Original Article
Food Science and Technology

ISSN 0101-2061 (Print)
ISSN 1678-457X (Online)

DOI: https://doi.org/10.1590/fst.106622

Consumer acceptability of infant food with oregano essencial oil by children diagnosed with cerebral palsy

Emília Maria Barbosa Carvalho KEMPINSKI[1], Ana Carolina Pelaes VITAL[1], Laura Adriane Moraes PINTO[1], Melina Aparecida Plastina CARDOSO[1]*, Ana Kechuana GUERRERO[2], Tatiane Rogelio RAMOS[3], Maribel Velandia VALERO[3], Ivanor Nunes do PRADO[3]

Abstract

Essential oils (EOs) are natural compounds extracted from plants that exhibit antimicrobial and antioxidant properties. and therefore attract interest as additives in the food industry. especially food for special populations. In the case of children diagnosed with Cerebral Palsy. another factor has to be considered. such as the consistency of food. This study evaluated consumer acceptability of infant food with oregano essential oil by children diagnosed with cerebral palsy and a questionnaire was applied to assess consumption habits and profile of the studied population. Samples were evaluated according to odor. flavor. color. and texture acceptability. Consumers were divided by days. with 35 children each day per sample (CONT without essential oil and EO with different concentration of oregano essential oil). Total number of children was 103. In relation to acceptability of color. odor and flavor of the CONT and EO-0.01% received higher grades. the infant food with 0.05% oregano essential oil showed lower scores compared with the other treatments. However. in relation to acceptability. all samples received satisfactory scores. In relation to texture. differences were not observed. The use of oregano essential oil could be an alternative for the development of an infant food.

Keywords: cluster analysis; infant food acceptability; natural additives; principal components analysis; special population.

Practical Application: Oregano oils are natural compounds that exhibit antimicrobial and antioxidant properties. and therefore can used as additives in the food industry. especially food for special populations.

1 Introduction

Nowadays. about 30% of humanity suffers from one or more of the multiple forms of malnutrition (Rytter et al., 2014). Malnutrition is a relevant factor for small children. particularly after weaning (Bressani, 1981; Rytter et al., 2014). The tragic consequences of malnutrition include death. disability. stunted mental and physical growth. Around 60% of the 10.9 million deaths each year among children aged under five years in the developing world are associated with malnutrition (World Health Organization, 2002). According to the ANVISA resolution – RDC nº 269 ANVISA (Brasil, 2005). the recommended daily intake (RDI) of protein for children and infants is about 34 g/day, which is not usually achieved in special populations.

Selective eating (also known as picky or fussy eating) in children can be defined as the consumption of "[...] an inadequate variety of foods [...]" (Galloway et al., 2005, p. 541). Children with higher levels of tactile and taste/smell sensitivity have been shown to eat less fruits and vegetables and to be more reluctant to eat new foods (Coulthard & Blissett. 2009). Children who are more sensory sensitive have lower thresholds for detecting sensory information and are better able to detect subtle changes in the sensory properties of foods. Coulthard & Blissett (2009) propose that these children are more likely to reject new foods. These factors worsen when associated with specific childhood pathologies, such as Cerebral Palsy (CP), which is a disorder of posture and movement resulting from non-progressive encephalopathy in the pre, peri or postnatal periods, with a single or multiple location in the immature brain The infant food contains the meat bovine (*Longissimus dorsi*), flat potato (*Solanum tuberosum*). Garlic (*Allium sativum*). hot water. NaCl, butylated hydroxytoluene, urucum (*Bixa orellana*) and oregano oil essential (Calis et al., 2008; Howle, 1999). According to Mancini et al. (2004). the functional performance of children with CP is influenced by the social environment (caregiver), which can interfere with routine use and, consequently, improve the abilities presented by these children.

For dysphagic patients whose dietary and energy requirements (protein) with adapted texture are not achieved. oral supplementation is necessary to overcome this nutritional deficiency. For patients with dysphagia, it is important that the texture of these products can be modified, in order for swallowing to become safe (Fernández et al., 2015).

Such motor disorders can lead to changes in movement and posture; thus, interfering in the development of orofacial organs and providing inadequate performance of speech, eating,

Received 28 Sept., 2022
Accepted 30 Nov., 2022
[1]*Programa de Pós-graduação em Ciências de Alimentos, Universidade Estadual de Maringá – UEM, Maringá, PR, Brasil*
[2]*Departamento de Producción y Sanidad Animal, Salud Pública Veterinaria y Ciencia y Tecnología de los Alimentos, Universidad Cardenal Herrera, Valencia, España*
[3]*Programa de Pós-graduação em Zootecnia, Universidade Estadual de Maringá – UEM, Maringá, PR, Brasil*
*Corresponding author: melina_cardoso@msn.com

swallowing, and leading to articular alterations, and respiratory changes (Dias et al., 2015; Mancini et al., 2004).

Consumer preferences or needs should be considered when a new product is proposed. since preferences may vary between individuals. groups. cultures. segments, and interests (Guerrero et al., 2018; Passetti et al., 2017; Vital et al., 2016, 2018a, b).

The practical investigation focused on the development of a food with a predominantly pasty texture meets the extreme need of children diagnosed with Cerebral Palsy and dysphagic disorders. Inserting this supplement in a daily diet may significantly increasing protein ingestion. particularly of bovine meat, which is not possible in its natural form due to chronic and non-transient dysphagic processes (Dias et al., 2015; Mancini et al., 2004).

Regarding to quality and food safety of meat products. there is a need to produce foods with less synthetic additives (harmful to health), but which still have their characteristics preserved and extensive shelf life (Taghvaei & Jafari, 2015).

The use of aromatic plants, with essential oils and flavoring. besides the antibacterial and antioxidant action, can be an important alternative for food preservation and flavor. reducing the concentration of synthetic additives in these products (Guerrero et al., 2018; Monteschio et al., 2017; Rivaroli et al., 2016; Sary et al., 2021a; Vital et al., 2018a, b).

The inclusion of EOs in infant food showed to be effective in maintaining the product quality during storage, showing better results than the synthetic antioxidant in some analyzes (Kempinski et al., 2017; Monteschio et al., 2017; Rivaroli et al., 2016; Vital et al., 2018b).

In this context, this study was realized to verify the consumer acceptability of a pasty infant food with oregano essential oil by children diagnosed with cerebral palsy.

2 Materials and methods

2.1 Meat for infant food formulation

The meat was obtained from eight crossbred young bulls (½ Angus x ½ Nellore). originating from a single father. finished in a feedlot for 62 days and slaughtered at 18-months. Average live weight was 482 ± 27.87 kg as described by Rivaroli et al. (2016). After slaughter, the carcasses were chilled at 4 °C for 24 h. Then, the *Longissimus dorsi* (LD) was excised from the left half of the carcass from the seventh to the last lumbar vertebrae. The LD was transported to the laboratory, vacuum-packaged and frozen intact at -18 °C, until analysis (less than 1 month of storage).

2.2 Preparation of the treatments

The infant food was prepared by pressure cooking the LD (262 g) in medium cubes with 200 mL of water for 15 min. Then, the meat was processed (NMP08e500 W Mondial processor) for 2 min. The ingredients (Table 1) were placed in a pan and cooked for 5 min, to form a homogeneous mass. The infant food contains the meat bovine (Longissimus dorsi), flat potato (Solanum tuberosum), Garlic (Allium sativum), hot water, NaCl, butylated hydroxytoluene, urucum (Bixa orellana) and oregano oil essential. The treatments were defined as follows: addition of 0.01% oregano EO (EO-0.01%), 0.05% oregano EO (EO-0.05%) and without addition of an antioxidant (CONT). Each sample. with or without the respective antioxidants. was individually packed in 30 g glasses with metal lids (pre-autoclaved at 121 °C for 15 min; PHOENIX vertical 75l). After packing, the samples were pasteurized in a water bath (60 °C) for 30 min and stored at 4 °C. CONT, EO-0.01% and EO-0.05% samples were served to the children one day after production.

Table 1. Characteristics of the consumers involved on the test (n = 103).

Age. years	%
1 – 4	38.8
5 – 8	30.1
9 – 12	21.4
13 – 16	9.7
Gender	
Male	56.3
Female	43.7
Frequency of consumption	
Beef	
Never	15.5
1 time/month	3.9
2 times/month	7.8
1 time/ week	17.5
2 - 4 times/week	40.8
More than 5 times/week	14.6
Pork	
Never	44.7
1 time/month	12.6
2 times/month	15.5
1 time/week	22.3
2 - 4 times/week	3.9
More than 5 times/week	1.0
Poultry	
Never	6.8
1 time/month	7.8
2 times/month	13.6
1 time/week	36.9
2 - 4 times/week	28.2
More than 5 times/week	6.8
Food consumption method	
Whole piece	35.0
Crushed	41.7
Whipped / pasty	23.3
Liquid	-
Preferred food type	
Sweet	28.2
Savory	71.8
Nutritional deficit	
Yes	23.3
No	36.9
Perhaps	24.3
Did not know how to respond	15.5

2.3 Microbiological analysis

The microbiological analyzes were made in order to guarantee the microbiological quality of the samples. It was determined Coliforms at 35 °C (NMP/g). Coliforms at 45 °C (NMP/g), *Bacillus cereus* (UFC/g), *Staphylococcus* coagulase positive, *Clostridium sulfite* reductant (UFC/g) and *Salmonella spp* (U.S. Food and Drug Administration, 1992). All treatments presented less than < 0.3 NMP/g total coliforms at 35 °C and 45 °C. *Staphylococcus* coagulase positive and *Salmonella spp* were not detected. *Bacillus cereus* was < 1 x 10^2 and *Clostridium sulfite* reductant < 10 UFC/g. Thus, all results were in accordance with what has been established by Brazilian legislation, certifying that the samples were adequate for human consumption (Veiros et al., 2006).

2.4 Consumer test design

The consumer test was performed at the Albert Sabin Special Education School – Northern Parana Rehabilitation Association (ANPR) – Maringá. Paraná, Brazil. Consumers were selected by age (1 to 4 years, 5 to 8 years. 9 to 12 years, and 13 to 16 years). The socio-economic data, the level of education and family income were also collected (Table 1).

Consumers were divided by days. with 35 children each day per sample (CONT. EO-0.01% and EO-0.05%). Total numbers of children were 105. Each day. the children evaluated a sample identified with a code in the form of circles. corresponding to the different treatments (Figure 1). The analysis took place in a period of 3 subsequent days. totaling 309 samples tested at the end of the days. To avoid order and transfer effects. the samples were served in a randomized design (Macfie et al., 1989). On the first day. children 1-35 (Group A) received the CONT treatment, 35-70 (Group B) received the EO-0.01% treatment and 70-105 (Group C) received the EO-0.05% treatment. On the second day, group C received the CONT treatment, group B received the EO-0.05% treatment and group A received the EO-0.01% treatment. On the third day. group B received the CONT treatment, group A received the EO-0.05% treatment, and group C received the EO-0.01% treatment. The statistical data totaled 103 children because there were two children missing on one of the experimentation days and both were disqualified.

2.5 Questionnaire

Participants were requested to taste the sample and evaluate the acceptability of the four studied attributes (color. odor. tenderness. and flavor) for each. with a 5-point scale ranging from 1 (dislike extremely) to 5 (like extremely). according to Laureati et al. (2015). Before consumer testing, a supplementary questionnaire was applied to the family in order to gather more information about consumption habits (Table 2).

2.6 Statistical analysis

Acceptability of the sensory attributes was assessed via analysis of variance using the general linear model (GLM) procedures with SPSS (v.23.0) for Windows. Treatments were considered a fixed effect and the consumer a random effect in the sensorial test.

Differences between means were evaluated using Tukey's test ($P \leq 0.05$). Hierarchical cluster analysis with Ward's method was used to determine the different segments of consumers. according to the overall acceptability using XLSTAT (v.19.4). The number of clusters was selected by a dendrogram. Principal Components Analysis (PCA) was used to verify the relationships between treatments and the attributes' acceptability and presented in a graphic. Correlations between attributes were evaluated using Pearson´s correlation coefficient. Mean and standard error of mean (SEM) were calculated for each variable.

Table 2. Socio-demographic characteristics of the families of the consumers involved in the test and information about their knowledge on essential oils and the use of spices (n = 103).

Family income: minimum wage (MW*)	%
Less than 1 MW	17.5
Up to 2 MW	47.6
2 to 6 MW	26.2
6 to 10 MW	6.8
More than 10 MW	1.9
Level of education	
Primary School incomplete	24.3
Primary School complete	10.7
Secondary School incomplete	13.6
Secondary School complete	25.2
High School incomplete	11.7
High School complete	14.6
Knows what essential oils are	
Yes	34.0
No	66.0
Uses oregano	
Yes	49.5
No	50.5
Uses other spices	
Yes	52.4
No	47.6

*MW: minimum wage (2017): 936 Brazilian Real = 292.5 US$.

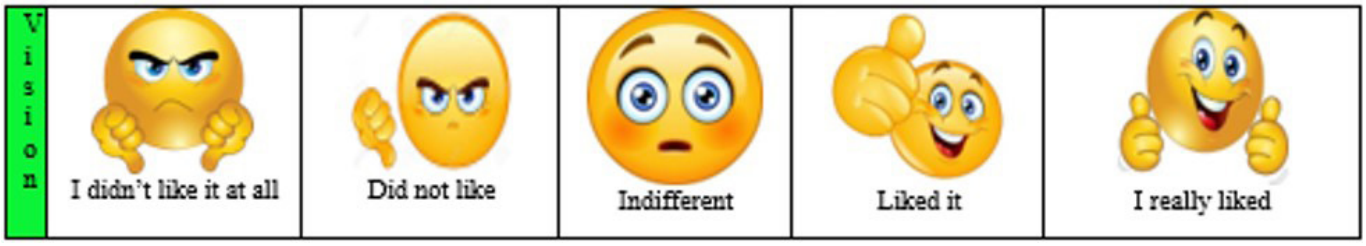

Figure 1. Children's vision after eating infant food.

3 Results and discussion

3.1 Socio-demographic characteristics. consumption and purchasing habits of children and their families

The applied questionnaires increased the information in relation to the consumers' habits. in order to understand what this population are accustomed to consume. The socio-economic characteristics of the children's families are presented in Table 1 and information about the children (consumers) is shown on Table 2. Consumers were composed of 56.3% male, and 43.7% female. with the majority of consumers being younger than 8 years of age (68.9%). In a study from Australia, of 90 children with CP, approximate values for this population were identified as 37.8% female and 62.2% male (Akhter et al., 2017).

A lot of family members (parent or guardian) had secondary school incomplete (48.6%) and fewer had completed high school. Families with household income at up to 2 minimum incomes (935 Brazilian Real or 290 U$) was 65.1%. In a survey conducted by Kranz et al. (2008) increasing family income was predictive of better diet quality scores in the total population. This finding indicates a threshold level in the relationship between family income and dietary intake. Family purchasing power has been found to predict the purchases of foods with high nutritional quality.

Consumption habits of children are presented in Table 2. Main beef consumption was two to four times a week. and one time a week (40.8 and 17.5%, respectively). A portion of 15.5% never eat beef, mainly associated with the difficulty of swallowing food due to the condition of dysphagia associated with Cerebral Palsy. In comparison. pork was never consumed by 44.7% of the children and chicken was consumed once a week. Answers related to beef consumption habits were not unexpected; 44.7% of the children eat once a week or do not eat and. those who do, consume it in a pasty or kneaded form (76.7%).

As the task of feeding these patients is time-consuming. laborious. and risks tracheal suction. the quantity of food supplied may be insufficient to meet individual demands (Marchand & Motil, 2006). These factors contribute to many children with cerebral palsy presenting impairments in their nutritional status (Caselli et al., 2017). The low rate of meat consumption may be due to the difficulty in processing this product to the ideal texture in order to produce a food that is compatible with the difficulty of swallowing for this population and is safe. minimizing the risk of aspiration for the dysphagic child. The children's preference for salty food (71.8%) may positively influence the acceptability of this product.

When a new product is developed, it is expected to have good acceptability. with basic or enriched nutrients, with flavor. aroma and texture compatible with the product. and with adequate packaging. maintaining its sensorial characteristics and shelf life during storage (Cardoso et al., 2022; Sary et al., 2021b). In relation to this special population (children with cerebral palsy and dysphagia). the development of a product to supplement their diet should meet their needs for the intake of meat or protein in general (20% of the food consumed per day) (World Health Organization, 2003).

Almost half of the children's families (66.0%) do not know what an essential oil is. and do not use oregano (50.5%). However. they have the custom of using spices in the preparation of food (52.4%). According to Table 2, oregano consumption is not a habit of the children participating in this study, and this factor may have influenced the lower acceptability for EO-0.05% when compared to EO-0.01% (Table 3).

Food choice is related with different factors which involve cultural. social. economic. and individual aspects (Vabø & Hansen. 2014). Moreover, the use of natural compounds (herbs or their derivatives) as natural additives is well accepted by consumers and. in the case of children. by parents, who considered these products safe and familiar, and had already showed a positive use as replacements for synthetic additives (Haugaard et al., 2014; Hung et al., 2016).

3.2 Consumer acceptability

In relation to acceptability. the treatment had a significant effect on consumer sensory scores for color ($P < 0.011$), odor ($P < 0.001$). and flavor ($P < 0.010$) (Table 4). No difference ($P > 0.05$) in tenderness was observed. In relation to color,

Table 3. Consumer (n = 103) acceptability of infant food with and without oregano essential oil.

Treatments	Sensory experience			
	Color	Odor	Flavor	Texture
CONT	3.93[a]	3.99[a]	3.80[a]	3.76
EO-0.01%	3.80[a]	3.78[a]	3.77[a]	3.75
EO-0.05%	3.55[b]	3.33[b]	3.33[b]	3.42
SEM	0.052	0.060	0.070	0.065
P < Value	0.011	0.001	0.010	0.055

Scale: of 1 to 5. Means followed by different lowercase letter in the same column are different ($P < 0.05$).

Table 4. Acceptability scores of infant foods with essential oil among three consumer groups that were identified by cluster analysis (n = 103).

Sensory acceptability	n	%	Treatments			SEM	P value
			CONT	EO-0.01	EO-0.05		
Color acceptability							
Cluster 1	55		4.39[ab]	4.47[a]	4.16[b]	0.04	0.008
Cluster 2	24		4.45[a]	3.12[b]	2.70[c]	0.11	<0.00
Cluster 3	24		2.54[b]	2.95[ab]	3.00[a]	0.08	0.030
Odor acceptability							
Cluster 1	50		4.50[a]	4.50[a]	4.12[b]	0.04	<0.001
Cluster 2	29		4.37[a]	3.20[b]	2.27[c]	0.12	<0.001
Cluster 3	24		2.45[b]	3.00[a]	3.00[a]	0.10	0.045
Flavor acceptability							
Cluster 1	63		4.58[a]	4.60[a]	4.01[b]	0.05	<0.001
Cluster 2	26		2.88[a]	1.88[b]	1.73[b]	0.10	<0.001
Cluster 3	14		2.00[b]	3.57[a]	3.28[a]	0.14	<0.001

Means followed by different lowercase letter in the same column are different ($P < 0.05$).

odor and flavor, the CONT and EO-0.01% received the higher grades (Table 4). The administration of the samples was carried out by previously trained caregivers, due to their greater affinity with the children involved in the research. In this way, we do not generate the denial from the presence of a stranger in the act of feeding. Clinicians may choose to ask the caregivers of young children to report the children's usual diet rather than the previous day's intake alone (Kranz et al., 2008).

As mentioned. most of children are not familiarized with the taste of oregano. and even less with the essential oil that has more accentuated characteristics, which may explain the children's preference for samples with less oregano and without oregano.

In relation to color, the difference could be associated with the odor since, in the Pearson correlation. the correlation between these two parameters were 1 (highly correlated).

Studies of taste thresholds present a confusing picture. with some studies suggesting that children as young as 5 ± 7 years of age have similar detection thresholds to adults. and others finding that children of this age have poorer sensitivity than adults (Arvedson. 2013; Benfer et al., 2014; Guinard, 2000).

Children tended to recognize only one of the components, while adults recognized both. These differences could be due to differences in taste perception, in cognitive ability (e.g. ability to separately process two sensations), or in response strategy (e.g. children may have focused on the more intense or more appealing taste quality) (Oram et al., 2001).

In the research in question. the children noticed differences between the treatments with varied intensities of oregano essential oil. with better preference and acceptability for the lower percentage of 0.01% OEO, to the detriment of the 0.05% OEO.

3.3 Cluster analysis

The preferences of a food attribute might not be homogenous among a group (clusters). Thus. it is important to verify these differences in order to identify different market niches. In Table 4. acceptability scores from three clusters of consumers for the infant food are described in terms of color, odor, and flavor.

3.4 Color acceptability

In terms of infant food color. there were three groups of consumers (Table 4). Cluster 1 was characterized by accepting the color of all samples. especially CONT and EO-0.01%. which performed better ($P < 0.008$) than EO-0.05%. This cluster represents the majority of consumers (53.4%). This sample was composed of 50.9% male and 49.1% female. all younger than 4 years.

The second cluster represented the 23.3% of consumers who preferred ($P \leq 0.001$) the color of CONT in relation to the other treatments. EO-0.05% was rejected, and EO-0.01% had intermediate acceptability. The percentage of males was 70.8% and of females was 29.2%; 70.8% were younger than 8 years. For the third group, despite the color characteristics, 23.3% of consumers rejected CONT, and EO-0.05% presented higher grades. Males represent 54.2% of this group and female represent 45.8%, with 75.0% of them being younger than 8 years.

3.5 Odor acceptability

In terms of odor. there were three groups of consumers (Table 4). Cluster 1, the largest, was characterized by accepting the odor of all samples, especially CONT and EO-0.01%, which differs ($P < 0.001$) from EO-0.05% statistically. Most of the consumers of this cluster were male (60%), and the majority were aged between 5-8 years.

The second cluster with 28.15% of consumers preferred ($P \leq 0.001$) the odor of CONT (without oregano essential oil) and rejected the odor of EO-0.005%. The percentage of male and female was similar on this group (55.2 *vs.* 44.8%, respectively); 55.2% were younger than 4 years of age.

In relation to the third group (23.3%), CONT odor was rejected (2.45 on a 5-point scale) and was different ($P < 0.045$) from the groups with oregano. Males and females of this cluster were in the similar proportion, 50.0%, with 41.7% of them being younger than 4 years, 33.3% between 5 and 8 years, 25.0% above 9 years of age.

3.6 Flavor acceptability

All clusters of consumers reported differences ($P < 0.001$) in flavor acceptability between foods (Table 4). Cluster 1 (61.16%) gave the best scores to treatments CONT and EO-0.01%. However, all treatments received grades above 4. This cluster contained 60.3% males. and 36.5% were older than 9 years of age. Cluster 2 (25.24%) rejected the flavor of all samples. presenting scores lower than 3 points. This segment consisted of 38.5% male and 61.5% female; 50% were older than 4 years of age. Cluster 3, which comprised 13.6% of the consumers, was characterized by rejection of the CONT, and acceptance of the infant food with essential oil, independent of its concentration. In this cluster, the majority was male (71.4%) and 42.9% of them were aged between 5 and 8.

3.7 Principal component analysis

Information about the infant food, the use of oregano essential oil and preferences by consumers is put in a graph in Figure 1. The two main component axes explained 100% of the total variance. The attributes of color. odor. flavor. and tenderness are situated on the right-hand side of F1, as well CONT and EO-0.01%. The EO-0.05% is on the other side (left of F1), inversely related to the attributes evaluated. Texture and flavor are situated in the same quadrant as EO-0.01%, which demonstrates an association between these factors (Figure 2). The association can be observed between odor, color, and CONT. The two factors of great relevance for dysphagic children (texture and flavor) are correlated with EO-0.01%, suggesting that the inclusion of natural additives in infant feeding may lead to good acceptability for this kind of food, and also that natural additive can be used to replace synthetic ones, as observed in a previous study (Kempinski et al., 2017).

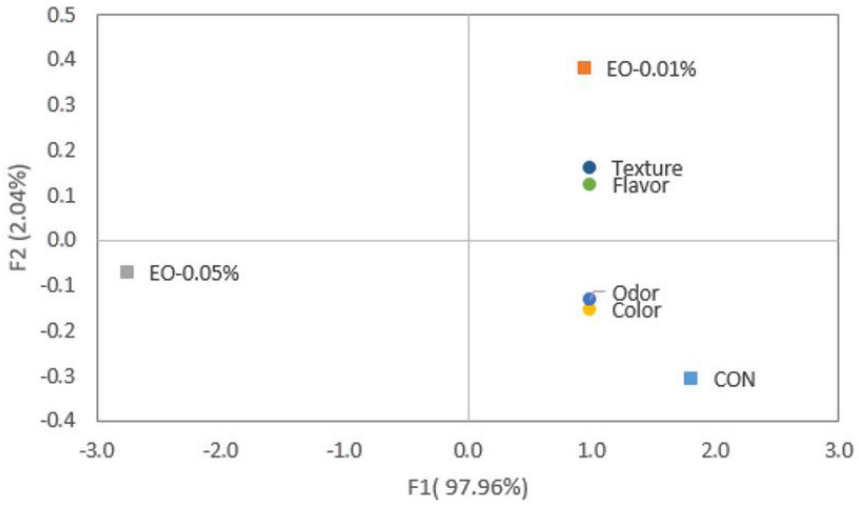

Figure 2. Main component analysis of the scores for odor. flavor. texture. and color acceptability of infant food with and without oregano essential oil. CONT: Control without oregano essential oil; EO-0.01%: infant food with 0.01% oregano essential oil; EO-0.05%: infant food with 0.05% oregano essential oil.

4 Conclusion

The development of a new food product with oregano essential oil (natural additive) that brings nutritional benefits to children demonstrated to be feasible due to its good acceptability. The EO-0.01% treatment demonstrates an association between texture and flavor. the most relevant attributes for children with cerebral palsy, and did not present differences between the control (without oregano essential oil) in relation to the sensory attributes. The infant food with 0.05% oregano essential oil showed lower scores compared with the other treatments. However, in relation to acceptability, all samples received satisfactory scores (above 3). In this way, the use of oregano essential oil could be an alternative food additive, not only due to its antioxidant power but also its good acceptability.

Acknowledgements

We thank the Coordination for the Improvement of High Education Personnel (CAPES) Foundation for their scholarship and financial support.

References

Akhter, R., Hassan, N. M. M., Martin, E. F., Muhit, M., Haque, M. R., Smithers-Sheedy, H., Jones, C., Badawi, N., & Khandaker, G. (2017). Risk factors for dental caries among children with cerebral palsy in a low-resource setting. *Developmental Medicine and Child Neurology*, 59(5), 538-543. http://dx.doi.org/10.1111/dmcn.13359. PMid:27935024.

Arvedson, J. C. (2013). Feeding children with cerebral palsy and swallowing difficulties. *European Journal of Clinical Nutrition*, 67(Suppl 2), S9-S12. http://dx.doi.org/10.1038/ejcn.2013.224. PMid:24301008.

Benfer, K. A., Weir, K. A., Bell, K. L., Ware, R. S., Davies, P. S. W., & Boyd, R. N. (2014). Oropharyngeal dysphagia in preschool children with cerebral palsy: oral phase impairments. *Research in Developmental Disabilities*, 35(12), 3469-3481. http://dx.doi.org/10.1016/j.ridd.2014.08.029. PMid:25213472.

Brasil, Agência Nacional de Vigilância Sanitária – ANVISA. (2005). Regulamento técnico sobre a ingestão diária recomendada (IDR) de proteína, vitaminas e minerais (Resolução-RDC nº 269, de 22 de Setembro de 2005). *Diário Oficial [da] República Federativa do Brasil*.

Bressani, R. (1981). The role of soybeans in food systems. *Journal of the American Oil Chemists' Society*, 58(3), 392-400. http://dx.doi.org/10.1007/BF02582388.

Calis, E. A. C., Veugelers, R., Sheppard, J. J., Tibboel, D., Evenhuis, H. M., & Penning, C. (2008). Dysphagia in children with severe generalized cerebral palsy and intellectual disability. *Developmental Medicine and Child Neurology*, 50(8), 625-630. http://dx.doi.org/10.1111/j.1469-8749.2008.03047.x. PMid:18754902.

Cardoso, M. A. P., Oliveira, C. F., Coppo, R. L., Yamato, M. A. C., Pedro, A. C., Oliveira, P. M., Carvalho, V. M., & Prado, I. N. (2022). Computer vision as the golden tool: mathematical models for evaluating color and storage time of hamburgers with goji berry natural additive. *Food Science and Technology (Campinas)*, 42, e35822. http://dx.doi.org/10.1590/fst.35822.

Caselli, T. B., Lomazi, E. A., Montenegro, M. A. S., & Bellomo-Brandão, M. A. (2017). Assessment of nutritional status of children and adolescents with spastic quadriplegic cerebral palsy. *Arquivos de Gastroenterologia*, 54(3), 201-205. http://dx.doi.org/10.1590/s0004-2803.201700000-32. PMid:28723982.

Coulthard, H., & Blissett, J. (2009). Fruit and vegetable consumption in children and their mothers. Moderating effects of child sensory sensitivity. *Appetite*, 52(2), 410-415. http://dx.doi.org/10.1016/j.appet.2008.11.015. PMid:19110019.

Dias, C. P., Goulart, N. B. A., Freire, B., Becker, J., & Vaz, M. A. (2015). Paralisia cerebral em pediatria. *Pediatricia Moderna*, 51(6), 224-229.

Fernández, A. C., Maza, B. P., Casariego, A. V., Taibo, R. V., Fondo, A. U., Rodríguez, I. C., & Pomar, M. D. B. (2015). Características técnicas de los productos alimentarios específicos para el paciente con disfagia. *Nutrición Hospitalaria*, 32(4), 1401-1407.

Galloway, A. T., Fiorito, L., Lee, Y., & Birch, L. L. (2005). Parental pressure, dietary patterns, and weight status among girls who are "picky eaters". *Journal of the American Dietetic Association*, 105(4), 541-548. http://dx.doi.org/10.1016/j.jada.2005.01.029. PMid:15800554.

Guerrero, A., Rivaroli, D. C., Sañudo, C., Campo, M. M., Valero, M. V., Jorge, A. M., & Prado, I. N. (2018). Consumer acceptability of beef from two sexes supplemented with essential oil mix. *Animal Production Science*, 58(9), 1700-1707. http://dx.doi.org/10.1071/AN15306.

Guinard, J.-X. (2000). Sensory and consumer testing with children. *Trends in Food Science & Technology*, 11(8), 273-283. http://dx.doi.org/10.1016/S0924-2244(01)00015-2.

Haugaard, P., Hansen, F., Jensen, M., & Grunert, K. G. (2014). Consumer attitudes toward new technique for preserving organic meat using herbs and berries. *Meat Science*, 96(1), 126-135. http://dx.doi.org/10.1016/j.meatsci.2013.06.010. PMid:23896146.

Howle, J. M. W. (1999). Cerebral palsy. In S. M. Campbell (Ed.), *Decision making in pediatric neurologic physical therapy* (pp. 23-83). London: Churchill Livingstone.

Hung, Y., de Kok, T. M., & Verbeke, WW. (2016). Consumer attitude and purchase intention towards processed meat products with natural compounds and a reduced level of nitrite. *Meat Science*, 121, 119-126. http://dx.doi.org/10.1016/j.meatsci.2016.06.002. PMid:27310600.

Kempinski, E. M. B. C., Vital, A. C. P., Monteschio, J. O., Alexandre, S., Nascimento, K. F., Madrona, G. S., Mikcha, J. M. G., & Prado, I. N. (2017). Development and quality evaluation of infant food with oregano essential oil for children diagnosed with cerebral palsy. *Lebensmittel-Wissenschaft + Technologie*, 84, 579-585. http://dx.doi.org/10.1016/j.lwt.2017.06.016.

Kranz, S., Findeis, J. L., & Shrestha, S. S. (2008). Use of the revised children's diet quality index to assess preschooler's diet quality, its sociodemographic predictors, and its association with body weight status. *Jornal de Pediatria*, 84(1), 26-34. http://dx.doi.org/10.2223/JPED.1745. PMid:18264615.

Laureati, M., Bergamaschi, V., & Pagliarini, E. (2015). Assessing childhood food neophobia: Validation of a scale in Italian primary school children. *Food Quality and Preference*, 40, 8-15. http://dx.doi.org/10.1016/j.foodqual.2014.08.003.

Macfie, H. J., Bratchell, N., Greehoff, K., & Vallis, L. V. (1989). Designs to balance the effect of order of presentation and first order carry over effect in hall tests. *Journal of Sensory Studies*, 4(2), 129-148. http://dx.doi.org/10.1111/j.1745-459X.1989.tb00463.x.

Mancini, M. C., Alves, A. C. M., Schaper, C., Figueiredo, E. M., Sampaio, R. F., Coelho, Z. A. C., & Tirado, M. G. A. (2004). Gravidade da paralisia cerebral e desempenho funcional. *Brazilian Journal of Physical Therapy*, 8(3), 253-260.

Marchand, V., & Motil, K. J., NASPGHAN Committee on Nutrition. (2006). Nutrition support for neurologically impaired children: a clinical report of the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition. *Journal of Pediatric Gastroenterology and Nutrition*, 43(1), 123-135. http://dx.doi.org/10.1097/01.mpg.0000228124.93841.ea. PMid:16819391.

Monteschio, J. O., Souza, K. A., Vital, A. A. C. P., Guerrero, A., Valero, M. V., Kempinski, E. M. B. C., Barcelos, V. C., Nascimento, K. F., & Prado, I. N. (2017). Clove and rosemary essential oils and encapsuled active principles (eugenol, thymol and vanillin blend) on meat quality of feedlot-finished heifers. *Meat Science*, 130, 50-57. http://dx.doi.org/10.1016/j.meatsci.2017.04.002. PMid:28431295.

Oram, N., Laing, D. G., Freeman, M. H., & Hutchinson, I. (2001). Analysis of taste mixtures by adults and children. *Developmental Psychobiology*, 38(1), 67-77. http://dx.doi.org/10.1002/1098-2302(2001)38:1<67::AID-DEV6>3.0.CO;2-D. PMid:11150062.

Passetti, R. A. C., Torrecilhas, J. A., Ornaghi, M. G., Mottin, C., de Oliveira, C. A. L., Guerrero, A., Del Mar Campo, M., Sañudo, C., & do Prado, I. N. (2017). Validation of photographs usage to evaluate meat visual acceptability of young bulls finished in feedlot fed with or without essential oils. *Meat Science*, 123, 105-111. http://dx.doi.org/10.1016/j.meatsci.2016.09.009. PMid:27685164.

Rivaroli, D. C., Guerrero, A., Velandia Valero, M., Zawadzki, F., Eiras, C. E., Campo, M. D. M., Sañudo, C., Mendes Jorge, A., & Nunes do Prado, I. (2016). Effect of essential oils on meat and fat qualities of crossbred young bulls finished in feedlots. *Meat Science*, 121, 278-284. http://dx.doi.org/10.1016/j.meatsci.2016.06.017. PMid:27388818.

Rytter, M. J. H., Kolte, L., Briend, A., Friis, H., & Christensen, V. B. (2014). The immune system in children with malnutrition—a systematic review. *PLoS One*, 9(8), e105017. http://dx.doi.org/10.1371/journal.pone.0105017. PMid:25153531.

Sary, C., Carbonera, F., Silva, M. C. D., Oliveira, M., Lewandowski, V., Todesco, H., Visentainer, J. V., Prado, I. N., & Ribeiro, R. P. (2021a). Effect of clove (Eugenia caryophyllus) and cinnamon (Cinnamomum zeylanicum) essential oils in Nile tilapia diets on performance, antioxidant power and lipid oxidation in fillets. *Aquaculture Research*, 50(2), 1-7. http://dx.doi.org/10.1111/are.13944.

Sary, C., Carbonera, F., Vital, A. C. P., Guerrero, A., Lewandowski, V., Visentainer, J. V., Prado, I. N., & Rribeiro, R. P. (2021b). Clove (Eugenia caryophyllus) essential oil in diets for Nile tilapia (Oreochromis niloticus) improves fillet quality. *Food Science and Technology (Campinas)*, 41, 1-7. http://dx.doi.org/10.1590/fst.60320.

Taghvaei, M., & Jafari, S. M. (2015). Application and stability of natural antioxidants in edible oils in order to substitute synthetic additives. *Journal of Food Science and Technology*, 52(3), 1272-1282. http://dx.doi.org/10.1007/s13197-013-1080-1. PMid:25745196.

U.S. Food and Drug Administration – FDA. (1992). *Bacteriological analytical manual* (7th ed.). Rockville: Association of Official Analytical Chemists International.

Vabø, M., & Hansen, H. (2014). The relationship between food preferences and food choice: a theoretical discussion. *International Journal of Business and Social Science*, 5(7), 145-157.

Veiros, M. B., Kent-Smith, L., & Proença, R. P. C. (2006). Legislação portuguesa e brasileira de segurança e higiene dos alimentos: panorama atual. *Revista Higiene Alimentar*, 20, 117-128.

Vital, A. C. P., Guerrero, A., Monteschio, J. O., Valero, M. V., Carvalho, C. B., de Abreu, B. A., Fo., Madrona, G. S., & Prado, I. N. (2016). Effect of edible and active coating (with rosemary and oregano essential oils) on beef characteristics and consumer acceptability. *PLoS One*, 11(8), e0160535. http://dx.doi.org/10.1371/journal.pone.0160535. PMid:27504957.

Vital, A. C. P., Guerrero, A., Kempinski, E. M. B. C., Monteschio, J. O., Sary, C., Ramos, T. R. R., Campo, M., & Prado, I. N. (2018a). Consumer profile and acceptability of cooked beef steks with edible and active coating containing oregano and rosemary essential oils. *Meat Science*, 143, 153-158. http://dx.doi.org/10.1016/j.meatsci.2018.04.035. PMid:29753217.

Vital, A. C. P., Guerrero, A., Ornaghi, M. G., Kempinski, E. M. B. C., Sary, C., Monteschio, J. O., Matumoto-Pintro, P. T., Ribeiro, R. P., & do Prado, I. N. (2018b). Quality and sensory acceptability of fish (*Oreochronis niloticus*) with alginate-based coating containing essential oils. *Journal of Food Science and Technology*, 55(12), 4945-4955. http://dx.doi.org/10.1007/s13197-018-3429-y. PMid:30482990.

World Health Organization – WHO. (2002). *Childhood nutrition and progress in implementing the International Code of Marketing of Breast-milk Substitutes: Vol. Document A*. Geneva: WHO.

World Health Organization – WHO. (2003). *Diet nutrition and prevention of chronic diseases: report of a joint WHO/FAO expert consultation*. Geneva: WHO.