Peroxide Value in Oils Used for Chicken Frying in Selected Restaurants in Khartoum City- Khartoum State-Sudan

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Abstract

The Increased peroxide value more than the recommended cause several health problems such as liver, cancers and cardiovascular diseases. This study was designed to estimate the amount of peroxide value of used oils in frying chicken, since some restaurants repeatedly reuse the oil for frying in order to reduce the cost Peroxide value of oils used for chicken frying in selected restaurants in Khartoum was measured. The study aim to assess the peroxide value of the oils at different frying times as follows: Fresh oil before frying-at the middle of frying and -at the end of frying. The study showed variations in the peroxide value in the oil before frying (fresh oil). All restaurants showed values within the recommended value except one restaurant showed high level (20.9meq/kg). The peanut oil showed lower peroxide value than palm olein. Several variations in the peroxide value during frying were observed. The changes were obvious in two restaurants where the values increased from 1.5 to 5.1mqv/kg and from 2.9 to 4.0 respectively at the middle of frying, then decreased to0.07and to 1.6 meq/kg at the end of frying. It is advisable to use freshly produce oil in frying process. It is not suitable to reuse the same oil for frying more than once plus check internationally, this may cause some health risks. Monitoring and inspection of oil should be used for frying before, during and at the end of frying process.

Keyword: Frying chicken, oil, peroxide value

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INTRODUCTION

Detection of peroxide gives the initial evidence of rancidity in unsaturated fats and oils. Other methods are available, but peroxide value is the most widely used. It gives a measure of the extent to which an oil sample has undergone primary oxidation, extent of secondary oxidation may be determined from p-anisidine test (Chakrabarty, 2016).The peroxide values is used for estimating the peroxides expressed as milliequivalent/kg of oil or milliequivalent active oxygen per kg of fat. high peroxide values point that lipid oxidation has occur. It is measured as reactive oxygen in terms of milliequivlent per kg fat. These oxidation is correlated with reduced flavor scores or paint flavor defects. Peroxide value is often used as indicator of freshness and quality related to oil oxidation (Gunstone, 2002). Fried chicken restaurants are the most popular restaurants in Sudan and fried chicken is the one of the most popular dishes preferred by all consumers worldwide (Talpur et al., 2009).

An independent positive association between the risk of hypertension and intake of heated frying oil had been proved to increase the risk of cancer and cardiovascular diseases (Rossouw, 2002). Deep frying is the most popular and one of the oldest methods of food production worldwide (Rani et al., 2010). Fried foods have desired flavor, color, and crunchy texture, which make deep-fat fried foods very populist to consumers. Frying is a process of immersing food in hot oil, in atmospheric pressure, and at a high temperature of 150º to 190ºC (Choe and min, 2006). When food is fried, the frying oil replaces part of the moisture content and during deep frying, the oil is continuously or repeatedly being exposed to temperature between 150and 1800 ºC in the presence of the substrate, air and water. Under these conditions, complex series of reactions take place, namely hydrolysis, oxidation, polymerization and cyclic compounds, resulting in the both volatile and non-volatile products (Mariod et al., 2006). It is important to understand what happen to the temperature, moisture and oil content of the product during the frying process to determine safe temperature and time of frying oil (Farah, 2004).

Shakak (2007) also reported that the chemical changes in the frying oils result in changes in their physical characteristics. The darkness of color of oil increases with increasing content of polymers, viscosity increases, and greater foaming of the oil occur. Some of the more volatile component, such as free fatty acids, accumulated to the point where the smoking point is decreased. The aroma and flavor also change with increased frying time, as do the color and flavor of the food fried. Deep fat frying is a complex phenomenon where water, oxygen and heat are the main factors, which determine the kinetics of oxidation, hydrolytic and polymerization processes. Beside the radical mechanism for the lipid peroxidation and polymerization of triglyceride another non-radical mechanism for formation of non-oxidized dimmers and cyclic triglycerides was proposed (Gertz and Kochar, 2001).

Also, it was declared that common antioxidant including tocopherols, butyrate hydroxyl anisole and propyl gallate, retard oxidation at ambient temperature, but they become substantially less effective or even inactive when subject to frying temperature (Nor ,2012). When the oil heated to 2000 ºC the peroxide will break down to aldehydes and ketones (Ali, 2002). With the continues of oxidation the peroxide will breakdown to aldehydes, ketones and acids and all had law molecular weight saturated or unsaturated and also had strong odors, non-toxic and bad flavor. Oxidation also cause stress in the oil color change to dark color and increased viscosity (Osman, 2007).

The final products of lipid oxidation - aldehydes, furans, ketones, alcohols, epoxides, and others - are responsible for well-known flavors and odors of oxidized lipids. However, these products are difficult to detect because many of these products are not stable, they are present at very low concentrations, present in complex mixtures that are difficult to separate, and they are reactive, so transform to other products and complex with food molecules, particularly proteins (Steltzer,2012). It is evident that the fatty acid composition of a particular fat is more important that it's absolute concentration regarding these diseases. High intakes of saturated fats and Trans fatty acids have been recognized as a risk factor for coronary heart disease (Ghidurus et al., 2010).

A huge consumption of frying chicken led owners of these restaurants to reduce the cost of oil by using the oil more than once for frying. This may lead to many health problems. Therefor regulations for food control are very important. This paper aims to determine hydrogen peroxide value in oils used for chicken frying in selected restaurants in Khartoum - Sudan.

MATERIALS and METHODS

Fried chicken oils Samples

Ten frying chicken restaurants were selected from Al-Amarat – Khartoum- Sudan, three oil samples were collected from each restaurant for determination of peroxide value as follows: At zero frying time (fresh oil), at middle of frying time, at the end of frying time before changing the oils.

Note: 8 restaurants were using peanut oils while two restaurants using palm olin oil.

Peroxide value determination

Peroxide value was determined according to method describe by A.O.A.C, (2005). Where five grams ±0.05 g were weighted and placed into 250 ml Erlenmeyer flask. Thirteen ml of acetic acid-chloroform (3:2) was added to samples and shacked to dissolve. 0.5 ml of saturated potassium iodide (KI) was added and left to stand with occasional swirled for one minute. Thirteen ml distilled water were added, 0.5 ml of 1% soluble starch indicator was added which gave blue color. Sodium thiosulfate ($Na_2S_2O_3$) 0.01 N were titrated with the Erlenmeyer flask contents and shacked until the color changed to light yellow. The titration was continued with continues shacked till the end point which is indicated by a faint blue color. Sodium thiosulfate ($Na_2S_2O_3$) was added dropwise until the blue color disappears. The peroxide value was calculated as meqg of peroxide value /Kg of oil according to the following equation.

$$PV=(S-B) *M*1000w$$

Where: S = volume (ml) of sodium thiosulphate in test active solution.

B = volume (ml) of sodium thiosulphate in blank solution

M = 0.01the concentration of the $Na_2S_2O_3$ solution.

W = Wight of oil sample in gram

RESULTS and DISCUSSION

Table 1. peroxide value in fresh oils, middle of frying and the end of frying of chicken.

Restaurant No	peroxide value in fresh oils Pv1(meq/kg)	peroxide value at the middle of frying Pv2(meq/kg)	peroxide value at the End of frying Pv3(meq/kg)
1	1.4	0.7	0.0
2	1.5	0.0	0.2
3	2.1	1.1	0.3
4	2.2	1.4	0.7
5	2.3	1.9	0.7
6	2.4	2.1	0.8
7	2.9	2.2	0.9
8	3	3	1.0
9	3.9	4	1.0
10	20.9	5.1	1.6

Table 1 shows that, the initial values for peroxide value of fresh, middle, and the end used oil in 10 restaurants before starting frying process. High value was recorded in restaurant no.10 (20.9meq/kg) while restaurant number 5 showed lower value of 2-3 meq/kg although the two restaurants were using palm oil .These differences in peroxide value between the 2 restaurants 5 and 10 may be due to differences of the source of palm oil , date of production and storage condition. On the other hand, the oil produced from peanut showed lower values of peroxide value. The peroxide value ranged from 1.4 to 2.2 meq/kg in restaurants No.1- 2- 3and 4 while restaurants no. 7- 8and 9 showed high values of 2.9- 3 and 3.9 meq/kg of oil respectively although this restaurants peanut oil .This variation may be due to oil processing techniques used for extraction of the oil, date of production and storage condition. The lower value 1.4meq/kg was recorded in restaurant no.1 .while restaurant no. 9 showed high value of 3.9meq/kg. All restaurants showed lower values below 10meq/kg except restaurant no. 10 which was higher than others.

The results of peroxide value (PV) at the middle of frying process are presented. The peroxide values decreased in all restaurants except in restaurants no. 2 and no. 7 were pv value increased from 1.5to 5.1meq/kg and from 2.9 to 4meq/kg respectively. The results of pv at the end of frying process .It could be noted that pv were decreased throughout in all restaurants. This is may be attributed to the fact that during frying process, food placed in hot oil will be heated quickly where water is evaporated, and the resulting steam causes a boiling action in the oil. This boiling action increases aeration in the oil, which results in increased oxidation of oil with the formation of hydro-peroxide, the primary oxidation product. All restaurants from where the sample of frying oil were taken are using high temperature of 190 to 200^0C which will cause breakdown of pv to aldehydes and ketones. These results are in agreement with what reported by Shakak (2007) and Ali, (2002). These results were further confirmed by darkness of color and high viscosity observed in all oils at the end of frying process. These changes in physical characteristics color darkening, increased viscosity and formation of foam will increase with increase of polymers content. To avoid formation of such physical characteristic using oil more than once should be avoided in order to avoid occurrence of such products which have some health hazards, This findings agreed with what reported by Choe and Min (2006) who reported in the chemical changes in the frying oils resulted in change in their physical characteristics. The color of oil darkness with increasing content of polymers, viscosity increased, and greater foaming of the oil occurred. The outcome of this study showed that the peroxide value increased initially and decreed at the end of frying process especially when the oil is repeatedly used for frying which may produce some chemical products that may be considered as health hazards. This has been confirmed by chi-square statistical test which showed that the peroxide value is greater than 0.05(>0.05) indicate that oil should not be used more than once in frying process.

CONCLUSIONS

Edible oils differ in their thermal susceptibility to frying .it is advisable to use freshly produced oil as possible and it is also advisable to chick the peroxide value before and during frying process. The quality of oils used for frying deteriorated at the end of frying time producing some unhealthy components such as ketons and aldeheds therefore it is not advisable to reuse the same oil for frying more than once. Monitoring, evaluation and inspection of oil used for frying should be carried out before and during frying process, the reuse of frying oil in chicken frying restaurants should be avoided and it is recommended that the oils used for frying of other products should be checked for peroxide value periodically.

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