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Original Article

Levels of Malondialdehyde in Fresh and Cooked Oil from Street Sellers and some Restaurants in Sana'a, Yemen

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Abstract

Background: Free radicals are reactive chemical species that have been linked to a variety of diseases, including heart disease, liver disease, and some cancers. The measuring of Malondialdehyde (MDA) levels in biological materials can be used as an important indicator of lipid peroxidation in vitro and in vivo for various diseases

Aim: to measure the level of MDA as an important indicator for lipid peroxidation of cooked oil of food street sellers and restaurants.

Methods: The study included 28 samples of oil; were divided into the three groups: 9 samples were collected as uncooked oil, 10 samples were collected as cooked oil (less than five times), and 9 samples were collected as cooked oil (more than five times) from food street sellers and some restaurants. Malondialdehyde, was measured by ELISA kit and data was analyzed using the statistical package, SPSS Version 21.

Results: the mean levels of Malondialdehyde in fresh and cooked oil for less than five times are 0.0458 and 0.0749 mmol/L respectively. A significant increase in MDA of cooked oil for less than five times was observed when compared to fresh oil (P value of 0.035). Also, results indicated that the mean levels of Malondialdehyde in fresh and cooked oil for more than five times are 0.0458 and 0.0635 mmol/L, respectively. A significant increase in the level of MDA of cooked oil for more than five timed was observed when compared to fresh oil (P-value of 0.015).

Conclusion: The increased in MDA levels in the cooked oil for less than five times and cooked oil for more than five times by about 40% and 30%, respectively, compared to those of fresh oil. The current finding may be considered as an awareness finding for the health risk associated with the use of cooked oil.

Keywords: Fresh oil, Cooked oil, Malondialdehyde, Lipid Peroxidation, Free radical.

Introduction:

When oxygen is metabolized by the process of oxidation, it produces unstable molecules called free radicals by taking electrons from other molecules, causing damage to DNA and other cells. Free radicals are reactive chemical species that have been linked to a variety of diseases, including heart disease, liver disease, and some cancers. However, free radical can also be produced either from exogenous sources (UV / Visible / IR irradiation or bacterial/fungal toxins) or from endogenous sources (enzymes like Superoxidae or Catalase). All major classes of bio-molecules may be attached by free radicals, but lipids are probably the most susceptible. Cell membranes are rich source of polyunsaturated fatty acids, and are readily attacked by oxidizing radicals.1

The oxidative attack of polyunsaturated fatty acids is known as lipid peroxidation. The main products of lipid peroxidation are lipid hydroperoxides (LOOH). Among the many differrent aldehydes which can be produced as secondary products during lipid peroxidation are MDA, propanal, hexanal and 4-hydroxynonenal (4-HNE).

Lipid peroxidation is a well-established mechanism of

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cellular injury in both plants and animals, and it is used as an indicator of oxidative stress in cells and tissues. Therefore, measurement of MDA is widely used as an indicator of lipid peroxidation. Increased levels of lipid peroxidation products have been found to be associated with a variety of chronic diseases in both human and animals. MDA reacts with amino group on protein and other molecules to form a variety of adducts. It also reacts with DNA bases that are mutagenic and possibly carcinogenic.3

MDA can be found in most biological samples including foodstuffs, serum, plasma, tissues and urine, as a result of lipid peroxidation. It has also been found in heated Sunflower and Palm used oils.4 MDA has been reported to be induced in various conditions and chronic disease states such as smoking, hepatitis C infection, HIV and diabetes.5-8 The determination of MDA-modified LDL was also reported as a useful marker for identifying patients related with coronary heart diseases.9

Moreover, Antioxidants are substances or nutrient in our food which can prevent or slow the oxidative damage to our body, due to the free radicals. When our body cells use oxygen, they usually produce free radicals (by-products) which can cause damage. Antioxidants acts as "free radical scavenger" and hence prevent and repair damage done by these free radicals. Health problem such as heart disease, diabetes and cancer may all be caused by oxidative damage.

Antioxidants may also enhance the immune defense system and therefore may lower the risk of cancer and infections. Antioxidants are widely used as supplements and have been investigated for prevention of disease such as cancer and coronary heart disease.10

Aim of the study:

The aim of this study is to measure the level of Malondialdehyde in cooked oil used by street food sellers and restaurants.

Subjects and Methods

This study was applied among street food sellers and some restaurants in Sana'a city, Republic of Yemen. A descriptive cross-sectional study was administered from October to November, 2014. Twenty eight oil samples were included in this study. Oil samples were collected from different food street sellers and restaurants, as well as from fresh oil of different brands (same brands that were used in food street seller and restaurants).

The samples were divided into the following groups: group one: 9 samples were collected as fresh uncooked oils (of different brands), group two: 10 samples were collected as cooked oils (used less than five times) from different sources of street food sellers and some restaurants, but of the same brands as in group 1. And group three: 9 samples were collected as cooked oils (used more than five times) from different sources of street food sellers and some restaurants, also of the same brands as in group1.

Three to five ml of oil samples were collected in small containers. Malondialdehyde was measured by Malondialdehyde ELISA kit, Catalogue Number: SL1135Hu, SunLong Biotech Co. LTD. Standards were prepared according to the procedure described by the kit. This kit allows for the determination of MDA concentration in Human serum, blood plasma, and other biological fluids. The concentration of MDA in each sample was measured spectrophotometerically at a wavelength of 450 nm, and determined by comparing of the O.D. of the samples to the standard curve.

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS-21, Chicago, USA). The results were expressed as means ± standard deviation (SD). $P< 0.05$ was considered to be statistically significant. Independent t-test was used to compare the means values. A verbal consent was obtained from all street sellers and some restaurants.

Results

The means of Malondialdehyde (MDA), for fresh, cooked oil for less than five times and cooked oil for more than five times, are 0.0458, 0.0749 and 0.0635 mmol/L, respectively, and are shown in Figure 1,. Such result indicates a significantly increase in MDA means of cooked oil for less than five times when compared to fresh oil, with 40% increase and a P value of 0.035. In contrast, there is a significant increase in MDA mean levels of the cooked oil for more than five times when compared to fresh oil, with only 30% increase and a P-value of 0.015.

However, the increase in MDA was found to be of maximum levels for the oil samples that were cooked less than five times. Afterword, the level of MDA started to decrease in the samples that were cooked furthermore times, as indicated in Figure 1.

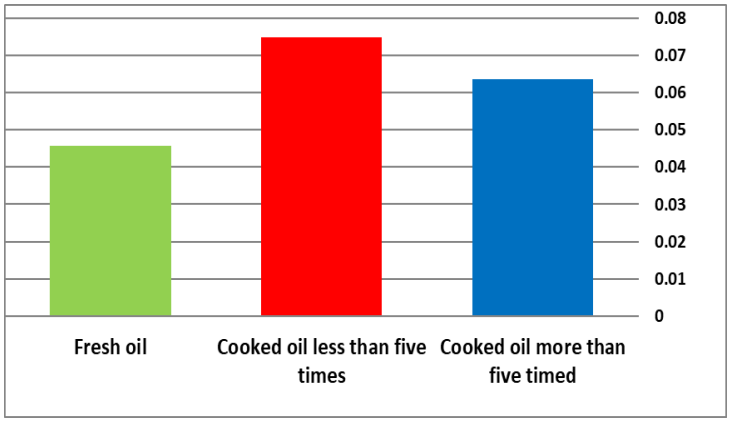

Figure 1: The Mean of Malondialdehyde (mmol/L) in fresh oil, cooked oil less than five times and cooked oil for more than five time.

Table 1 indicates a significance increase in mean levels of MDA in cooked oil less than five times when compared to fresh oil (P- value of 0.013). In addition, Table 2 indicates a significance increase in means of MDA in fresh oil and cooked oil for more than five times (P-value of 0.015). Table 3 shows that there was no lstatistically significant difference in means of MDA in cooked oils less than five times and those cooked more than five times.

Table 1: Comparison of MDA Mean±SD in fresh oil and cooked oil less than five times.

Groups	n	Mean	SD	P - value
Fresh oil	9	0.0458	±0.0062	0.013
Cooked oil<5 times	10	0.0798	±0.0354	

Table 2: Comparison of MDA Mean±SD in fresh oil and cooked oil for more than five times

Groups	n	Mean	SD	P-value
Fresh oil	9	0.0458	±0.006	0.015
Cooked oil>5 times	9	0.0635	±0.01854	

Table 3: Comparison of MDA Mean±SD in cooked oil less than five time and cooked oil more than five times.

Groups	n	Mean	SD	P-value
Cooked oil <5 times	10	0.0798	±0.0354	0.136
Cooked oil >5 times	9	0.0635	±0.01854	

Discussion

The results of the study was indicated that a significant increase in MDA in cooked oil less than five and more than five times compared to fresh oil by about 40% and 30% respectively. In contrast, the differences in MDA means of the cooked oil for less than five times and more than five times samples was not significant. Such findings suggest that the peoxidation of oil on the double bonds occurs during the first cooking period, and after the depletion of all double bonds, no more MDA is released, thus MDA mean levels remain of not much change. Furthermore, the levels of MDA in the cooked oil for five times and more than five times are not significantly increased and almost the same (about 8% less in MDA levels for those cooked more than five times). Such a non-significant change (increased) in the levels of MDA can be attributed to the depletion of all double bonds and if cooking continues some MDA may evaporate as a result

of long cooking. Therefore, thus study can be considered as an awareness finding for the health risk associated with the use of cooked oil. The production of MDA in high amounts may put people in risk for many diseases, such as, diabetes, cardiovascular, Alzheimer and cancer.11-16 However, the current study has not dealt with the effects of exposure to MDA on people or cooks of street sellers and restaurants, who may have high potential of exposure to MDA.

The current findings can be indirectly linked to a similar research that was done on Chinese women who were exposed to fumes of cooked oil at homes. Women were found to suffer from high risk of respiratory diseases, lung cancer and bladder cancer.21 However, studies have not investigated the health effects of levels of exposure to fumes of cooked oil on cooks in Chinese restaurants, who may have high exposure to fumes of cooked oil.17 This finding may indicate the exposure of Chinese woman to the products of lipids peroxidation during cooking.

Therefore, one limitation of our study was the lack of measurement of MDA in blood of food street sellers and restaurant cooks. Another limitation was the lack of information regarding periods of individual susceptibility to MDA exposure during work. Regardless of such limitations, the current study offers evidence for the presence of MDA in cooked oil which may put people at risk for diseases.

Conclusion

The study reveals that MDA is produced when oil of different brands are cooked for more than one time, or could be produced from the first cook. No much change in the MDA levels were observed when is cooked for more than five times when compare to less than five times. This can be explained by that MDA is produced on the first peroxidation of lipid and no difference as it is cooked for many times, this will be as risk factors for many diseases, such as cardiovascular and cancer.

Recommendations

It is recommended to evaluate the MDA levels in blood of street food sellers as well as cooks in restaurants, along with some other products of lipid peroxidation.

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