



REPORT ON THE ACCEPTABILITY AND QUALITY OF THE DEVELOPED PRODUCTS

DELIVERABLE 4.6

Pulping

Developing of Pumpkin Pulp Formulation using a Sustainable Integrated Strategy



UNIVERSITY OF
THESSALY





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Document information

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1 Summary

The PulpIng project aims to develop a high-quality pumpkin pulp product enriched with value-added compounds from pumpkin by-products. This initiative promotes sustainability and an integrative approach. The main objective of WP4 is to develop a pumpkin pulp formulation ready to use and incorporated with natural preservatives that ensure stability over the product shelf-life. The present report concerns WP4 deliverable D4.6 “Report on the acceptability and quality of the developed products”, where the acceptability and quality of pumpkin pulp formulations by consumers are presented and discussed.

2 Description of the evaluation strategy

In the present Task 4.2, the optimized preservative extract obtained in the previous Task 2.2 was incorporated into the pumpkin pulp. The extract obtained from the Butternut squash peels in the optimal global condition of heat-assisted extraction was incorporated in the pumpkin pulp, to replace the traditional preservative potassium sorbate.

The following formulations previously described in Deliverable 4.3, were tested for their acceptability and quality:

- Traditional formulation (SP): potassium sorbate
- Pumpkin peel extract at a concentration of 10g/kg + 50% of the amount of potassium sorbate concentration in the traditional formulation (PE10SP)

The test involved 106 untrained participants at the premises of the Polytechnic Institute of Bragança, Bragança, Portugal. Participants were asked to evaluate the overall acceptance on a scale from 1 to 5 (1-very dissatisfactory, 2-dissatisfactory, 3-neutral, 4-satisfactory, 5-very satisfactory), according to the evaluation form presented in **Annex 1**. Each participant received portions of both samples, with one being the PE10SP formulation and the other SP as control, coded discreetly.

3 Results and discussion

Among the 106 participants, 77 were female with ages ranging from 19 to 66 years, and 29 were male with ages ranging from 19 to 55 years. **Figure 1** presents the number of responses for each formulation, reflecting consumers' perception of overall acceptance, on a scale that goes from very dissatisfactory to very satisfactory.

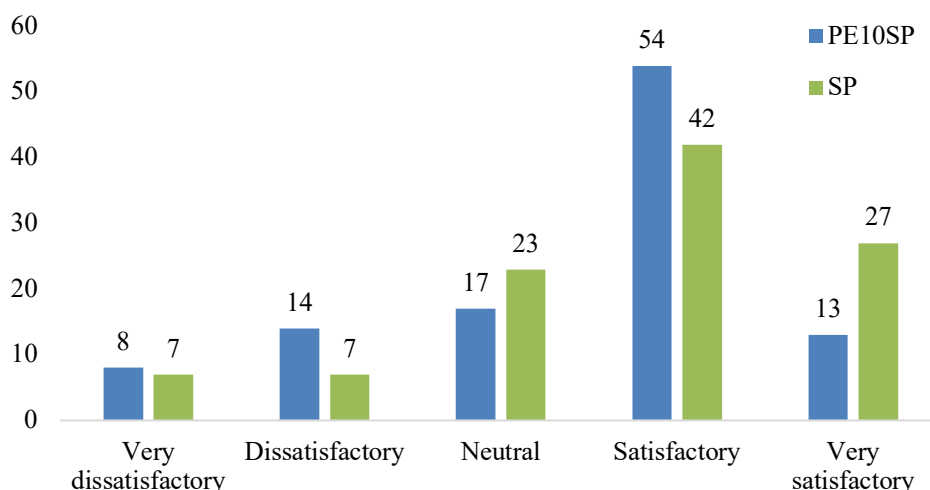


Figure 1. Comparison of the overall acceptance between PE10SP and SP formulations.

Both formulations were generally well received, with most consumers rating them positively, as responses are concentrated in the “satisfactory” category for both formulations. Furthermore, the combined percentage of “very satisfactory” and “satisfactory” ratings is also almost the same for both formulations, with PE10SP at 63.2% and SP at 65.1%, further highlighting their global acceptance and comparability. Although the SP had slightly higher overall acceptance, indicated by more “very satisfactory” ratings and fewer negative responses, the PE10SP was still received positively by the majority. Notably, 54 people gave identical ratings for both formulations, indicating that many consumers did not perceive a significant difference. In summary, both formulations demonstrate comparable consumer acceptance.

Consumers were also surveyed about their awareness and preference for natural food additives (**Annex 1**). The responses were overwhelmingly positive when asked about their preference for consuming natural products free of artificial preservatives, as shown in **Table 1**.

Table 1. Consumer preference for natural products.

Preference	Multiple choice responses
Yes, I prefer natural products without artificial preservatives	66
Yes, but it is not a determining factor in my choice	40
No, I have no preference for natural products	3
I have no formed opinion on the matter	3

The survey results indicate a clear consumer preference for natural products free from artificial preservatives, with 66 responses strongly favouring these products. Although 40 consumers also prefer natural products, they consider other factors in their purchasing decisions. Only a small fraction of consumers have no preference or opinion on the subject. These insights are valuable

for guiding product development, marketing strategies, and consumer education efforts to align with prevailing consumer trends and preferences.

In response to consumer preferences for natural products without artificial preservatives, the research investigated the factors that influence these choices. **Table 2** shows the number of consumers who agree with each factor influencing their decisions.

Table 2. Consumer decision factors regarding preference for natural food options without artificial preservatives.

Factors	Multiple choice responses
Concern for health and food safety	81
Concern for the environment and sustainability	39
Better taste and quality of natural products	33
Influence of information and advertising campaigns	4
I have no formed opinion on the matter	7
Price-quality ratio	1

The survey results highlight several important consumer preferences regarding food choices. A significant majority of respondents (81) expressed strong concerns about health and food safety, indicating a clear priority for safe and nutritious food options. Furthermore, a notable proportion (39) showed interest in environmental sustainability, suggesting that consumers are increasingly aware of the ecological impact of their food choices. The taste and quality of natural products were also valued, with 33 interviewees emphasizing the importance of authentic flavours and high product standards. In contrast, only 4 interviewees cited the influence of information and advertising campaigns as a decisive factor, indicating that direct benefits for health and personal values can outweigh marketing appeals. A small minority did not indicate any opinion on the matter, possibly reflecting the need for more education or involvement on these issues. Interestingly, only one respondent considered price-quality as a significant determinant, suggesting that while cost remains a consideration, it is less influential compared to factors such as health, sustainability and taste quality. These findings highlight the diverse and nuanced considerations that influence consumers' food choices, providing valuable insights for industry stakeholders looking to align products with evolving consumer preferences and values.

4 Conclusion

Analysis of the survey results reveals that there is a significant demand for natural products among consumers, especially those concerned about health, environmental sustainability and the sensorial quality of food. The high number of respondents who prioritize health and food safety suggests that a natural product free of artificial preservatives may find a receptive market among



those seeking safer and more nutritious food options. Furthermore, growing concern about environmental sustainability and the preference for foods with better flavour and natural quality indicate a promising opportunity for the success of products that meet these criteria.

Combined with these concepts and preferences, together with the satisfactory global acceptance rate of the PE10SP formulation found in the research, the great potential of the pumpkin pulp formulation developed here is notable. The replacement, even if partial, of the artificial preservative potassium sorbate with natural pumpkin peel extract, aligns the major aspects of food safety and environmental sustainability.



Annex 1

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Prova Sensorial - PulpIng

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Prova sensorial para avaliação de polpa de abóbora com conservante natural de casca de abóbora em comparação com a formulação tradicional com sorbato de potássio .

Instruções:

Estão a ser entregues duas amostras de formulação de polpa de abóbora para si. Por favor, avalie-as atentamente conforme indicado em cada questão.

Observações:

Por favor, limpe seu paladar entre as amostras com água;
Não discuta suas opiniões com outros participantes durante a avaliação.

* Indica uma pergunta obrigatória

1. Nome *

2. Idade *

Exemplo: 7 de janeiro de 2019

3. Sexo *

Marcar apenas uma oval.

Feminino

Masculino

Prefiro não dizer

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4. **Cor** *

Avalie a cor com relação a sua intensidade amarelo/laranja

Marcar apenas uma oval por linha.

	Amarelo	Amarelo-alaranjado	Intermédio	Alaranjado-amarelo	Laranja
Amostra 256	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Amostra 875	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5. **Cor** *

Avalie a cor conforme a atratividade visual

Marcar apenas uma oval por linha.

	Muito insatisfatório	Insatisfatório	Indiferente	Satisfatório	Muito satisfatório
Amostra 256	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Amostra 875	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. **Aroma** *

Avalie a atratividade do aroma, ou seja, o quanto este é agradável e característico.

Marcar apenas uma oval por linha.

	Muito insatisfatório	Insatisfatório	Indiferente	Satisfatório	Muito satisfatório
Amostra 256	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Amostra 875	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. **Sabor** *

Avalie a agradabilidade do sabor, ou seja, o quanto é atrativo e característico.

Marcar apenas uma oval por linha.

	Muito insatisfatório	Insatisfatório	Indiferente	Satisfatório	Muito satisfatório
Amostra 256	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Amostra 875	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. **Textura** *

Avalie a agradabilidade da textura dos produtos

Marcar apenas uma oval por linha.

	Muito insatisfatório	Insatisfatório	Indiferente	Satisfatório	Muito satisfatório
Amostra 256	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Amostra 875	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. **Avaliação Global** *

Avalie os produtos considerando o aspecto global

Marcar apenas uma oval por linha.

	Muito insatisfatório	Insatisfatório	Indiferente	Satisfatório	Muito satisfatório
Amostra 256	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Amostra 875	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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10. **Comentários adicionais**

Deixe seu comentário sobre o que achou dos produtos

11. **Você prefere consumir produtos naturais e livres de conservantes artificiais? ***

Marque todas que se aplicam.

- Sim, prefiro produtos naturais sem conservantes artificiais
- Sim, mas não é um fator determinante na minha escolha
- Não, não tenho preferência por produtos naturais
- Não tenho opinião formada sobre o assunto
- Outro: _____

12. **Qual a principal razão para sua escolha acima? ***

Por favor, selecione a opção que mais se aplica a você

Marque todas que se aplicam.

- Preocupação com a saúde e segurança alimentar
- Preocupação com o meio ambiente e sustentabilidade
- Melhor sabor e qualidade dos produtos naturais
- Influência de informações e campanhas publicitárias
- Não tenho opinião formada sobre o assunto
- Outro: _____

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