Comparative analysis of sensory properties of French fries made by vacuum and deep fat frying

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INTRODUCTION

Deep-fat frying is one of the oldest and most popular food preparation processes and consists basically in the immersion of food pieces in hot oil. The results are products with unique and distinctive qualities of flavor, color, appearance, taste, aroma and texture however, with a high fat content. Diet with this type of food has been linked to many diseases common in developed countries, such as obesity and coronary heart disease [1]. Consequently, there has been a growing movement to reduce the fat content of deep fried products. Vacuum frying could be a feasible alternative since the food preparation is done by convention, requiring less oil quantity than in the conventional process therefore, producing low-fat foods [2].

The aim of this work was to evaluate and to compare the sensory profile of raw potato and pre-frying frozen chips (French fries) fried in vegetable and sunflower oil using traditional electric fryer and a vacuum fryer (Actifry, Tefal).

EXPERIMENTAL

Experimental design

Oils

Potatoes

Raw — Pre-frying frozen chips

Frying process

Traditional fryer

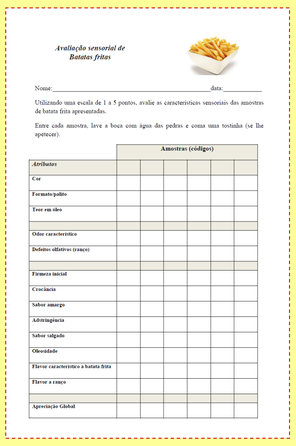
Oil: 2L
Potatoes:: 250g
Time: 7 min
3 batches

Vacuum fryer

Oil: 2,5 mL
Potatoes:: 250g
Time: 20 min
One frying

French Fries samples

Sensory evaluation scoresheet



Avaliação sensorial de Batatas fritas

Nome:_____data:_____

Utilizando uma escala de 1 a 5 pontos, avalie as características sensoriais das amostras de batata frita apresentadas.

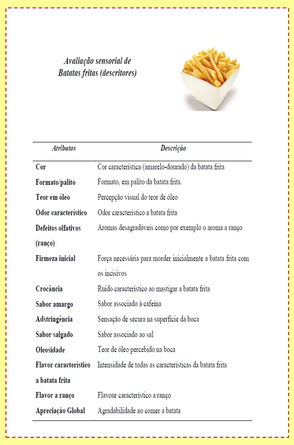
Entre cada amostra, lave a boca com água das pedras e coma uma tostinha (se lhe apetecer).

Atributos	Amostras (códigos)				
Cor					
Formato/palito					
Teor em óleo					
Odor característico					
Defeitos olfativos (ranço)					
Firmeza inicial					
Crocância					
Sabor amargo					
Adstringência					
Sabor salgado					
Oleosidade					
Flavor característico a batata frita					
Flavor a ranço					
Apreciação Global					

Sensory analysis

- **Panel:** 11 judges with experience in sensory evaluation (3 ♀ 8 ♂ ; ages: 20-50)
- **Methodology:** Quantitative Descriptive Analysis (QDA)
- **Scale:** increasing 5-points numerical intensity

Vocabulary description



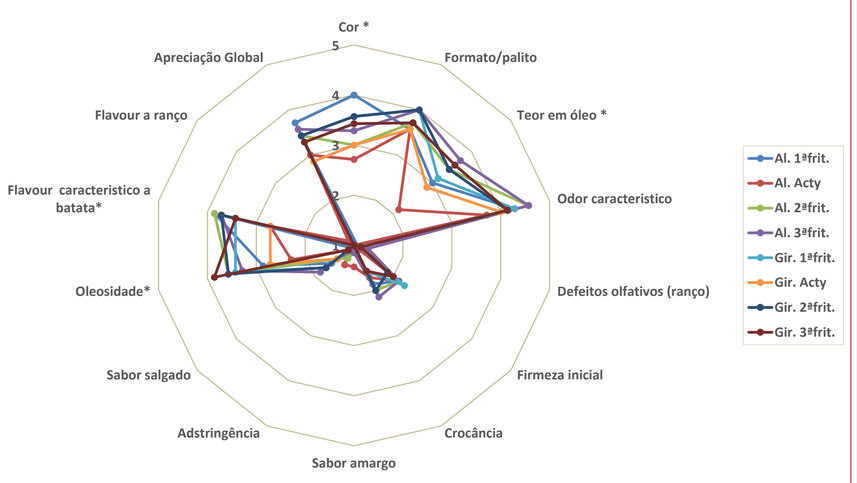
Avaliação sensorial de Batatas fritas (descritores)

Atributos	Descrição
Cor	Cor característica (amarelo-dourado) da batata frita
Formato/palito	Formato, em palito da batata frita.
Teor em óleo	Perceção visual do teor de óleo
Odor característico	Odor característico a batata frita
Defeitos olfativos (ranço)	Aromas desagradáveis como por exemplo o aroma a ranço
Firmeza inicial	Força necessária para morder inicialmente a batata frita com os incisivos
Crocância	Ruído característico ao mastigar a batata frita
Sabor amargo	Sabor associado à cafeína
Adstringência	Sensação de secura na superfície da boca
Sabor salgado	Sabor associado ao sal
Oleosidade	Teor de óleo percebido na boca
Flavor característico a batata frita	Intensidade de todas as características da batata frita
Flavor a ranço	Flavour característico a ranço
Apreciação Global	Agradabilidade ao comer a batata

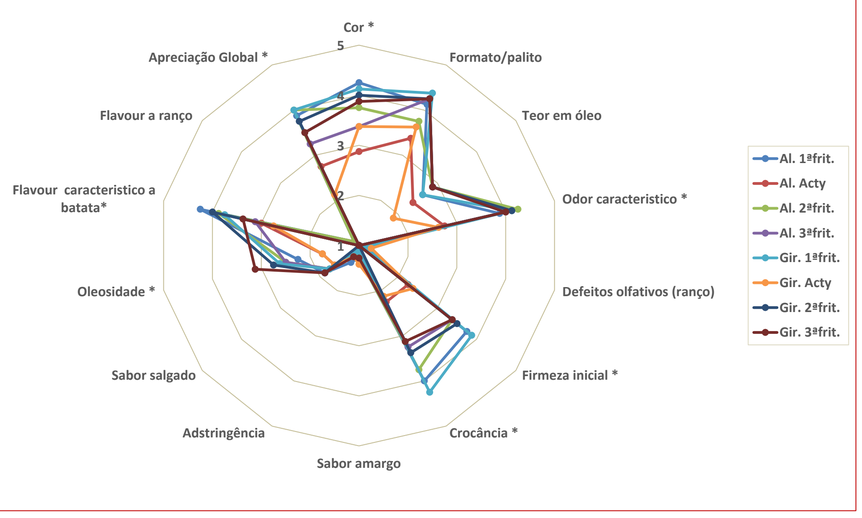
RESULTS

Sensory profile

Raw Potatoes



Pre-frying frozen chips



- ☑ Raw potatoes: significant differences ($p<0.05$) in the sensorial parameters: color, oiliness and characteristic taste of French fries.
- ☑ Pre-frying frozen chips: significant differences in almost all sensory attributes except rancid odor; taste and mouth-fell parameters.
- ☑ Higher values were observed in the 1st frying process by the traditional electric fryer and lower in Actifry.
- ☑ Texture parameters (firmness and churchiness) – higher values when pre-frying frozen potatoes are used.

- ☑ Raw potatoes: hierarchical grouping was carried out by the type of oil (vegetable and sunflower).
- ☑ Pre-frying frozen chips: hierarchical grouping was arranged by the number of frying and not the type of the oil.
- ☑ Actifry process a single group was formed, independently of the type of oil.
- ☑ A hierarchical grouping was performed for all samples. 3 groups were formed: (1) pre-frying frozen chips in both oils; (2) raw potatoes and pre-frying frozen chips in actifry fryer; (3) raw potatoes in both oils.

Legend

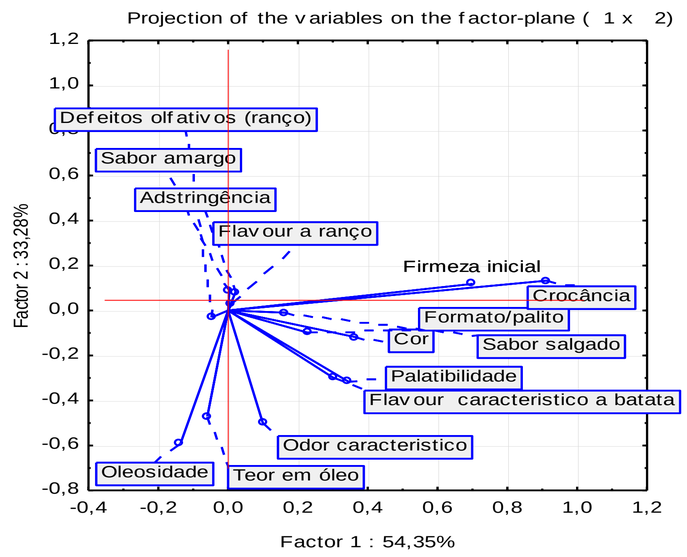
Sensory Analysis attributes

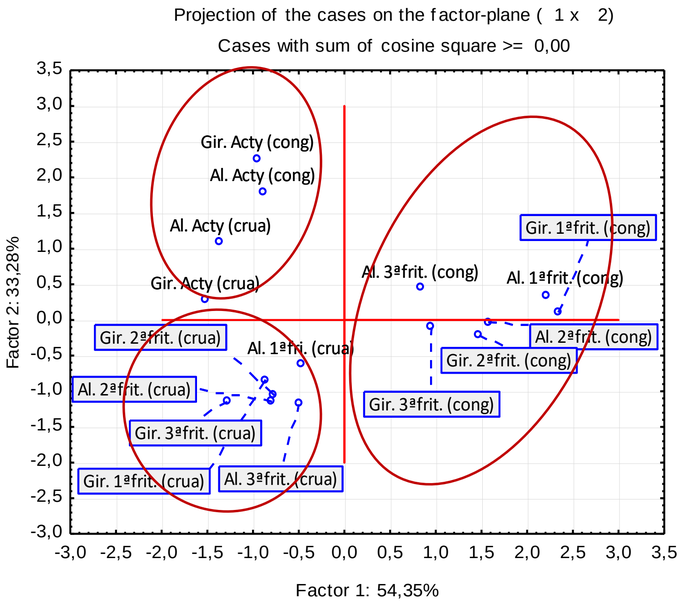
Appearance: cor - color; formato/palito - stick shape; teor em óleo - oil content
Odor: odor característico - characteristic odor; defeitos olfativos (ranço) – rancid odor
Taste and mouth fell: adstringência - astringency; sabor amargo - bitterness; sabor salgado - salty
Flavor: flavour característico a batata - French fries characteristic flavor; oleosidade - oiliness; flavour a ranço – rancid
Texture: firmeza inicial – firmness; crocância – crunchiness
Global appreciation – Palatibilidade

Oils/potatoes/frying methods

Al. – Vegetable oil
Gir. – Sunflower oil
crua – raw potatoes
cong. – pre-frying frozen chips
1ªfrit. – 1st frying batch
2ªfrit. – 2nd frying batch
3ªfrit. – 3th frying batch
Acty – Actifry (vacuum fryer)

Principal Component Analysis (All samples)





References

[1] Saguy, I.S, Dana, D., Journal of Food Engineering 56 (2003), 143-152.
[2} Garayo, J., Moreira, R., Journal of Food Engineering 55 (2002), 181-191.

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