.86) in relation to the others. In an industry such as the popsicles industry, which works with scale gains, these price differences are extremely significant for the revenues, so work on the concept and the marketing of the product are crucial factors for profitability.

Among the four concepts presented, it was clear that the concept "chocolate" was not well accepted by consumers, so it was not used in the next stage of research with consumers in the market-place. As for the concept "*soro de leite*", it was noted by the paired T-test that the concept was not statistically different from the concept "essential amino acids". However, analyzing the data in Figure 1, as well as the consumers purchase intent and willingness to pay, it was clear that the concept "essential amino acids" excelled the concept "*soro de leite*". This perception was also detected in the speech of some interviewees when asked if *"soro de leite"* would have a viable commercial appeal:

> "There are still many people with prejudice regarding *soro de leite*. Unfortunately, they don´t know its importance as food. Many believe that *soro de leite* is only for animal feed." – Interviewee 10, Cândido Tostes Institute.

> "*Soro de leite* is sometimes seen as a byproduct from the consumer standpoint" – Interviewee 4, Cândido Tostes Institute.

The concept "whey" is excelled in all stages of the analysis, presenting good sensory acceptance means, good purchase intent and higher purchase price when compared to the others. In this sense, it was decided to take to the final step of this study the popsicle under the concepts, "essential amino acids" and "whey".

4.2 Consumer Research and Market Segmentation

This final stage of the study included 158 participants, of which 52% were men and 48% women. The great majority, 56%, is aged between 19 and 30 years old, followed by 26% aged between 31-50 years old. As for household income, 33% of respondents claimed to have income between 4-8 Brazilian minimum wages, followed by 23% with income between 2-4 minimum wages then 19% with incomes of up to two minimum wages, other 19% with an income between 8-16 minimum wages and a minority of 6% with income greater than 16 minimum wages. It was noticed a high level of education among the respondents, as 44% are enrolled in undergrad school, 12% have completed it and 19% are enrolled in or have completed the graduate school.

4.2.1 Selection of the best concept by the consumer

The basic idea of this step was to define what concept ("essential amino acids" or "whey") presented better sensory acceptance, consumer preference and purchase intent and what are the possible market segments for the insertion of the product. After looking at the packaging prototypes and reading the concepts, it was noticed that 58.6% and 61.3% of the consumers had higher expectations in relation to the concepts "essential amino acids" and "whey", respectively (p-value > 0.05 on the paired T-test).

After tasting samples, it was noted a good sensory acceptance by the consumers for both concepts, since the majority of the consumers really liked or extremely liked the products, not having significant difference by the paired T-test (p-value > 0.05). It was also observed that for both concepts, more than half of consumers, 56.1%, claimed that the products were better than they expected. Most consumers said they would probably buy or would certainly buy the products if they were available in retail stores (77.2% for "essential amino acids" and 80.3% for "whey"), also not statistically different by the paired T-test (p-value > 0.05).

As for the average purchase price, for the "essential amino acids" concept, the value was R$2.01 and for the concept "whey" the value was R$ 2.24. It is worth noticing that despite these price differences, both prices are shown consistent with those practiced by popsicle manufactures in the Brazilian market. However, it is noteworthy that this R$ 0.23 difference is relevant to market and company revenues (p-value < 0.01; means: 2.0078 amino & 2.2224 whey; std. deviation: 0.0689 amino & 0.0802 whey); thereby, conveying the product under the concept "chocolate popsicle made with whey" seems to be more profitable.

This assumption can be corroborated when consumers were asked what was their favorite popsicle out of the two presented, the vast majority, 64%, have chosen the chocolate popsicle made with "whey". Consumers who preferred "whey" to "essential amino acids" claimed that the former is tastier, features a creamier texture, has greater nutritional appeal and health benefits. Thus, it is emphasized here the importance of the concepts and how the information is conveyed to the consumer.

The results support the assumption that there is market appeal for popsicles made with whey. When questioning researchers and experts about the feasibility

of using whey as a raw material in the manufacturing of popsicles, 75% of respondents found it feasible, as follows:

> "Yes, since there are other products which already contain whey in their formulations, there is a promising market to do it with popsicles. However, there is a lack in research, whey standardization and specific technology to do so." – Interviewee 5, Cândido Tostes Institute.

> "Yes, for nutritional issues this replacement is quite interesting, not to mention the series of advantages from the functional and technological standpoint." Interviewee 7, Federal University of Juiz de Fora.

> "Of course! Whey is as good and nutritious as milk." – Interviewee 10, Embrapa Dairy Cattle.

The interviewee 9 was more cautious:

> "Whey has a complex supply chain, mainly involving logistics. It could be a substitute for milk powder using in the formulations the whey powder (...) I do not believe that fluid whey would be a practical alternative." – Interviewee 9, Food Additives Industry.

When asking the same question to popsicles manufacturers, it was noticed that there was a barrier and a certain degree of prejudice with whey as a raw material for popsicles:

> "It is a matter of principle, our company understands that whey is a product that reduces the quality (...) reduces palatability (...) reduces the final price of the popsicle. So we do not use and do not recommend it." – Interviewee 3, Popsicle Industry.

> "Unfortunately the use of whey did not give us good results in the taste of the product, we have tried several times, but without success. Perhaps if there was a whey standardization, but I don´t know how would be this procedure." – Interviewee 2, Popsicle Industry.

It is evident the lack and need of research and improvement of technologies for a better use and standardization of whey as a raw material, tied to the fact that popsicle manufactures need to gain more knowledge about the benefits of using whey; as pointed by some interviewees:

> "Whey is highly profitable, but the executives have not seen it yet (...) the concept and vision about whey should be changed." – Interviewee 11, Food Additives Industry.

> "Few companies use whey for popsicle manufacturing, due to ignorance and/or difficulty in finding quality raw material." - Interviewee 6, Food Additives Industry.

Therefore, it is clear that the call for whey-based popsicles should be focused on the nutritional characteristics and health benefits provided by whey. When the consumers, subjects of the research, were asked to position themselves about the affirmation: "I buy popsicles for pleasure and not for its nutritional properties", 92% claimed that they indeed focus more on pleasure rather than on nutritional properties at the time of purchase.

When asked to position themselves about the affirmation: "Popsicle is a product that is good for health", more than half of respondents, 62%, agreed on some level with the statement. These results show that consumers agree that popsicle does good for health, but neglect the nutritional aspects of the product over pleasure at the time of purchase. Thus, a marketing appeal to popsicle made with whey can be glimpsed here, which can be evidenced by the speech of some interviewees when asked about what would be the best concept for the product:

> "Product that contains proteins with high nutritional value." – Interviewee 4, Cândido Tostes Institute.

> "Nutritious product." – Interviewee 7, Cândido Tostes Institute.

> "Whey!!!" – Interviewee 8, Federal University of Juiz de Fora.

4.2.2 Market segmentation

Based on the data and reports portrayed so far, this section aims at drawing a market segmentation, joining the data from the quantitative stage to the reports of qualitative one.

On the basis of the quantitative questionnaire, a cluster analysis was performed in which two groups were extracted. Of the 158 participants that comprised this analysis, 151 composed the corpus of the analysis, of which 102 (67.5%) were placed in Group 1 and 49 (32.5%) in Group 2. It is worth highlighting that demographically, the groups showed no statistical differences (paired T-test p-value > 0.005). The variables that differed the groups were the ones related to sensory acceptance, purchase intent and market insertion.

In terms of popsicle consumption, it was noticed a similar behavior between the groups, making clear once again the seasonality of popsicles in Brazil, whereas in colder months both groups do not consume popsicles very often and the opposite phenomenon occurs in hotter months.

As for the favorite concept, most consumers in both groups preferred the popsicle made with "whey" (62.7% of group 1 consumers, and 65.3% of consumers group 2) rather than the popsicle made with "essential amino acids";

thus no significant difference between groups was noted (chi-squared $p > 0.05$).

However, when asked if popsicle is good for health, it was noted a significant difference between groups (chi-square $p < 0.001$). For Group 1 respondents, 20.6% strongly agreed and 56.9% partially agreed with the statement. Group 2, on the other hand, was more disperse, being important to emphasize here a significant portion of consumers who partially disagreed of the statement (30.6%). Consumers from Group 1 believe more strongly that popsicles are products that are good for health.

When asked if they buy popsicles for pleasure and not for its nutritional properties, it was observed that, even though both groups agree that buy more for pleasure (chi-square $p = 0.73$), group 1 displayed a lower percentage of consumers who agreed to some extent with the statement (88.2%), while in Group 2, this percentage was 100%. These results corroborate the assertion that Group 1 consumers are more aware of health and nutritional aspects than Group 2 consumers.

It was also identified significant differences between the groups (chi-square $p < 0.001$) with respect to the statement: "Popsicle is a product for children." It was observed that 100% of Group 2 consumers disagreed with the statement on some level (95.9% totally disagreed and 4.1% partially disagreed). Group 1, however, was more dispersed, even with a large percentage (45.1%), also totally disagreeing with the statement. It was identified a considerable number of consumers who were indifferent or agreed in some level with the statement.

It was also noted significant difference between the groups (chi-square $p < 0.001$) regarding the statement "I would buy popsicle more often if they were cheaper." It was observed that the Group 1 tended to agree more with the statement than Group 2.

In relation to the other statements presented in the questionnaire, there was no significant difference between the groups; they both behaved similarly regarding brand importance and packaging when buying popsicles, considering these characteristics as important.

From Table 2, it is noted that Group 1 tends to value more the nutritional aspects and considers popsicles as products with a healthy appeal, besides being more price sensitive. Group 1 presents itself as a group of utilitarian consumers, which in the view of Lucian *et al.* (2009), are rational consumers who consciously consider the consequences of alternative behaviors and choose one the product/service that leads to the most desirable consequences. That is, the objectivity of the criteria is closely related to the functionality of the product, which in turn, is the main value for this type of consumer.

Group 2, however, buys more for pleasure and appears to be willing to pay more for the product. These consumers tend to see beyond utilitarianism, also seeing a social aspect in the purchase. According to Levy (1959), cited by Lucian *et al.* (2009), people buy products not only for what they can do, but also for what they mean. This consumption called by Addis and Holbrook (2001) as hedonic, designates those facets of behavior related to the multisensory aspects of an experience with products wherein the term multisensory means experience in the perception of multiple sensory modalities including tastes, sounds, tactile impressions and visual images.

In this sense, based on the results obtained and endorsed by the theories, it was decided to name the Group 1 "healthy and conscious consumers" and Group 2 of "hedonic consumers", that is, they consume for pleasure.

Considering the product characteristics and the best concept elected by consumers (whey), the group of "healthy and conscious consumers" can be seen as an interesting segment for the product. Such inference can be supported by the speech of some respondents:

TABLE 2 – Key differences found between groups

	Group 1	Group 2
Popsicle is a product that is good for health.	greater emphasis	lesser emphasis
I buy popsicles for pleasure and not for its nutritional properties.	lesser emphasis	greater emphasis
Popsicle is a product for children.	lesser emphasis	greater emphasis
I would buy popsicles more often if they were cheaper.	greater emphasis	lesser emphasis
When buying popsicle I care much about its brand.	equal emphasis	equal emphasis
Packaging is very important when purchasing popsicles	equal emphasis	equal emphasis

Source: research data

> "A good idea would be to direct the marketing of this product for physical activities practitioners and people who care about health." Interviewee 3 – University of Wisconsin.

> "For athletes and sportsmen." Interviewee 4 – Cândido Tostes Institute.

On the other hand, the group of "hedonic consumers" also presents certain market appeal, as highlighted by some interviewees:

> "The segments could be the same of ordinary popsicles, because those who already have a habit of eating popsicles, they look for new product releases that in Brazil are normally on summer (…)." Interviewee 2, Brazilian Association of Cheese Industries.

> "I believe that the segment would be the same as the actual popsicle segments (...), that is, an appeal of low-cost refreshing dessert." Interviewee 7, Federal University of Juiz de Fora.

Other possible segments also appeared in the speeches of the interviewees:

> "Given that whey is cheaper than milk, this product could be used to reduce the popsicle price and boost its consumption by lower social classes." – Interviewee 7, Cândido Tostes Institute.

> "The main market are the children who has not yet developed prejudices." – Interviewee 10, Embrapa Dairy Cattle.

It is observed a broad spectrum of possible segments for the product. However, by a joint analysis of the data, the most viable segment for the product is healthy foods and for physical activities practitioners, since the English term "whey" is well known and appreciated by such group of Brazilian consumers. Thus, release the product in the form of chocolate popsicle made with whey may seem as an appropriate strategy for this market.

5 CONCLUDING REMARKS

It was identified that the concept "whey" was the one that mostly stood out in all steps of the analysis, presenting the highest scores of sensory acceptance and purchase intent and higher purchasing price among the four concepts.

Based on this, a managerial implication can be extracted; in an industry such as popsicles manufacturing, in which profitability lies on economies of scale, knowing how to convey the concept and the marketing of the product reflects directly on price and profitability.

For the final stage of the research with consumers in the market, the concepts chocolate popsicle with "essential amino acids" and chocolate popsicle with "whey" where the ones that stood out. The results showed that both concepts performed higher than consumers expectations, indicating a real possibility of market insertion for the popsicle under the form of these concepts and it has chances to compete for market shares with popsicles made with milk and/or water, a fact corroborated by the speech of the interviewed whey experts.

However, in the speech of popsicles manufacturers, it was observed preconceptions regarding whey as a raw material, which leads to the conclusion that there is a need of greater knowledge on the part of the manufacturers about the benefits of using whey.

It can also be concluded that the market appeal for whey-based popsicles should be focused on its nutritional characteristics and health benefits, which are aspects that have been neglected by consumers.

As for market segmentation, two groups were extracted by the cluster analysis: Group 1 named "healthy and conscious consumers" and Group 2 "hedonic consumers". It was concluded that the Group 1 values more the nutritional aspects and considers popsicles as products with a healthy appeal, and these consumers are also more sensitive to price. Group 2, on the other hand, purchases more for pleasure and is willing to pay more for the product, which could be explained by the higher income and higher education when compared to the first group.

Taking into account the best concept, "whey", and seeking to identify the best segment for the insertion of the product, it was concluded that the group of "healthy and conscious consumers" appears as an interesting segment to be pursued. A managerial implication derived from this conclusion is that the Brazilian popsicle industry can convey the product under the concept "whey" aiming to explore the segment of "healthy and conscious consumers" and seek potential customers such as fitness enthusiasts, elite athletes, regular gym members, among others.

The segment of "hedonic consumers" also has marketing appeal, as some interviewees pointed out. Thus, as managerial implication, the popsicles manufactures can create marketing campaigns for the general public elucidating the nutritional benefits of the product and without raising its price.

Other managerial implications drawn from the study relate to public policies, in the sense that social programs can be created aiming at: 1) using whey as

food, as partial and/or complete replacement to milk; 2) reducing production costs, 3) increasing milk supply, which is likely to be used for other purposes and 4) reducing environmental impacts caused by improper disposal of whey.

The academic implications of this study are related to the relevance of interdisciplinarity. By linking fields of knowledge (in this case, administration and science and food technology) one can reach most accurate and complete results about the subject matter, creating subsidies so that both areas can develop projects and new theoretical foundations.

Regarding the research limitations, the non-probabilistic sampling cannot be generalized to the population. Another limitation was the difficulty of accessing popsicles manufacturers, which hampered the gathering of information for the qualitative stage.

For future studies, it is suggested further deepening on the apparent paradoxes "taste versus health" and "income level versus health appeal" found on the group segmentation. Moreover, further studies that uses probabilistic samples, different concepts for the product, replication of the research in other locations and countries with different audiences, different languages and idiomatic expressions that might be related to whey can also be conducted to better understand the vision of popsicles manufactures and people linked to the whey production chain.

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