

original article

Measurement of used oil rancidity indexes in the confectioneries and food shops

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ABSTRACT

Aims: The aim of this study was to determine the peroxide value, acid value and rancidity of edible oil which are used in sweet pancake, samosa, confectionery and sandwich shop.

Materials and Methods: This descriptive study was carried out on all sandwich shops and sweet pancake at north region of Isfahan city. The peroxide value, acid value and rancidity were determined based on national standard procedure number 4179, on thirty samples.

Results: The average of peroxide and acid value was 5.2 and 0.5, respectively. Around 7.4 percent of tested oil has a non permissible rancidity value. Also, 87 percent of samples were healthy. In general, 98.1 percent of oil samples were unusable.

Conclusion: The acid and peroxide numbers was in acceptable range, however, the rancidity or oil chemicals corruption caused by inappropriate conservation conditions. This type of fast food, have adverse effects on consumers' health.

Key words: Confectioneries and food shops, Isfahan, rancidity indexes, used oil

INTRODUCTION

The people's lifestyle has changed during recent decades due to the changes in economy, society, technology, and population. These changes caused improper habits including

sedentary, reduction of dietary fiber intake, and increase in consumption of refined carbohydrates and saturated animal fat which has been associated with consumption of foods cooked from animal sources with high energy density.^[1] These inappropriate habits lead to increasing cardiovascular and other non communicable diseases, which are the main reasons of fatality in the world.^[2] Fats and oils play an important role in taste, odor, texture, and quality of foods. Regardless of the source, amount, and composition of fat in a foodstuff, monitoring the quality of fat and oil during preparation of the foods is of special importance. The most common method of using heat in cooking foods is frying them in oils which are highly popular. Since, frying makes

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the food delicious and golden brown which is tasty to many people.^[3] That is why fried foods are common in sandwich shops and confectioneries.^[4] Too much heating in presence of air causes oxidative changes in unsaturated acryl groups in glycerides and other unsaturated elements in fats and oils. These changes alter nutritional properties of the fats and result in formation of many oxidized and polymerized compounds. These chemical and physical changes caused by too much heat often change the taste and odor of foods. While frying the foods too much, the oxidation of the oil increases and this will cause the production of hydroperoxides and volatile compounds like aldehydes, ketones, carboxylic acids and other unfavorable chemical substances.^[5]

There are various methods for measurement of oil oxidation. Considering that at what stage the oxidation is done, several supplementary tests such as peroxide value, rancidity, and acid value are used to measure hydroperoxides, aldehydes, and free acids during oxidation stages.^[6] Evidence shows that the people tend to consume prepared foods outside home. However, there is no information on how these foods are prepared particularly the execution of rules for foods and beverages and also the way of heating oil while cooking. The study by Mirnezami and Sanei on 386 samples taken from 30 food shops and confectionaries within 4 years showed no significant difference in the amount of peroxide, although the acid value was not consistent to the standard.^[5] The study by Pourmohammadi *et al.* on used oils in food shops showed an impermissible peroxide value of these oils.^[7]

This study was conducted to determine the peroxide value, acid value and rancidity of the oil used in confectionaries and samosa shop in Borkhar and Meymeh of Isfahan province. Samosa is a fried or baked pastry with a savory filling such as spiced potatoes, onions, peas, lentils, ground lamb or chicken.

MATERIALS AND METHODS

This was a cross-sectional descriptive and analytic study. Considering that there were 60 markets of confectionaries and food shops in Borkhar and Meymeh of Isfahan province and also restricted equipment and utilities, and the probability of non-cooperation of some operators of these markets, 50% (30 markets) of these markets were selected randomly for sampling. In order to increase the accuracy and validity of the experiments, at least 2 samples were taken in two work shifts of the markets. Totally, 60 samples were collected of which 6 samples were excluded due to their contamination and finally 54 samples were tested. The 54 samples were taken randomly from confectionaries and samosa shops in Borkhar and Meymeh. To do the experiments of peroxide value, 5 g of oil was added to 30 ml of acetic acid-chloroform solution, then 0.5 ml of potassium iodide was added to the solution and it was titrated by 0.1 N sodium thiosulfate. The peroxide value was calculated with regard to the amount of used thiosulfate. If the value is less than 5, the oil is safe, if the

value is between 5-10, the oil is usable and not preservable, and if the value is more than 10, the oil is unusable. To do the rancidity experiment using Kreis test, 5 g of the oils was added to 5 ml of chloridric acid, then phloroglucin solution was added to make a 2-phase of ether and acid solution. As one of the products of fats self-oxidation is epihydrin aldehyde which forms red color while reacting with phloroglucin, the red color of the acidic phase indicates the presence of epihydrin aldehyde. The rancidity is determined upon removing interfering factors by diluting the solution. In this respect, the oils were divided into three categories of safe, usable and not preservable, and unusable. To do the experiment for acid value, 100 ml of neutralized ethane-benzene mixture and 2 ml of phenolphthalein indicator were added to 5 g of the sample oils and then the solution was titrated by adding alcoholic potash solution. Finally, the acid value was calculated based on the sample weight and obtained results. If the acid value is less than 1, the oil is safe, and if the value is more than 1, the oil has gone rancid.^[4]

RESULTS

The status of oils used in confectionaries and samosa shops is shown in Table 1. According to these results, 98.1% of the oils went rancid and were not usable.

The experiments showed that the tested oil was safe in terms of acid value and only 7.4% of the oil went rancid. This result indicated that 87% of the oils in confectionaries and samosa shops were usable in terms of the peroxide value. However, the reason of the rancidity of the oils used in confectionaries and samosa shops in Borkhar and Meymeh was that the oils were not usable and preservable, although the acid and peroxide values showed the safety of the oils.

Deep frying generates compounds with desirable or undesirable taste changing the texture and quality of the fried foods. Hydrolysis, oxidation, and polymerization of the oils are the common reactions taken place during frying and cause the production of volatile and non-volatile chemical compounds. These changes decrease the amount of unsaturated fatty acids and increase viscosity, color, and volatile fatty acids.

Furthermore, the temperature, duration of frying, type of used oil, the existing antioxidant, and the way of frying affect these processes.^[5] Hydrolysis increase the amount of free fatty acids, monoacylglycerol, diacylglycerol, and glycerols in oil, while oxidation produces hydroperoxides, small volatile molecules like aldehydes, ketones, carboxylic acids, and short-chain alkanes and which not only influence the quality of the foods but also make consumers face with a lot of health risks.

Also, environmental health conditions of food shops in studying region was inspected which is shown in Table 2. From 18 confectionary shops, 13 were sanitary and 5 were hygienic. While all of 12 samosa shops were sanitary and

Table 1: The status of oils used in confectionaries and samosa shops in terms of their peroxide value, rancidity, and acid value, in Borkhar and Meymeh

Sample type	Numbers	Results				Acid value	
		Peroxide		Rancidity		Permissible (%)	Impermissible (%)
		(%) Permissible	(%) Impermissible	(%) Permissible	(%) Impermissible		
Confectionary	35	(85.7) 30	(14.3) 5	(2.9) 1	(97.1) 34	(100) 35	(0) 0
Samosa shop	19	(89.5) 17	(10.5) 2	(0) 0	(100) 19	(87.9) 15	(21.4) 4

Table 2: Environmental health conditions of food shops in studying region

Shop type	Environmental health conditions	
	Sanitary*	Hygienic**
Confectionary	13	5
Samosa	12	-

*Improving just building health. **Improving whole of hygiene, building and tools health

hygienic status were improper.

DISCUSSION

According to the results of the study, peroxide value mean was 5.23 showing that the oils were usable which was not consistent with the result of the rancidity of the oils. This result meant that the oils produced peroxide and hydroperoxide during oxidation process, and then experienced the process of aldehyde and ketone production. The presence of these compounds in the samples showed the rancidity higher than permissible limit.

Moreover, the acid value mean was 0.46 showing that the oils were safe. However, regarding the rancidity result, the acid value mean showed that the oils had not still reached the stage of producing fatty acids during oxidation, and that is why the acid value did not indicate a high value. Actually, oxidation was ceased in the stage of aldehyde and ketone production.^[4,5]

As shown in this study, if one of the oil parameters likes peroxide, rancidity, and acid value changes, the oil will be unusable. The study by Mirnezami and Sanei on 386 samples taken from food shops and confectionaries within 4 years showed no significant difference in the amount of peroxide, although the acid value was not consistent to the standard.^[6] The study by Pourmohammadi *et al.* on used oils in food shops showed an impermissible peroxide value of these oils.^[7] Studies have shown these foods were often unsafe and caused weight gain, obesity, increase of diabetes type 2 and cardiovascular diseases.

Chemical analysis of fried foods in 35 countries in 2005 and 2006 showed that besides having high energy density due to too much fat, the adverse level of trans fatty acids of these foods had unfavorable effects on humans.^[8] It was found that trans fatty acids increased lipoprotein cholesterol with low density and sometimes lipoprotein cholesterol with high

density which increased cardiovascular diseases.^[9]

Moreover, the studies on mice showed that the use of oils with compounds created during oxidation at high temperature caused teratogenic effects (birth defects) and increased fetal anomalies. These effects are reduced using antioxidant along with oils.^[10,11]

Therefore, people must pay attention to the harmful effects of fried foods regarding today's increasing prepared foods, especially fried ones.

In this study, the oils of two different kinds of foods, i.e., the oils of confectionaries and samosa shops were evaluated. As the confections and sambosah are cooked in different ways, their production temperatures are probably different. Therefore, classification of the results determines the oxidation process more precisely. It is recommended to assess the oil of one food in similar studies.

CONCLUSIONS

It can be concluded that the oils used in confectionaries and food shops in Borkhar and Meymeh are not safe and may contain toxic matters which threat the consumers' health. Therefore, related authorities should control the execution of health rules and regulations by food supply centers and confectionaries, besides paying attention to supply and distribution of suitable oils for cooking. Thus, it is suggested to perform training, research, and intervention programs on chemical quality of used oils in food shops with cooperation of managers and personnel of food supply and distribution centers.

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