

EFFECT OF STORAGE CONDITIONS ON MDA LEVELS OF DIFFERENT CLASS AND TYPE OF DRY DOG FOOD

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Abstract

The aim of this study was the determination of malondialdehyde (MDA) changes of 20 dry types of premium (P) and economic class (E) commercial dog foods at different stocking temperatures (4 °C, 20 °C, 35 °C) and different stocking times (3, 6, and 12 months). At the time of purchase, MDA concentrations of premium dry type foods were lower than those of economic class. The MDA concentrations of dog food increased with the progress of stocking times at increasing temperatures. In the 10th month of stocking, the MDA levels was significantly higher, up to 6 times at a temperature of 35 and a storage time of 10 months compared to the concentration at the time of purchase. Malondialdehyde, often known as MDA, is the result of the oxidation of polyunsaturated fatty acids in food during cooking and storage. Cellular proteins can react with MDA from the body and from ingested sources and the reaction products are considered harmful.

Key words: dry dog food, MDA concentration, storage condition

To meet their dogs' optimal nutrient-energy needs and to ensure their long-term health, dog owners select the best food possible (Heinze C.R., 2016). The storage conditions affect a commercial pet food's capacity to keep the best nutritional quality and flavor (Kara K., 2021; Koppel K., 2014).

Even though there is a difference between dog foods in terms of shelf life, the shelf life of unopened dry extruded dog food ranges from 4 months to 3 years, depending on the information on the label. However, manufacturers typically claim that the shelf life of the majority of dry extruded dog foods is roughly one year as stated on the label (Case L. et al, 2011; Hillestad K., 2018).

During the storage of commercial dry dog food, various processes can take place that affect its natural properties (Usuga A. *et al*, 2023). One of these is lipid peroxidation (Marchi M., et al, 2014). This process can lead to rancidity of the food and therefore a reduced shelf life. (Błaszczuk A. et al, 2013). Antioxidant additions, either natural or synthetic, are used to stop lipid peroxidation, which is a sign of shelf life (Case L. et al, 2011; Glodde F. et al, 2018).

One of the main causes of the deterioration of animal feed with high levels of polyunsaturated fatty acids and their shortened shelf life is lipid oxidation. Products of oxidation alter the flavor of food and the fatty acid composition (Stadtman E.R. and Levine R.L., 2003).

Malondialdehyde (MDA) is a final oxidation product of lipids, and is used as a barometer of lipid oxidation levels. The determination of MDA is one of the oldest methods of assessing the degree of lipid oxidation and one of the most widely used markers of oxidative stress (Verk B. *et al*, 2017).

Malondialdehyde is the result of the oxidation of polyunsaturated fatty acids in food during cooking and storage. MDA can develop in both human and animal bodies. Cellular proteins can react with MDA from the body and from ingested sources and the reaction products are considered harmful (Beynen A.C., 2022)

The aim of this study was the determination of malondialdehyde (MDA) changes of 20 dry types of premium (P) and economic class (E) commercial dry dog foods. Different stocking temperatures (4 °C, 20 °C, 35 °C) and different storage times (3, 6, and 10 months) were examined.

MATERIAL AND METHOD

MDA (Malondialdehyde) concentration was determined in 20 brands of dry dog food. The dog foods consisted of 10 premium classes (P) and 10 economic classes (E), collected from various veterinary shops. Analyses were carried out at the time of purchase of the food, and then at storage intervals of 3, 6 and 10 months, and at different storage temperatures (4 °C, 20 °C and 35°C). The

dog food was stored at 4 °C in a refrigerator and. Stocking of dog food at 21 °C and 35 °C was carried out in two different thermostatic control cabinets. Dry foods in pellet form were milled after each different stocking condition. The quantity of MDA was measured using an assay test kit, spectrophotometric. MDA is condensed with thiobarbituric acid (TBA) to form a red product with maximum absorption peak at 532nm. After colorimetry, the content of lipid peroxide in the sample can be estimated, and the same time absorbance at 600 nm is measured. The amount of MDA was calculated using the difference in absorbance at 532nm and 600 nm.

RESULTS AND DISCUSSIONS

Following the analyses carried out we noticed that MDA concentrations of dog food stocked at different temperatures increased significantly with increased stocking times. The presented study shows individual differences between commercial companies in terms of MDA values of commercial dog foods at the time of purchase. At the time of purchase, the concentrations of MDA (29 mg/kg) in dry-type premium dog foods were lower than those concentrations of dry type economic foods (35 mg/kg) (*Table 1*). The dog food type was effective changing the MDA concentration of the dog food according to the stocking conditions. MDA concentrations of the dog foods at 3, 6, and 10 months stocking times were similar for P and E dog foods. From *Table 1* we can see the increased level of MDA with increasing temperature and storage time. The increase of MDA levels was progressive. The MDA concentration increased from 29 mg/kg feed at the time of purchase to 65 if the food was kept at a temperature of 4 °C for 10 months, and even to a level of 215 when the temperature was 35 degrees for a period of 10 months, in the case of economic classes dry food. if we are referring to the premium classes, here we can also observe a gradual increase from 29 mg/kg food at the time of purchase to a level of 196 mg/kg food in samples kept for 10 months at 35 °C.

The extrusion process applied in pet food production as well as the storage time of the food are the main conditions that cause lipid oxidation in these foods (Chanadang S. *et al*, 2016). There are studies showing that the extrusion process has a negative effect on antioxidants (Case L.P *et al*, 2011).

Oxidation products that form, is evidenced by changes in the taste and smell of food. In the present study, it was found that the increase in the concentration of MDA, which is the indicator of the density of its final oxidation products, reveals that the oxidation duration is different between food classes. Premium classes foods had lower concentrations in terms of oxidation end products (MDA) than economic foods. It is possible that premium foods include high levels of antioxidants and no use of oxidized raw materials (animal fat, vegetable oil, etc.) in the formula, but differences in extrusion processes may occur (Ahlstrom Q. *et al*, 2004). Increases in MDA levels due to increased storage temperatures up to 35 °C in the present study were consistent with those in the literature. In the present study, MDA that increased with increasing storage times and temperatures were similar to the results of increased lipid peroxidation of dried dog food stored for 7 months at 21 °C by Holda K. and Glogowski R. (2016). However, it is believed that storing dry food for more than 6 months at high temperatures will adversely affect the food consumption of dogs by increased lipid peroxidation of the food.

CONCLUSIONS

The MDA and concentrations of dog dry food increased with the progress of stocking times at increasing temperatures. Stocking dog food at 35 °C for up to 3, 6 and 10 months had a significant effect on lipid peroxidation. It can be seen that the typical storage of dry dog kibbles has an effect on the lipid fraction properties.

Table 1

The effect of stocking at different temperatures and different times on the average concentration of MDA (mg/kg food) in dog foods

| | Temperture | Time of purchase | 3 months | 6 months | 10 months |
|---------------|------------|------------------|----------|----------|-----------|
| Economic food | 4 °C | 35 | 38 | 52 | 65 |
| | 20°C | 35 | 58 | 85 | 105 |

| | | | | | |
|--------------|------|----|----|-----|-----|
| Premium food | 35°C | 35 | 65 | 110 | 215 |
| | 4°C | 29 | 32 | 40 | 45 |
| | 20°C | 29 | 35 | 42 | 86 |
| | 35°C | 29 | 48 | 86 | 196 |

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