

Determination of some quality characteristics in pet foods*

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Summary: The purpose of this study was to determine some quality characteristics in pet foods. For this purpose 36 samples each of cat and dog dry extruded foods were taken from market, and moisture, water activity and durability index analysis were made. The mean water activity values were 0.41 at 24.59°C and 0.44 at 24.47°C for cat and dog dry extruded foods, respectively. Moisture level was 5.89% for cat food, 6.44% for dog food, durability index was 98.22% for cat food, 98.91% for dog food. The correlation coefficients between moisture and water activity in cat and dog foods were found to be 0.580 and 0.525, respectively ($P < 0.01$). Water activity ($P < 0.05$) and moisture values ($P < 0.01$) were significantly higher in dog foods than cat foods. Thus, we can conclude that food samples of cat and dog obtained from the market are safe and of good quality.

Keywords: Durability index, moisture, pet foods, shelf life, water activity.

Kedi ve köpek mamalarında bazı kalite özelliklerinin belirlenmesi

Özet: Bu çalışmada kedi ve köpek mamalarında bazı kalite özelliklerinin belirlenmesi amaçlanmıştır. Bu amaçla piyasadan 36 adet kedi ve 36 adet köpek kuru ekstrude mamalarından örnekler alınarak nem, su aktivitesi ve dayanıklılık indeksi yönünden analiz edilmiştir. Kedi kuru ekstrude mamalarda ortalama su aktivitesi değerleri 24.59°C' de 0.41, köpek kuru ekstrude mamalarında ise ortalama 24.47°C' de 0.44 olarak bulunmuştur. Nem düzeyi kedi mamalarında ortalama %5.89 ve köpek mamalarında ise %6.44 düzeyinde, dayanıklılık indeksi kedi mamalarında %98.22, köpek mamalarında ise %98.91 olarak saptanmıştır. Kedi ve köpek ekstrude mamalarında su aktivitesinin nem düzeyi ile korelasyon katsayısı sırasıyla 0.580 ve 0.525 olarak bulunmuştur ($P < 0.01$). Köpek kuru ekstrude mamalarında su aktivitesi değeri ($P < 0.05$) ve nem düzeyi ($P < 0.01$) kedi mamalarından önemli ölçüde daha yüksektir. Sonuç olarak, piyasadan toplanan 36 kedi ve 36 köpek kuru ekstrude mamalarının raf ömrünü etkileyen özellikler bakımından iyi kaliteli olduğu belirlenmiştir.

Anahtar sözcükler: Dayanıklılık indeksi, kedi-köpek maması, nem, raf ömrü, su aktivitesi.

Introduction

Important developments related to pet sector took place especially in the second half of the twentieth century as in all other scientific subjects. Positive changes in the socio-economic levels of people and their lifestyle make notable improvements in interest of pets. The pet sector has shown developments with the production of balanced and advanced pet foods.

Pet food and other animal feeds need to be nutritionally safe and stable at a specified shelf life. Just like human food, pet diet components are susceptible to microbial, chemical, physical, and insect spoilage. Water activity (a_w) is a very practical tool in developing and producing nutritious, safe and stable pet food because it is critical for microbial growth, texture, flavor, chemical reactivity (such as browning or lipid oxidation), or enzyme activity (2).

Water activity is based in thermodynamics and is defined as the vapor pressure of water over a sample divided by the vapor pressure of pure water at a given temperature. Water activity values represent a scale that ranges from 0 to 1 (3). Bacteria, molds and yeast require water for growth and every microorganism has a minimum water activity below which it does not grow. A water activity less than 0.85 is needed in food in order to avoid regulatory attention. At this value a food is considered to be non-hazardous because there is not enough available water to support pathogen growth. Dry pet food and hard treats typically are in the a_w range of 0.40-0.45 (11). At this low level of available water ($< 0.6 a_w$), microbial stability is not an issue. Canned foods, however, are typically higher than 0.85 a_w and should be acidified. Although water activities less than 0.85 is considered to be non-hazardous from the pathogenic bacterial growth

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point of view, but growth of yeast and molds can cause spoilage and physical deterioration. Soft pet foods and kibbles typically fall in this intermediate range 0.60-0.85 a_w and supplementary processing such as pasteurization, pH control or addition of preservatives is necessary for protection of these foods (11).

Physical stability is extremely dependent on water activity. Dried foods will come to a final equilibrium with their environment. If the relative humidity of the environment is higher than the water activity of the product, the product will take on water until it reaches equilibrium with the environment. If this added water activity is above the critical limit for the food, it will begin to cake which is unacceptable to the consumer.

A critical water activity limit should be determined for each new product. This can be established by creating a water absorption isotherm. An isotherm is created at a set temperature by examining water activity readings vs. moisture readings for a product. From the isotherm, the water moisture level that the product will reach at a specific relative humidity at a set temperature can be established. If the moisture level associated with the critical limit (physical characteristics change) for a product is noted, storage/packaging conditions can be established. A product with a critical limit above realistic storage conditions will need no special packaging. Products with a lower critical limit might need airtight sealed containers (11).

Insects are another potential problem during storage of pet foods, which in some cases can be controlled by water activity. Mites are commonly found in some food ingredients and have the ability to survive through some processing steps. Mites may be active at 5°C above 0.65 a_w , at 25°C above 0.63 a_w and at 40°C above 0.60 a_w . Dry pet foods and treats, which are well below 0.60 a_w , should remain free of mites (6).

Most of the pet foods consist of dry foods and 95% of dry foods are extruded pet foods. Quality of extruded, pelleted foods are affected by some factors related to their production. However, the studies to determine the water activity and durability index of pet foods are limited and there is no study about this subject in Turkey. Therefore the objective of this research was to determine some quality characteristics in pet foods with measuring moisture, water activity and durability index.

Materials and Methods

Material: Thirty-six samples each from cat and dog dry extruded foods were randomly collected from market. Each and every sample belonged to different companies and had different ingredients and composition.

Traits measured: Moisture content of the pet dry extruded foods was determined according to the AOAC (1). The durability index was measured by Phost box equipment (Figure 1) as follows:



Figure 1. Phost box equipment.

Şekil 1. Phost box aleti.

- Measure the diameter of particulate of dry extruded pet food.
- Pass the pet food sample from the sieve having the diameter 1-1.5 mm, smaller than that of sample particle.
- Weigh about 100 g from the sample on the sieve (W1); place it in the cylinder having 2 metal rings and then put another 2 metal rings in the cylinder above the sample.
- Cover the cylinder and placed it in the Phost box equipment.
- Repeat four times for the same sample
- Run the Phost box equipment, cylinders are rotated. After 10 minutes the equipment is stopped.
- Remove the cylinders
- Sieve the food samples in the cylinder, remove the rings.
- Weigh the sample left over the sieve (W2)
- Calculate the durability index (DI) as follows:

$$DI = (W2 * 100) / W1$$

Water activity values of extruded pet foods were measured by using water activity equipment (LabSwift- a_w , Novasina, Switzerland).

Statistical analysis: Data of extruded pet foods were given as mean \pm standart error, minimum and maximum. Comparison between dog and cat foods was examined with Student t test. Correlation of moisture, water activity and durability index values of foods was determined by Pearson analysis method. Level of significance was taken as $P < 0.05$ (5).

Results

Water activity, moisture and durability index values of cat and dog extruded foods were given in Table 1. The average water activity value was found to be 0.41 for cat dry extruded food and 0.44 for dog dry extruded food. The mean temperature at water activity measurement was determined as $24.59 \pm 0.25^\circ\text{C}$ for cat and $24.47 \pm 0.31^\circ\text{C}$ for dog extruded foods.

Correlation between water activity, moisture and durability index values of cat and dog dry extruded foods was given in Table 2. The scatterplots between water activity and moisture levels of pet dry extruded foods were given in Figure 2 and Figure 3. Water activity ($P < 0.05$) and moisture ($P < 0.01$) of dog dry foods were found to be higher than those of cat dry foods.

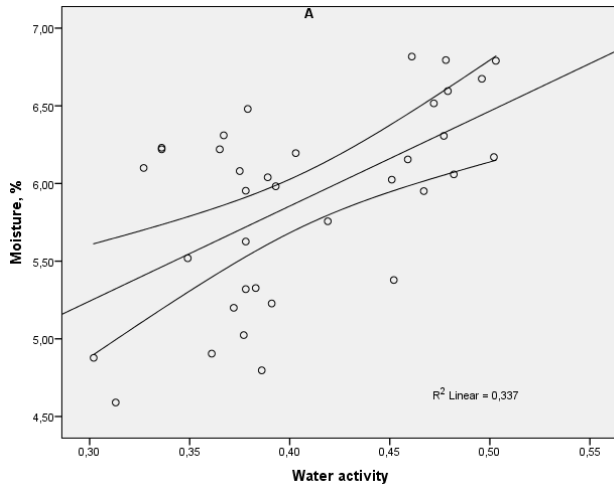


Figure 2. Scatterplot between water activity and moisture levels in cat extruded foods.

Şekil 2. Kedi ekstrude mamalarda su aktivitesi ve nem düzeyleri arasındaki saçılım grafiği.

Discussion and Conclusion

Water activity plays very important role in physical, chemical and biological durabilities of pet foods. Therefore, water activity value is an important parameter for production, packaging and shelf life of dry foods. Dry pet food and hard treats typically are in the 0.40-0.45 water activity range as shown by Timmons (11). Novasina (8) reported that values of water activities as 0.25-0.50 in cat and dog dry foods. Decagon (6) also reported the range of water activity value for pet foods was 0.40-0.65 and the microorganisms generally inhibited by lowest water activity in this range were *Saccharomyces rouxii*, *Aspergillus echinulatus* and *Monascus bisporus*. In this study, the average water activity was found to be 0.41 in cat dry extruded food at 24.59°C and 0.44 in dog dry extruded

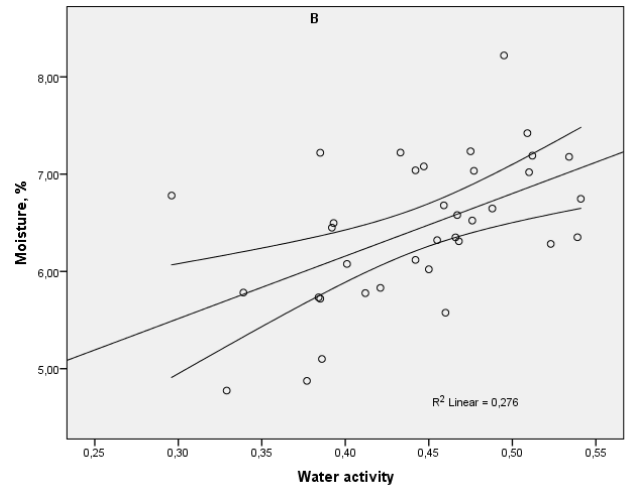


Figure 3. Scatterplot between water activity and moisture levels in dog extruded foods.

Şekil 3. Köpek ekstrude mamalarda su aktivitesi ve nem düzeyi arasındaki saçılım grafiği.

Table 1. Water activity, moisture and durability index values of cat and dog extruded foods¹

Tablo 1. Kedi ve köpek ekstrude mamalarda su aktivitesi, nem ve dayanıklılık indeks değerleri¹

	Cat Extruded Food	Dog Extruded Food	t	P
Water activity	0.41±0.01 (0.30-0.50)	0.44±0.01 (0.30-0.54)	-2.642	0.010
Moisture, %	5.89±0.10 (4.59-6.82)	6.44±0.12 (4.77-8.22)	-1.401	0.166
Durability index, %	98.22±0.46 (88.78-99.98)	98.91±0.19 (94.42-99.98)	-3.382	0.001

1: Mean±SE (min-max).

1: Ortalama±Standart hata (minimum-maksimum).

Table 2. Correlation between water activity, moisture and durability index values in cat and dog extruded foods.

Tablo 2. Kedi ve köpek ekstrude mamalarda su aktivitesi, nem ve dayanıklılık indeksi değerleri arasındaki korelasyon.

		Cat Extruded Food		Dog Extruded Food	
		Moisture	Durability index	Moisture	Durability index
Water activity	r	0.580	0.358	0.525	0.324
	p	<0.001	0.032	0.001	0.054
Moisture	r		0.197		0.231
	p		0.250		0.175

r: Pearson correlation coefficient.

r: Pearson korelasyon katsayısı.

food at 24.47°C. In some researches (6,11) pet dry foods should be lower than 0.60 water activity levels for protection from any infestations. In this study maximum water activity levels were found to be 0.50 for cat dry food and 0.54 for dog dry food, lower than 0.60. Therefore, it was concluded that pet dry extruded foods in the market are not susceptible to any distortion.

In this study average and maximum moisture levels were found to be 5.89% and 6.82% for cat dry food and 6.44% and 8.22% for dog dry food, respectively. These values are low because they are produced with extrusion technique. Pet dry foods in the market have a longer shelf life due to having less moisture (4). Schmidt and Fontana (9) observed that pet dry foods contained 4.4% moisture and 0.236 water activity at 25°C.

Physical properties of foods besides nutritional quality and safety are also very important. Foods must be in the form of high quality pellets not to crumble during transportation and distribution. Shredding of foods adversely affect the food consumption of pet animals (10,13).

In this study, average durability index was found to be 98.22% for cat dry extruded foods and 98,91 for dog dry extruded foods. Because of using extrusion methods in their production, the foods were resistant to crumble. Tran et al. (12) reported that durability index of extruded commercial dry dog food was $88 \pm 10.7\%$. In another study (13), durability index of dry dog foods was recorded between 80.7 to 92.5% according to the pressing characteristics and heat treatment used in their production (13). Durability index of foods was observed to be higher in this study than those of other studies (12, 13). These results may vary depending on the production methods and durability index measurement methods.

Labuza and Altunakar (7) reported that the water activity level that limits the growth of the all microorganisms is 0.60. This water activity level will not support growth of microorganisms, however microorganisms are alive at low water activity value and they begin to grow when they find a suitable environment. Therefore, the relationship between water activity and moisture must be known.

In this study the correlation coefficients between moisture and water activity in cat and dog dry foods were found to be 0.580 and 0.525, respectively ($P < 0.01$).

Water activity value of dog dry foods (0.44) was found to be higher ($P < 0.05$) than that of cat dry foods (0.41). This difference may be due to the raw materials in foods. Foods having various raw materials such as fish, poultry meat, lamb meat, egg, milk and vegetables show different water activity.

Moisture levels of dog dry foods were found to be higher than those of cat foods ($P < 0.01$). This difference may be due to the different raw material usage in foods and extrusion technique.

It is concluded that cat and dog dry extruded foods obtained from market were safe and of good quality. Further studies must be done with pet foods subclassified to age, wet and semi-moist pet foods.

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