High oleic low linolenic rapeseed oil as alternative to common used frying oils

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Abstract

Changes of high-oleic low linolenic rapeseed oil during 72 h of deep-fat frying of potatoes were compared concerning chemical, physical and sensory parameters with commonly used frying oils, palmolein, high-oleic sunflower oil and partially hydrogenated rapeseed oil. From a sensory point of view French fries obtained with HOLL rapeseed oil, palmolein and high-oleic sunflower oil, respectively, were still suitable for human consumption after 66 hours of deep-fat frying, while French fries fried in partially hydrogenated rapeseed oil were inedible after 30 h. During the frying period none of the oils exceeded the limit for the amount of polar compounds, oligomer triglycerides and free fatty acids, respectively, recommended by the German Society of Fat Science (DGF) as criteria for rejection of used frying oils. From the results it can be concluded that the use of high-oleic low linolenic rapeseed oil for deep-fat frying is comparable to other common used oils.

Key words: frying, high-oleic low linolenic rapeseed oil, high-oleic sunflower oil, palm olein, partially hydrogenated rapeseed oil

Introduction

Deep-fat frying is one of the most popular methods for the preparation of food. Nevertheless food being fried is in iscussion, because it contains a lot of oil from the frying medium. Since the oil becomes part of the food the nutritional value of the food strongly depends on the composition of the oil used for frying. Palm olein but also partially hydrogenated oils like hydrogenated rapeseed oil or peanut oil are common used for industrial but also homemade frying. From a technical point of view these oils are favourable, because of the low content of polyunsaturated fatty acids, which are critical concerning the oxidative stability of the oils. But a strong disadvantage of these types of oil is the high amount of unhealthy fatty acids such as saturated or *trans*-fatty acids which are taken up with products being fried. Palm olein is distinguished by a high amount of saturated fatty acids and in hydrogenated fats and oils high amounts of *trans*-fatty acids can be found, which are hold responsible for some negative effects on blood cholesterol resulting in coronary heart diseases (Precht and Molkentin, 1995; Stender et al., 1995). From this the perfect frying oil should be low in saturated and *trans*-fatty acids, high in mono-unsaturated oleic acid, stable against oxidative deterioration during use and the use of the oil should ensure the production of high-quality and tasty foods.

The paper describes the results of a frying experiment using high-oleic low linolenic rapeseed oil as frying medium in comparison to palm olein, high-oleic sunflower oil and hydrogenated rapeseed oil.

Materials and Methods

For the investigation fryers, usually applied in household were used. A frying temperature of 175°C was chosen. For the investigation 2.0 l of the appropriate edible oil were filled into the fryer and afterwards the oil was heated up to 175°C within 10 min. The oil was hold on this temperature for 1 h before 50 g pre-fried potatoes were fried 3.5 min.. Five frying operations were carried out each day with 50 g pre-fried potatoes, each. Between each frying step the fryer was hold at 175 °C for 1 h without frying material, resulting in a thermal load of the oil of 6 h per day.

At the end of each day the oil was cooled down, filtrated and 200 mL of oil were taken for the characterisation. The oil was stored at 6°C until further use. Next day 200 mL fresh oil was added and the experiment was repeated on eleven successive days. This resulted in a total thermal load of the oils of 72 hours.

The oils as well as the fresh French fries were characterized with regard to the sensory quality and also some chemical parameters, such as content of free fatty acids, polar compounds and oligomer triglycerides were used for the evaluation.

Partially hydrogenated rapeseed oil (PHRO), Palm olein (PA), high-oleic sunflower oil (HOSO) and high-oleic low linolenic rapeseed oil (HOLL) (NATREON™) were used as frying medium.

Table 1. Methods used for the evaluation of fresh and used frying oils

No.	Parameter	Method	Reference
1	Polar compounds	DGF C-III 3b	DGF, 2005
2	Oligomere triglycerides	Cd 22-91	AOCS, 1990
3	Free fatty acids	DGF C-V 2	DGF, 2005
4	Sensory assessment	modified DGF C-II 1 (97)	DGF, 2005

Results

An important parameter for the assessment of the frying process is the quality of the product being fried, because the sensory quality is responsible for the success of the product on the market. If the sensory sensation does not meet the expectation of the consumer it will be rejected. The sensory quality is not only the taste of the French fries but also the colour, the crust and the inner composition of the fried potatoes.

With continuing frying time the taste of the fried potatoes was judged poorer and poorer (Fig. 1). The French fries took on rancid aroma components and the taste turned into bitter, burnt and rancid. Especially French fries deep-fried with PHRO showed a strange smell and taste, which led to a clear devaluation of the products. This is not surprising, because it is known that hydrogenated frying oils impart a different type of flavour to food. French fries obtained with HOLL, PO and HOSO, respectively, were still suitable for human consumption after 66 hours of deep-fat frying, the taste was still satisfactory (assessment better than 6 (dotted line)). Only afterwards French fries were judged worse. At the beginning of frying, within the first 42 h the assessment of French fries fried in PO and HOSO, respectively, were evaluated better than French fries fried in HOLL. Then the results were comparable.

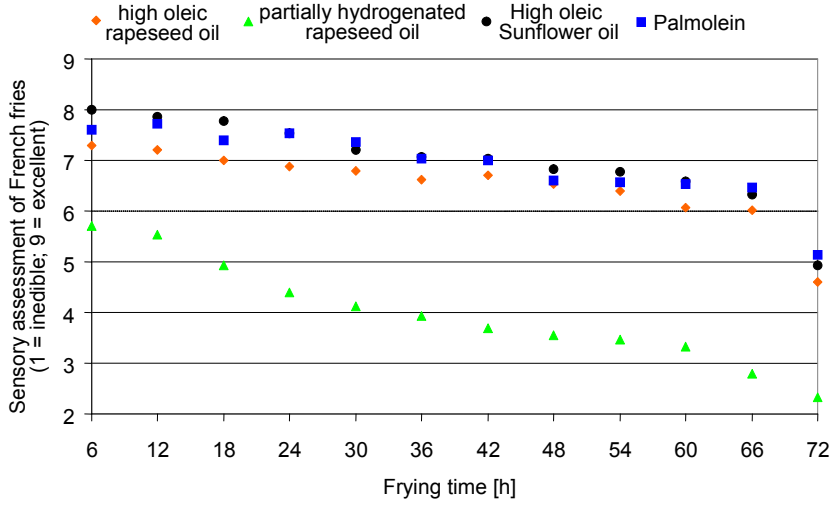

Fig. 1. Development of the sensory evaluation during a frying period of 72 h.

Looking on the other parameters for the characterisation of the fried products, like crust, inner composition or colour, all the oils showed acceptable results with regard to the colour of the French fries. The inner composition and the crust were in an adequate up to a good level over a frying period of 54 hours. For HOLL and PO, respectively, these parameters were even reasonable over a period of 66 h. Only the inner composition and the crust of PHOR were evaluated worse after only 30 h of frying (results not shown).

For the further assessment of the oils regarding their suitability as frying medium the recommendations of the German Society of Fat Science (Anonymous, 2000) were used: oligomer triglycerides, polar compounds (Fig. 2) and free fatty acids. Comparable to the polar compounds also for oligomer triglycerides and free fatty acids the amount increased linear with the frying time. But not any of the oils exceeded the limits given in the recommendation for these parameters during the frying period of 72 h, which would lead to the rejection of the oils. While the amount of polar compounds in HOLL, HOSO and PHRO was comparable, but significantly different ($p < 0.01$), in PO higher amounts of polar compounds were found, as a result of the higher initial content of this oil.

A summarized comparison of the used oils was carried out by distribution of rank numbers according to the come out of each oil at the most important parameters for the assessment of the oils after a frying time of 72 h. The oil coming out on the top got an 1 and the worst oil a 4. After distribution of the rank numbers the mean value was calculated for each oil. Additionally to the amount of polar compounds, oligomer triglycerides and free fatty acids as well as the sensory evaluation of the oil, the sensory evaluation of the potatoes being fried was used for the assessment, because this is one of the most important criteria for the consumer. The summary of this assessment is shown in Table 2.

No significant differences ($p < 0.01$) were found between HOLL, HOSO and PHRO concerning the total assessment of the results, even if the table shows that HOLL has clear advantages with regard to the sensory evaluation of both, oil and product. In contrast, PHRO had better results for the chemical parameters, but a bad sensory evaluation. Further on it should be pointed out that only small differences in the chemical parameters of all oils were found. Only the total result of the assessment of PO was significantly worst than the results of the other oils ($p < 0.01$).

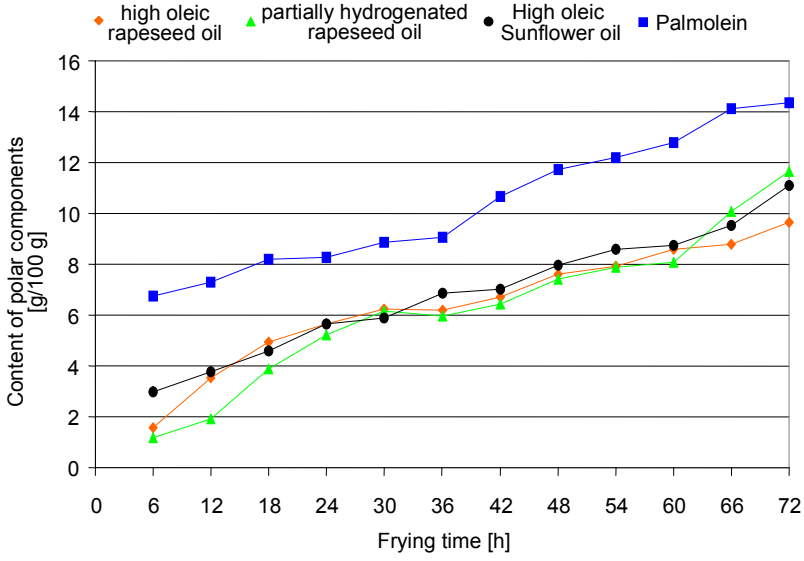

Fig. 2. Development of polar compounds during a frying period of 72 h.

Table. 2 Summarized results, calculated from the most important parameters

Type of oil	Oligomer triglycerides	Polar compounds	Free fatty acids	Sensory evaluation (oil)	Sensory evaluation (French fries)	Total result
HOLL	2	3	4	1	1	2.2
HOSO	3	1	2	4	1	2.2
PHRO	1	2	1	4	4	2.4
PO	4	4	3	4	1	3.2

HOLL=high-oleic rapeseed oil; PHRO=partially hydrogenated rapeseed oil;
HOSO=high-oleic sunflower oil; PO= Palm olein

Conclusion

The investigation shows that the use of HOLL rapeseed oil is an interesting alternative to common used oils. Looking on the results of the frying experiment indicates that HOLL rapeseed oil came to better or at least comparable results with regard to the sensory evaluation and the chemical parameters used for the assessment of the oils and the products being fried.

From this it can be concluded that HOLL rapeseed oil fulfils most of the demands necessary for frying oils, because it has some advantages with regard to health aspects, shows a high oxidative stability and the oil results in high quality and tasty food. The oil meets the needs of nutrition, taste and functionality, because it is low in saturated fatty acids, contains no *trans*-fatty acids and is high in oleic acid. The amount of linolenic acid is only moderate. Additionally the oil shows a high frying stability comparable to common used frying oils and results in good flavour characteristics of the products being fried.

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