

Awareness about the Hazards of Repeatedly Heated Cooking Oil

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ABSTRACT:

Objective: To measure the hazardous contents in reused cooking oil and to find out the awareness about its effect on health.

Methodology: A cross-sectional study was conducted during 2012. Convenient sampling technique was used to collect oil samples from home, and lower, middle and high class restaurants. A self-administered questionnaire was used in this process and the samples were analyzed in the laboratory of PCSIR for reused cooking oil contents.

Results: A total of 28 oil samples were obtained from home, lower, middle and high class restaurants. Most of the respondents 12 (42.9%) were using same cooking oil 2 times, mixing of oil was done by 16 (57.1%) and 12 (42.9%) were aware about the hazards of reused cooking oil.

The mean value of free fatty acid was $48.3 \pm 5.4\%$, Peroxide (meq/kg) was 20.3 ± 9.12 and mean acid value was $0.88 \pm 1.05\%$

Conclusion: The repeated use of the same cooking oil is a very common practice in Pakistan due to unawareness of its hazards. In order to rectify this health issue, proactive measures should be taken both by the concerned authorities as well as the consumers to maintain a healthy lifestyle.

Keywords: Repeatedly heated cooking oil, Hazards, Awareness.

INTRODUCTION:

Deep frying is the most popular and one of the ancient methods of preparing food throughout the world, which is involved in heat and mass transferral. However, in order to decrease the cost of prepared food, oil used in frying is consumed repeatedly. Repeated heating alters the physical characteristics of the oil with increase in its consistency, change of color (darkening), frothing and reduction in smoke point¹, which may change the fatty acid constitution of the oil and makes it harmful for human consumption. Oil undergoes a number of chemical changes by heating, such as polymerization, hydrolysis and oxidation², leading to formation of oxidative products like hydro peroxide and aldehydes, having the risk of being absorbed into the prepared food³.

Cooking oils are “vegetable oils”, which are extracted from sunflower seeds, coconut, palm, ground nut and cotton seeds etc. These days these oils are extensively

used in the cooking of food. These oils have fats, which are the esters of glycerol and several straight chained mono carboxylic acids. Foods are more prone to be contaminated with chemicals during processing of food, cooking methods, time, temperature, amount of fat and oil added⁴. Several studies on formation of mutagens during preparation of food have been done earlier, but most of them were on items/cooking methods that are most often in practice in the developed countries. When cooked at higher temperatures (160–190°C) for a prolonged time, oil is susceptible to thermal oxidation, hydrolysis and polymerization with a conformational change of fatty acid from cis to trans isomers and accelerates the formation of oxidized and polymerized lipid compounds in the medium. Peroxide value is a helpful method to ascertain the quality of oil⁵.

In Pakistan, consumption of fried foods made at road side eateries, food outlets in markets and restaurants is quite common. Socio-economic status of people determines their food intake pattern. It has been reported in a survey in Pakistan that 62% of people consumed fast food on weekly basis⁶. The genotoxic potential of such repeatedly heated oils have been evaluated in few studies^{7,8}. Investigations that have been carried out in animals demonstrate that use of repeatedly heated cooking oil increases the presence of reactive oxygen species (ROS) and thus a decreased radical scavenging activity and thereby oxidative stress⁹.

Cooking oil is used in preparation of food by home cooks, food manufacturers and catering establishments such as restaurants and industrial kitchens. When used in frying at multiple times results in the formation of free radicals and other harmful constituents which adversely affect the health of the consumer by increasing blood pressure^{10,11,12,13}, risk of cardiovascular diseases^{14,15}, endothelial dysfunction¹⁶, increased lipid peroxidation, increased levels of low density lipoprotein¹⁷ and

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atherosclerosis¹⁸. So there is a need to measure the quantity of biochemical compounds in reused cooking oil and to assess the awareness about its hazards on human health among Pakistani population in order to make a public policy to combat this public health problem.

METHODOLOGY:

This cross-sectional study was done in 2012 at Hamdard College of Medicine and Dentistry, Hamdard University Karachi, after obtaining approval from the institute Ethical Review Committee. The cooking oil samples were obtained from home, lower, middle and high class restaurants using non probability convenient sampling technique. A total of 28 samples were collected after taking informed consent by the study team and anonymity was assured.

A self-administered questionnaire was used to record the site of sample collection, type of cooking oil, colour of oil, number of times the same oil was used, number of food items fried in same oil, and knowledge of consumer about the hazards of reuse of cooking oil. The biochemical analysis of each oil sample was done at Pakistan Council of Scientific & Industrial Research (PCSIR) Laboratory in Karachi for free fatty acid percentage, peroxide and acid value.

Each sample of 100 millilitre (ml) cooking oil was collected in a standard plastic container. For free fatty acid, oil sample (approximately 50 ml) was kept in a conical flask. Neutralized ethanol (50ml) in another conical flask was added with 1ml phenolphthalein 1% and 1-8 drops of 0.1% NaOH. The reagents were kept

in a water bath chamber for 2 minutes for warming purpose, then added to weighed oil sample in a conical flask, and titrated with 0.25% NaOH. The end point was brick red colour. The burette reading and free fatty acid value of the oil sample was noted. The fatty acid constitution was expressed as the percentage of total fatty acids.

For peroxide measurement approximately 50 ml oil sample was weighted in a conical flask, added with 30 ml of Acetic Acid and chloroform. After shaking for 1 minute, 0.5 ml of potassium iodide and 30 ml of distilled water was added. Then it was titrated with sodium thiosulfate. When the solution became light in colour, 0.5ml soluble starch 1% was added and re-titration was done until solution became colourless. The burette reading and its peroxide value of the oil sample was noted. The values were expressed in milliequivalent of peroxide per kilogram of the sample.

Descriptive statistics was done by determining frequencies and percentage by using SPSS version 20

RESULTS:

Out of the total 28 oil samples, equal number of samples (7) were obtained from home, as well as low, middle and high class restaurants (25% each). Most of the respondents were using same cooking oil 2 times (Table-1). Vegetable oil was used by 14 and combination of oil was used by 14 respondents for cooking. Mixing of oil was done by 16 and only 12 were aware about the hazards of reused cooking oil. Most of the oil samples were light brown in colour (Table-1).

TABLE-1: Percentage and frequency description of oil

	Characteristics	Frequency (n)	Percentage (%)
Sample collection point	Home	7	25
	Lower Class Restaurant	7	25
	Middle Class Restaurant	7	25
	High Class Restaurant	7	25
Number of times same oil used	1	4	14.3
	2	12	42.9
	3	6	21.4
	> 3	6	21.4
Type of oil	Vegetable	14	50
	Combination of oil	14	50
Mixing of oil	Yes	16	57.1
	No	12	42.9
Colour	Yellow	8	28.5
	Light Brown	10	35.7
	Dark Brown/Red	5	17.9
	Black	5	17.9
Knowledge about hazards of reused oil	Yes	12	42.9
	No	16	57.1

The mean value of free fatty acid (percent), Peroxide (meq/kg) and mean acid value (percent) are shown in Table 2.

Table -2: Measurement of hazardous contents in oil samples

VARIABLE	MEAN
Free fatty acid (percent)	48.3± 5.4
Peroxide (meq/kg)	20.39± 9.12
Acid value (percent)	0.88± 1.05

DISCUSSION:

The objective of the present research was to focus on the quality of the oil based on hazardous contents in the oil (free fatty acid, peroxide & acid value). Use of repeatedly heated cooking oil has become popular practice and majority of the people are unaware about the hazards of reused cooking oil on their health¹⁹. Nowadays, deep fried foods are being consumed in excess leading to enhanced risk of obesity²⁰. Equal percentage of samples were collected from different level of classes which consist of lower, middle and high class restaurants to ensure that the mean value is determined fairly. Number of times oil reused was twice with percentage of 42.9% while 21.4% were using oil more than three times. Study done in Kuala Lumpur reported that 47.6% of respondents were using cooking oil 3 times or more¹⁹. In our study the color of cooking oil was dark brown (17.9%). Studies have reported that repeatedly heating reduced the quality of cooking oil by darkening its color and altering its smell as well as the taste^{1,23}.

The results of this study showed that only 42.9% of respondents were aware about the hazards of reused cooking oil. Study about the level of knowledge, attitude and practices regarding repeatedly reused cooking oil showed that most of the study participants had only moderate (53.0%) or low (18.0%) level of knowledge¹⁹. The procedure of frying leads to the formation of free radicals and other noxious agents. Free-radical initiated oxidation is one of the main causes of rancidity in fats and oils²¹. During frying, food is immersed in hot oil at a high temperature of 150°C to 190°C. This study showed a very high mean peroxide level which exceeded the upper limit determined by the American Oil Chemists' Society (AOCS) which is 10 meq/kg oil²². The high value indicated increased lipid peroxidation products, mainly the peroxides that were formed in the oil while heating. Another study reported the peroxide value (>10 meq/kg) of oil heated more than five times²³.

Free fatty acids are very sensitive; at raised temperatures they go through chemical transformations like hydrolysis, oxidation, and polymerization²⁴. Heat and water quicken

the hydrolysis of triglycerides and enhance the amount of free fatty acid in the oil. This study showed increased mean percentage of free fatty acid (48.3) in repeatedly used cooking oil. Another study showed that waste frying oil contained high free fatty acid content (16.415%)²⁵.

CONCLUSION:

The repeated use of the same cooking oil is a very common practice in Pakistan due to unawareness of its hazards. Based on values that we observed in our research, both peroxide and free fatty acid increased with the repeated use of cooking oil which are harmful for health, however, many consumers of oil focus more on their earnings rather than the quality of oil. This especially occurred at lower and middle class restaurants. Thus, people visiting these restaurants are at risk of developing diseases caused by increased percentage of harmful constituents of repeatedly heated cooking oil such as, Type II Diabetes, hepatic steatosis and cardiovascular diseases. In order to decrease this health issue, proactive measures should be taken both by the concerned authorities as well as the consumers to maintain a healthy lifestyle.

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