J Biochem Tech (2018) Special Issue (2): 128-130
ISSN: 0974-2328

Determining Hydrogen Peroxide Index of Cooking Oil: Fast Food Shops in Northern Iran

Reza Ghanbari, Milad Mousazadeh*, Seyede Parvin Moussavi and Reza Rostami

Received: 28 March 2018 / Received in revised form: 06 Jun 2018, Accepted: 11 June 2018, Published online: 05 September 2018

Abstract

Background and Aims: Extensive oxidation as a dire consequence of oil overheating leads to increasing peroxides as well as volatile compounds. Such materials can cause free radicals in humans' body and consequently result in cancers, inflammatory diseases, and atherosclerosis. According to harms of hydrogen peroxide and overconsumption of fast food by people, it is necessary to determine health factors of it in terms of food safety. Materials and Method: in this descriptive study, according to standard number 493 of Institute of Standards and Industrial Research of Iran, 128 samples of the most heated oils in peak hours were prepared with census from all fast food shops of Ramsar town (64 cases) in 2016. Having transported samples to laboratory and determined peroxide number according to standard number 4179, samples were analyzed. Data were analyzed with statistical software SPSS version 20 through tests T and Mann–Whitney.
Results: 46 samples (36%) of all were unusable and 82 samples (64%) were usable (p=0.012). Minimum number of peroxide was 1.2 miliequivalent per kilogram (MEq kg) and maximum number of peroxide was 62.5 MEq kg. Furthermore, there was a significant difference between usable and unusable oil samples in two shops ($p \leq 0.001$). Conclusion: Results revealed that peroxide concentration in most samples were more than permitted amount. Obviously, ways of using oils in studied shops were inappropriate. Therefore, it is suggested teaching owners of these shops and supervising them regularly owing to dire consequences of high peroxide on health.

Keywords: fast food shops, edible oil, hydrogen peroxide, fast food.

Reza Ghanbari
Department of Environmental Health Engineering, Faculty of Health, Qazvin University of Medical Sciences, Qazvin, Iran
Social Determinants of Health Research Center, Qazvin University of Medical Sciences, Qazvin, Iran

Milad Mousazadeh*
Student research committee, Qazvin University of Medical Sciences, Qazvin, Iran

Seyede Parvin Moussavi
Environmental Health Research Center, International Branch of Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran

Reza Rostami
Student research committee, Kermanshah University of Medical sciences, Kermanshah, Iran

***E-mail:** m.mousazadeh@qums.ac.ir

Introduction

Not only Social, financial, and demographic changes, but also appearing technologies in the past few decades has revolutionized people lifestyle. Therefore, these days individuals are bitterly suffering from sedentary lifestyle and improper eating habit including convenient food and fast food with high amount of calorie and carbohydrate (Popkin, 2006). Frying food in oils has been selected as the most widespread method for cooking food in fast food shops. Because most people develop taste for such a food due to its wonderful aroma and splendid color (Warner & Gupta, 2005). Overheating oils leads to oxidative changes in unsaturated glyceride groups and other unsaturated portions existing in oils. Consequently, nutritional properties of oils are changed and results in producing a great deal of oxidized compounds (Farrokhzaeh & et al 2011; Mohammadi, AZIZI & TASLIMI, 2007). In the other words, during overheating oils, its oxidations accelerates which consequent to producing hydro peroxides, and volatile compounds such as ketones, aldehydes, and carboxylic acids.

Oxidation of oils is the most important factor of food putrefaction. Oxidative putrefaction of oils contributes to strong smell and taste off. Furthermore, proportion or complete destruction of vitamins and the other nutrients is another consequence of it. Peroxide compounds in fried food can cause free radicals in humans' bodies. Aside from causing food putrefaction, these free radicals also harm body texture (Choe & Min, 2007). Furthermore, according to studies, they can lead to cancers, inflammatory diseases, liver disorders, and early aging (Oyagbemi, Azeez & Saba, 2009). With increasing heating time and times of using oil, the probability of such chemical reactions and consequently producing peroxide has been increased (Takeoka, Full & Dao, 1997). Studies in Iran revealed that 57% of oil samples from restaurants and 95% samples from fast food shops had a peroxide number higher than permitted level (Iranian national standard) (Arbabi & Deris, 2011; Pourmahmodi & et al, 2009). Permitted standard levels of peroxide for solid and liquid

oils are respectively 2 and 5 MEq kg (Iran SoIro, 2008). Studies by Al-Saghir and colleagues showed that consuming Trans Fatty Acids leads to increasing cholesterol-lipoprotein with high density and probability of heart diseases (Al-Saghir & et al, 2013).

It seemed so necessary to perform this research owing to some reasons such as strong tendency of people to have restaurant and fast food, penetrating restaurants and fast food shops everywhere in our country even to the remotest areas, aforementioned harms of frying and overusing oils in such centers, and poor literature study related to existing peroxide in fast food. Thus, this study aimed determining peroxide number of consumed oils in preparing fast food in Ramsar town.

Materials & Methods

In this descriptive study, samples were prepared from all fast food shops (64 shops) of Ramsar town in 2016. In reaching such a purpose, unbroken glassware (chemically, without interaction with oils) were used. Cleanliness and spotlessness of glassware was paid close attention in sampling. It should be noted that sampling was carried out with census method. 2 samples were prepared from each shop. The best time for sampling was midday when there was the hottest and overused oil. Totally, 128 samples were prepared from fast food shops in the second half of summer and first half of autumn of 2016 (August, September, October, November). The method of sampling was according to standard number 493 of Institute of Standards and Industrial Research of Iran. And samples kept at the temperature 5 to 15 degree centigrade during transportation to laboratory.

Having transported samples to laboratory, for doing test according to standard number 4179, 30 ml chloroform acetic acid solution and 0.5 ml Potassium iodide were added to 5 gram sample in an Erlenmeyer flask. Then the mixture was left 1 minute. After rest time, a few drops of starch-based adhesive and also 30 ml distilled water were added to the mixture in Erlenmeyer. Then, titration was done on that with thiosulfate solution (0.01 Normality). Upon reaching transparency in terms of samples' color, titration was usually stopped and peroxide number (MEq kg) was estimated with following formula (13).

H_2O_2 Index as Meq/kg =
(1000×normality×consumed titration volume) /Sample volume

For statistical tests according to limitation in samples numbers, tests T and Mann–Whitney were performed. Furthermore, the importance of using software SPSS version 20 cannot be abnegated in analyzing data.

Results and Discussion

46 samples (36%) from all were unusable and 82 samples (64%) were usable. The least peroxide number was 1.2 MEq kg and the highest was 62.5 MEq kg. From total 67 samples fast food, 27 samples (21.09%) were unusable and 40 samples (33.24%) were usable. The least peroxide number for fast food samples was 1.5 MEq kg and the highest was 68.25 MEq kg. Furthermore, from all 61 sandwich samples, 42 samples (31.87%) were usable and 19 samples (14.84%) were unusable. The least peroxide number for sandwich samples 3.6 and the highest number was 65.7 MEq kg. Table 1 presented distribution of abundance of peroxide (MEq kg) in oil samples of fast food shops.

Table 1- Distribution of abundance of peroxide in oil samples of fast food shops of Ramsar town (MEq kg)

Sandwiches	**Fast food**	**Peroxide (mEq/kg)**
(10 %) 14	(7.81 %) 10	Under 5
(21.87 %) 28	(23.43 %) 30	5-15
(13.28 %) 17	(17.18 %) 22	15-30
(1.56 %) 2	(3.93 %) 5	30-65
(47.65 %) 61	(52.35 %) 67	Total

Findings revealed that peroxide number in most usable oils in fast food shops was higher than permitted level. Table 2 shows average and standard deviation of peroxide in oil samples of fast food shops. Statistically, there was a significant difference between usable and unusable oil samples in both fast food shops and sandwich centers ($p \leq 0.001$).

Table 2- Average and standard deviation of peroxide of oil samples from fast food shops

Sandwich center	Fast food shop	usability
5.23 ± 3.92	6.17 ± 4.64	yes
31.47 ± 10.21	32.84 ± 10.62	no
≤ 0.001	≤ 0.001	P.Value

Regarding results from Mann–Whitney test, there was not a significant difference between usable and unusable oils in 2 months of summer and 2 months of autumn. Furthermore, there was not any remarkable difference between peroxide number of usable and unusable oils ($p>0.05$). In the other words, summer and autumn seasons did not affect producing or increasing peroxide number in studied oils.

Results showed peroxide amount of consuming oils in most samples were higher than permitted level. The reasons why there was such a problem were high temperature, frying time, type of oil, and existing antioxidant. In a study by Ammarlouyi and colleagues on studying the amount of peroxide in consuming oils of fast food shops in Elam in 2013, peroxide number of samples was over permitted level (Amarloei, 2013).

In a research by Takouka and colleagues, it was revealed that frying food by oils at high temperatures causes toxins what negatively influence on both food quality and consumers' health. The longer and more times of using oil, it is the more probable to have chemical reactions and consequently more peroxide amount (Takeoka, Full & Dao, 1997). In a research work in Kashan on Zoolbia and Bamieh (two kinds of traditional Iranian cookie specialized for entertaining in Ramadan month) by Asemani, the

highest peroxide numbers of samples were 65 and 38.8 MEq kg (Horwitz, 1975). They were over standard level and such a result corresponded with the present study.

Conclusion

According to the results, it turns out that most of the oils collected at the fast food shops that is sampling they were oxidized which may cause health problems. The present study suggests that, in order to train owners of these shops who should be used to fry foods from special frying oils in addition, do not use heat for a long time to fry and use of these oils as a long time should be avoided. Regarding increasingly consumption of fast food especially fried food, it is necessary to pay close attention to dire consequences of using them. For future studies, in addition to peroxide number, it would be a great idea to measure unpleasant and toxic compounds owing to high temperature of fried food. Moreover, considering consequences of peroxide on health, it is necessary to teach fast food workers and supervise them regularly.

References

Al-Saghir, S., Thurner, K., Wagner, K. H., Frisch, G., Luf, W., Razzazi-Fazeli, E., & Elmadfa, I. (2004). Effects of different cooking procedures on lipid quality and cholesterol oxidation of farmed salmon fish (Salmo salar). *Journal of Agricultural and Food Chemistry*, *52*(16), 5290-5296.

Amarloei, A., nikseresht, K., Gholami Parizad, E., Pour Abbas, A., & khodarahmi, F. (2013). Study of peroxide value of oil consumed in the deli systems (Sandwich and Falafel) in Ilam city. *scientific journal of ilam university of medical sciences*, *21*(6), 182-188.

Arbabi, M., & Deris, F. (2011). Determination of hydrogen peroxide index in the consumption edible oils in fast food shops. *Journal of Shahrekord Uuniversity of Medical Sciences*, *13*.

Asemi, Z., Ziya, S., Doulati, M. A., Abedi, T., Hosseini, A., & Yosefi, H. (2006). Evaluation of peroxide concentration in Zoolbia and Bamieh in Kashan City in 2003–2004. *KAUMS Journal (FEYZ)*, *9*(4), 56-60.

Choe, E., & Min, D. B. (2007). Chemistry of deep-fat frying oils. *Journal of food science*, *72*(5), R77-R86.

Farrokhzaeh, H., Ghorbani, E., Hashemi, H., Mohebat, L., Nikaeen, M., Hassanzadeh, A., ... & Jaberi, H. (2011). Measuring the used oil rancidity indexes in confectioneries and delicatessens of the town of Borkhar and Meymeh in Isfahan province in 2009..

Horwitz, W. (1975). *Official methods of analysis* (Vol. 222). Washington, DC: Association of Official Analytical Chemists.

Iran SoIro. Oils and fat of Animal and herbaceous. peroxide measurement. Tehran2008.

Mohammadi, T., Azizi, T. M. H., & Taslimi, A. (2007). Relation Of Fatty Acids Composition With Stability Of Sunflower And Canola Oil Blends

Oyagbemi, A. A., Azeez, O. I., & Saba, A. B. (2009). Interactions between reactive oxygen species and cancer: the roles of natural dietary antioxidants and their molecular mechanisms of action. *Asian Pac J Cancer Prev*, *10*(4), 535-44.

Popkin, B. M. (2006). Global nutrition dynamics: the world is shifting rapidly toward a diet linked with noncommunicable diseases–. *The American journal of clinical nutrition*, *84*(2), 289-298

Pourmahmodi, A., Akbar-Tabatori, M., Poursamadi, A., Sadat, A., & Karimi, A. (2009). Determination peroxide-value in the consumption oils at restaurants and fast food shops in Yasouj. *J Yasuj Univ Med Sci*, *13*(1), 115-23.

Takeoka, G. R., Full, G. H., & Dao, L. T. (1997). Effect of heating on the characteristics and chemical composition of selected frying oils and fats. *Journal of Agricultural and Food Chemistry*, *45*(8), 3244-3249.

Warner, K., & Gupta, M. (2005). Potato chip quality and frying oil stability of high oleic acid soybean oil. *Journal of food science*, *70*(6), s395-s400.