

# Determination of the Fraud of Processed Meat Products by ELISA

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**Abstract:** Determination of meat origin is important for consumer rights, religious beliefs and national laws. Nowadays, people demand reliable information about the food they consume. The consumer's choice is greatly influenced by the food composition detailed in labeling. In the case of processed meat products, this is going to be especially important because fraud cannot be visually assayed understood. Consumers cannot take measures except to trust the label information on the product. Enzyme-Linked Immuno Sorbent Assay (ELISA) is widely used technique for in detecting meat product authenticity because of its specificity, simplicity and sensitivity. 155 fast food samples (77 toasts, 38 hamburgers and 40 pizzas) sold as 100% beef products collected randomly from fast food restaurants in İstanbul, Tekirdağ and Edirne were analyzed by using ELISA. Fraudulent meat products were found in 53 (34.2%) of 155 fast food samples. Although it was detected horse-meat in two toasts, no pork was detected in samples.

**Keywords;** Meat product, animal species, fraudulent meat, ELISA

## İřlenmiř Et Ürünlerindeki Hilelerin ELISA Tekniđi ile Tespit Edilmesi

**Özet:** Tüketime sunulan etlerin orijinlerinin belirlenmesi, tüketici hakları, dini inançlar ve ulusal mevzuatlar yönünden önemlidir. Günümüzde insanlar, tükettikleri gıdalara iliřkin güvenilir bilgiler talep etmektedirler. Gıdaların etiketlerinde ayrıntılı şekilde belirtilen içerik bilgileri, tüketicilerin tercihlerini büyük ölçüde etkilemektedir. İřlenmiř et ürünlerinde bu yönde yapılan hile duyuşal olarak analiz edilemez. Tüketicilerin, ürün üzerindeki etiket bilgisine güvenmek dışında alabileceđi önlem yoktur. Enzim Bađlı İmmunoSorbent Testi (ELISA), özgülüđü, basitliđi ve duyarlılıđı nedeniyle, et ürünlerinin orijinalliđinin tespitinde yaygın olarak kullanılan bir testtir. Bu çalışmada, İstanbul, Tekirdağ ve Edirne'deki fastfood lokantalarından % 100 sığır eti ürünü olarak satılan, 155 gıda örneđi (77 tost, 38 hamburger ve 40 pizza) ELISA tekniđi ile incelendi. Örneklerin, 53 tanesinin (% 34,2) hileli olduđu bulundu. İki tostta at eti tespit edilirken örneklerin hiçbirinde domuz eti tespit edilmedi.

**Anahtar kelimeler;** Et ürünü, hayvan türü, hileli et, ELISA

## Introduction

Meat one of the best sources of protein for humans, and delicious is widely consumed worldwide [19]. Identification of animal species used in the production of meat products is important for consumer rights, religious beliefs and national legislation. In addition, the control of, the content of processed meat products is also economically important. The marketing of low-value animal meat as superior value meat can only be prevented by strict controls. Meat products are the most appropriate food product for to realize adulteration because of valuable, expensive and healthy animal meats can be easily mixed with less valuable meats and sick animal meats [21]. The escalating prices of commercial meat commodities and the globalization of food trade the incidence of meat adulteration and fraud

have become more commonplace [8, 17]. Consumers have a right to know that what meat species they eat. Nowadays, many consumers are concerned about the meat they consume and, rely on labeling information when choosing among meat products [7]. In recent years, reduction of beef, increase of import live cattle and feed price in Turkey have led to an increase in meat prices. Beef meat consumption per person decreased from 14.2 kg to 13.2 kg in 2016 [2, 18]. Beef is one of the important food for a balanced diet in Turkey, however, the increase of prices made it more difficult to reach those products [2]. The price increases caused the consumer to choose the products of firms that are away from food safety and quality standards while reducing the consumption [20]. For this reason, independent studies that investigating fraudulent meat in meat

products is important for informing the public and monitoring the national measures.

Determination of the sources of meat in meat products attracts researchers' attention, due to important for community health, tradition, and religious preoccupation. For this purpose, a variety of methods have been developed. These methods have been classified as morphological, electrophoretic, immunological, serological and genetic methods as well as methods based on sensory qualities, anatomical differences, histological characteristics of hair, properties of tissue fats and amount of glycogen in meat [4, 9, 16, 24]. DNA technology and PCR technique are used to identification of animal species in meat products in a way faster, simpler and reliable but cost. PCR techniques used for the identification of meat species include RAPD-PCR [14], species-specific PCR [15], RFLP-PCR [1], real-time PCR [23], simplex and multiplex PCR [12]. Electrophoretic methods are used in the determination of animal species in meat products according to protein profiles of either general protein or specific enzymes. The Sodium Dodecyl Sulfate Polyacrylamide Gel Electrophoresis (SDS-PAGE) technique can be used successfully in the determination of up to 5-10% of animal species in meat products and their mixtures. However, since electropherograms are affected by various factors, it is necessary to pay attention to the interpretation and interpretation of these techniques [10]. The multiplex PCR and ELISA are widely preferred technique to determine meat origin because of its specificity, simplicity and sensitivity [5, 12, 13, 24]. SDS-PAGE, AGID and Uhlenhuth pre-sipitation ring methods can also be used in laboratories that do not have this opportunity [24].

In this study, fast food products containing meat (toast, pizza, and hamburger) sold as a 100% beef products were analyzed to determine the origin of meat by using the ELISA method. [3].

## Material and Method

Samples were collected randomly from fast food restaurants and from meat products of different companies with different production serial numbers in 2015-2016. Toast, hamburgers, pizzas samples sold as 100 % beef products. A total of 155 samples

were collected 30 (10 toast, 10 hamburgers and 10 pizzas) from Edirne, 30 (10 toast, 10 hamburgers and 10 pizzas) from Tekirdağ and 95 (57 toast, 18 hamburgers and 20 pizzas) from İstanbul. The collected food samples were stored at -20°C until the tests were performed.

ELISA method was used to identify the animal species in meat products. ELISA method is determined the specific enzymes belonging to animal species [11, 13, 21]. ELISA tests were carried out in Biotechnology and Genetics Laboratory, Keşan Vocational School, Trakya University. Meat products in the collected specimens were individually separated in sterile bags. Those not heat-treated were subjected to heat treatment. Protein extraction and ELISA (Elisa Stat Fax 303/Plus, USA) studies were performed using the commercial kit (Elisa-Tek, 2501 NW 66th Court, Gainesville, FL 32653, USA) according to the manufacturer's instructions. The findings obtained from samples analyzed were calculated as the percent value (%) using Excel statistics program with Windows 2010.

## Results

We studied 155 samples and detected the pure beef in 60 toasts (77.9%) and in 22 hamburgers (57.9%) and in 20 pizzas (50.0%). Fraudulent meat products were found in 53 (34.2%) of 155 food samples (Table 1). In the samples, 102 (65.8%) beef, 51 (32.9%) beef and poultry meat, 2 (1.3%) beef and horse-meat were detected. Although it was detected horse-meat in two toasts, no pork was detected in samples. The number of fraudulent meat sample for toast, pizza, and hamburger samples was found 17 (22.1%), 16 (42.1%), 20 (50.0%), respectively, which are shown in Table 1.

**Table 1.** Samples collected from the market by random sampling and their analysis results.

Sample Name	Sample number n	Beef products n (%)	Beef-Poultry meat mixture n (%)	Beef-Horse meat mixture n (%)
Toast	77	60 (77.9)	15 (19.5)	2 (2.6)
Hamburger	38	22 (57.9)	16 (42.1)	0 (0.0)
Pizza	40	20 (50.0)	20 (50.0)	0 (0.0)
Total	155	102 (65.8)	51 (32.9)	2 (1.3)

The present study investigated whether the information given by the manufacturers on the label

was correct. Results of the present study showed that 53 of total 155 beef samples had been mislabeled.

## Discussion

Uncovering of adulterated meat products is important for several reasons. Allergic individuals and those who hold religious beliefs that specify allowable intake of certain species have a special interest in proper labeling. Proper labeling is also important to help fair-trade. This issue is being more important as the halal market has expanded in global trade. [7, 10, 12]. Consumers cannot take measures except to trust the label information on the product. For this reason, to do independent studies are important for informing the public and for monitoring the national measures. In Turkey, according to the Turkish Food Codex: Notification of meat and meat products (Notification no: 2012/74), prepared meat mixtures should not be produced by mixing the beef with poultry meat, after March 1, 2013 [3].

It was reported that 19.2% of the products were fraudulent meat, in a study conducted on 410 samples in Bursa and İstanbul region [11]. In the study with 116 samples in İzmir province and its vicinity, it was reported that 15.5% fraudulent meat products were found [21]. The other study was carried out in Istanbul province totally 79 samples and, it was reported 53.4% fraudulent meat products. In this study, the rate of fraudulent meat products was determined as 34.2%. The increase in the proportion of fraudulent meat products in studies conducted after 2010 is thought to be related to increased red meat prices.

Yalçın and Alkan [24] determined horse-meat in 4 (2.86%) of the 140 samples by Agar gel immunodiffusion assay. Türkyılmaz et al. [22] found horse-meat (or donkey) in 4 (2.5%) and, pork in 2 (1.7%) of the 121 samples by ELISA method. Günşen et al. [11] found horse-meat in 14 (3.4%) of the 410 samples by ELISA method. Özpınar et al. [16] were reported that they did not find horse-meat and pork in 79 samples. In our study, horse-meat was found in 2 (1.3%) of 155 food samples, but there was no pork mixture. With compared to samples of previous researchers, the ratio of mix horse meat products was at the lowest level of 1.3

% and fraudulent meat products were at the highest level of 34.2 % in our total meat product samples.

The increase in the price differences between red and white meat in recent years has caused the increase of the fraudulent meat product ratio. It was determined that mostly poultry meat was mixed with meat products sold as a 100% beef products for fraud. Such cases erode consumer confidence and may cause reducing the chance of competition of fair producers. In Turkey, horse, donkey, poultry meat and pork are used species for fraudulent in meat products. In meat plants, processing poultry and ruminant species should not together and the meat processing should process a single species or its products in a separated production line. The presence of equine meat or pork in meat products is unacceptable by the Muslim and Jewish consumers, even though contamination is unintentional and incidental level.

As a result, meat products must be properly labeled by the producers, and routinely monitored by food authorities. Fraud in processed meat products can be avoided or reduced as a result of regular checks that can be done with the ELISA technique, which is a practical, inexpensive and a fast detection method. Therefore, consumers can be assured of healthy and reliable processed meat products.

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