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# Chemical residues in burger and sausage meat products

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**ABSTRACT**

This study was designed to detect some chemical contaminants in burger and sausage. A total of 150 samples of burger and sausage meat products (75 of each) were collected from different local markets in Giza governorate, Egypt. Samples were subjected to determination of residue levels of antibiotics, zeranol and trenbolone hormones, heavy metals and pesticides. The incidence of antibiotics, organophosphorus pesticides (OPPs) and arsenic (As) residues levels were not detected in all examined samples of meat products, while zeranol residue incidence in burger was zero and 100% sausage samples with mean value of (0.3721 ppb). The trenbolone residues was recorded in all examined samples of both burger and sausage with mean values of (0.1368 ppb) and (0.14367 ppb), respectively. Lead was detected in all samples of burger (100%) with mean value of (0.04844 ppm) and (67%) of sausage with mean value of (0.2575 ppm). Cadmium was recorded in (67%) of burger while it was not recorded in any of sausage samples. The zinc residues was present in all examined samples of burger and sausage with mean value of (0.44784 ppm) and (0.6132 ppm) ,respectively. The residues of PP.DDT were recorded in all examined samples of burger and sausage. The mean value of PP.DDT in sausage (2.476 ppm) was higher than in burger (1.92004 ppm). The residues of methoxychlor were recorded only in burger samples with mean value (49.66062 ppm) while methoxychlor not recorded in sausage samples. Endrin only recorded in burger samples with mean value (0.716 ppm) but sausage samples were free. The PP. DDD was recoded in all burger and sausage samples with mean values (0.464 ppm) and (0.614 ppm). In this study four types of (OCP) residues were recorded in burger sample, while only two types of (OCP) residues recorded in sausage samples. Accordingly, it seems that such residues as, antibiotics, hormones, heavy metals and pesticides in some meat products constitute a public health hazard, so we need to routinely monitor these chemical residues as food quality control measure

## 1. INTRODUCTION

Meat and meat products are important for nutrition and the human diet, but also, one of the major routs of human intake contaminants such as (antibiotics, hormones, heavy metals, and pesticides), contaminated substances may enter the food chain at many different stages. These contaminants in forages and other foods can transmitted to animal products, veterinary drugs can leave residues in animal products (Heena Jalal et al., 2015).

The administration of health risk related substances such as growth promoting agents and hormones is recurring problem in animal production where the compounds are often used to increase the productivity and to reduce breeding cost (Toffolatti et al., 2006). There are many routs for human exposure to lead and cadmium. Individuals be aware of the health effects resulting from consumption of heavy metal contaminated food products. While the food chain constitutes a main source of accumulation of such heavy metals.

Meat products represent an essential part of the human diet and are consumed mostly on daily basis. This makes them a continuous source of exposure to lead and cadmium. Thus, leading to various diseases liked to the toxicity of such metals. Accordingly, it is important to determine their levels in meat and meat products to assess the health risks derived from their consumption. The level of heavy metals in meat and meat products depend on several factors such as the environmental conditions, grazing land, and the genetic characteristics of the animal's organism (Demirezen et al., 2006).

The use of pesticides and other highly toxic chemicals like DDT on crops can lead to cancer, infertility, and diseases of liver in animals. Toxins like DDT can diffuse into fat and are stored in animal fat. Among the pesticides chlorinated hydrocarbons (aldrin, endrin, dieldrin, heptachlor, toxaphene, etc.) have been the worst culprit (Rama et al., 2016).

This study was planned to evaluate the residue levels of antibiotics, zeranol hormone, trenbolore hormone, heavy metals (Lead, cadmium, zinc, and arsenic) and pesticides (organochlorine and organophosphorus) in burger and sausage meat products.

## 2. MATERIAL AND METHODS

*2.1 Collection of samples:*

A total of 150 samples of burger and sausage meat products (75 of each) were collected from local markets in Giza

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governorate. The samples were transferred into ice box to animal health research institute (Giza branch laboratory). All samples were kept at -18 °C for further investigation as fast as possible without delay.

*2.2. Methods*

*2.2.1. Determination of Antibiotics residues in meat products*

The method was carried out according the **Heitzman (1990)** using microbiological assay

*2.2.2. Determination of anabolic steroid residues*

*2.2.2.1. Detection of zeranol residues by* (ELISA) method according to Biopharm AG-Darmstadt, Germany: RIDA-SCREEN® Zeranol, Enzyme Immunoassay for quantitative analysis of zeranol .

*2.2.2.2. Detection of trenbolone residues:* by (ELISA) method) according to: **R- Biopharm AG-Darmstadt, Germany: RIDASCREEN®** Trenbolone, Enzyme Immunoassay for the quantitive analysis of trenbolone (ART, No.: R2601).

2.2.3.Determination of heavy metals (Lead, Cadmium, Zink and Arsenic)

It was Carried out according to Staniskiane et al. (2006) and Chawdnury et al. (2011) using Atomic Absorption flam emission Spectrophotometer model AAS – 240FS Varian Australia.

The samples were digested by wet digestion method. AOAC Official method 970.52 (1996)

2.2.4. Detection of Pesticides

The detection of organophosphorus and organochlorine pesticides were carried out according to **JAOAC (1974)** using Gas Chromatography (GC).

*2.3.Statistical Analysis* **(S.A.S, 2001):**

Numerical data collected were statistically analyzed for analysis of variance and least significant difference. Chi-square, *t*. test and correlation were calculated when required.

## 3. RESULTS

This study revealed that the incidence percent of antibiotics, organophosphate pesticides (OPPs), and arsenic residues were zero in all examined burger and sausage samples. The residues of hormones were illustrated in table 1: which shows that the zeranol residues were zero in all examined burger samples (75) 100% whereas it was recorded in all examined sausage samples (75) 100% with mean value (0.3721 ppb). Whereas 75 of burger samples (100%) harbor residues of trenbolone. The mean value of trenbolone residues in burger samples was (0.1368 ± 0.069 ppb) with range (0.02- 0.022 ppb). The hormone residues were recorded in all examined sausage samples (75) 100% for either zeranol or trenbolone with mean value (0.3721 ± 0.0263 ppb) and (0.1437 ± 0.0152 ppb) respectively. Results in table 2: showed that the mean values of some heavy metals (Lead, cadmium) in burger samples were (0.04844 ppm), (0.00298 ppm), respectively. The percent of positive samples for lead (100%) and (67%) for cadmium. The concentration of lead residues (ppm) mean value in examined sausage samples was (0.2575) ppm. The number of positive samples of sausage harbor lead residues was 50 samples (67%) with range (0.05 to 0.47 ppm).On the other hand, the cadmium residues were not detected in any of sausage samples. table 3. illustrated that none of examined burger samples have arsenic residues. Concerning the zinc residues in burger samples, 100% of the samples contain zinc residues with mean value (0.44784 ppm). On the other hand, the arsenic residues were not detected in any of sausage samples, whereas the zinc residues were recorded in 75 samples (100%) of sausage. The average zinc residue level was (0.6132 ppm). The organochlorine pesticide (OCPs) residues were examined in burger and sausage samples in this study. Results in table 4:revealed that 12 types of OCP which are: Alfa- BHC, gamma BHC, delta BHC, heptachlor, aldrin, heptachlor epoxide endosulfan, dieldrin, PP-DDE, endosulfan 11, endrin aldehyde and endosulfan sulfate were not detected in burger examined samples. The last four detected types of OCP were: endrin, PP-DDD, PP-DDT and Methoxychlor. The lowest value was recorded for PP-DDD (0.464 ppm) while the highest value was recorded for Methoxychlor (49.66062 ppm). The PP-DDT was relatively higher (1.9004 ppm) than endrin (0.716 ppm). The examined sausage samples harbor only two OCP residues: PP- DDD and PP-DDT were 0.614 (ppm) and 2.476 (ppm) respectively. On the other hand, the other recorded (OCP) in table 4 were not detected in examined sausage samples.

## 4. DISCUSSION

The absence of zeranol hormone in examined burger samples may be due to the effect of freezing on the reduction of zeranol, this agree with the results recorded by (Maykola, 2020). Zeranol and trenbolone MRLs 2 ppb in cattle muscle and 10 ppb in cattle liver (Codex Alimentarious 1997 and EC 1999). This show that the examined samples of burger were not exceed the mentioned MRLs by Codex 1997 and EC 1999.

Table 1 Hormone residues in examined burger and sausage samples (No of each = 75)

| Type of sample | Zeranol (ppb) | | | | | | Trenbolone (ppb) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No of +ve | % of +ve | Min | Max | Mean | SE± | No of +ve | % of +ve | Min | Max | Mean | SE± |
| Burger | 0 | 0% | 0 | 0 | 0 | 0 | 75 | 100% | 0.02 | 0.22 | 0.1368 | 0.0069 |
| Sausage | 75 | 100% | 0.1 | 0.9 | 0.3721 | 0.0263 | 75 | 100% | 0.03 | 0.35 | 0.1437 | 0.0152 |

Table 2 Lead and Cadmium residues (ppm)in examined burger and sausage samples (No. of each = 75)

| Type of sample | Lead (ppm) | | | | | | Cadmium (ppm) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No of +ve | % of +ve | Min | Max | Mean | SE± | No of +ve | % of +ve | Min | Max | Mean | SE± |
| Burger | 75 | 100% | 0.04 | 0.06 | 0.04844 | 0.0008 | 50 | 67% | 0.001 | 0.006 | 0.00298 | 0.00023 |
| Sausage | 50 | 67% | 0.05 | 0.47 | 0.2575 | 0.0293 | 0 | 0% | 0 | 0 | 0 | 0 |

Table 3 Arsenic and Zinc residues(ppm) in examined burger and sausage samples (No. of each = 75)

| Type of sample | Arsenic (ppm) | | | | | | Zinc (ppm) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No of +ve | % of +ve | Min | Max | Mean | SE± | No of +ve | % of +ve | Min | Max | Mean | SE± |
| Burger | 0 | 0% | 0 | 0 | 0 | 0 | 75 | 100% | 0.37 | 0.529 | 0.44784 | 0.00725 |
| Sausage | 0 | 0% | 0 | 0 | 0 | 0 | 75 | 100% | 0.345 | 0.789 | 0.6132 | 0.0223 |

Table 4. Organochlorine pesticide residues by (Gas Chromatography) in examined burger and sausage samples (No. of each = 75)

| Name of (OCP) | Burger | | Sausage | |
|---|---|---|---|---|
| | Detected residues (ug/ul) | Calculated residues (ppm) | Detected residues (ug/ul) | Calculated residues (ppm) |
| 1- Alfa - BHC | - | - | - | - |
| 2- Gama - BHC | - | - | - | - |
| 3- Delta - BHC | - | - | - | - |
| 4- Heptachlor | - | - | - | - |
| 5- Aldrin | - | - | - | - |
| 6- Heptachlor epoxide | - | - | - | - |
| 7- Endosulfan | - | - | - | - |
| 8- Dieldrin | - | - | - | - |
| 9- PP DDE | - | - | - | - |
| 10- Endrin | 1.94579 $e^{-1}$ | 0.716 | - | - |
| 11- Endosulfan 11 | - | - | - | - |
| 12- PP. DDD | 1.26100 $e^{-1}$ | 0.454 | $4.53722^{-2}$ | 0.614 |
| 13- Endrin aldehyde | - | - | - | - |
| 14- Endosulfan sulfate | - | - | - | - |
| 15- PP-DDT | 1.92004 | 1.92004 | $6.73172^{-2}$ | 2.476 |
| 16- Methoxychlor | 49.66062 | 49.66062 | - | - |

The mean residues of both zeranol and trenbolone in the examined sausage samples within the MRLs recommended by Codex (1997) and EC (1999) for both zeranol and trenbolone. The MRLs of (EU 2006) for lead and cadmium 0.1 and 0.05 ppm in lean meat respectively. According to the MRLs recommended by (EU 2006), the examined burger samples in this study were accepted. In the present study lower results of both lead and zinc while absent of both cadmium and arsenic. According to the MRLs recommended by (EU, 2006) for lead and cadmium the mean value of lead in examined sausage samples was rejected. Lead poisonous has neurotoxic effect, cellular inactivation binds to gastrointestinal enzymes and renal systems (Emin et al., 2010). Cadmium accumulate in kidneys and it has an extremely long biological half-life in humans in the order of 20-30 years WHO (2009). The main exposure to heavy metals usually comes from food. After continuously evaluating studies on food additives and their toxicity, the WHO has come to the conclusion that even low levels of some metals, such as lead and cadmium, can give rise to diseases in humans (WHO, 2000; 2001).Organochlorines are DDT, DDD, dicofol, endrin, dieldrin, chlorobenilate, lindane, BHC, Methoxychlor, aldrin, chlordane, heptachlor, endosulfan, isordil, toxaphene, chlorpropylat (Ravidran, 2016). On contrary these OCPs were detected in all examined meat and meat products (Herrera et al., 1994). The endrin has moderate persistence half-life (1 day to 12 years) and highly hazardous. The PP-DDD is high persistence half-life (5-10 years), acute hazard is unlikely. On the same concern PP-DDT has high persistence half-life (2-15 years), moderately hazardous, whereas the Methoxychlor has high persistence half-life<120 days and acute hazard is unlikely. There different processing stages including mincing, stuffing and storage either chilling or freezing of fresh sausage may be the cause of absence of most organophosphorus pesticides and the low detected range of both PP-DDD and PP-DDT, 0.614 and 2.476 (ppm) respectively, this result may agree with that reported by (Sharma et al., 2005). According to EC 2004and FAO/WHO 2017 MRLs for PP-DDT is 5 ppm in meat, it is mean that the examined meat products (burger and sausage) were not exceed the fore mentioned MRLs. On the other hand, the OCP Methoxychlor only detected in burger samples with value 49.66 (ppm). The MRLs of Methoxychlor recommended by EC (2004) and FAO/WHO(2016) is 0.01 ppm. Accordingly, the Methoxychlor exceeds this limit in burger meat product. It is obvious from present data that four types of OCP residues were recorded in burger samples whereas two types of OCP residues only were recorded in sausage samples. Many of the organochlorine molecules are carcinogenic and neurotoxic (Kaiser, 2000).

## 5. CONCULOSIONS

It could be concluded from this study that analysis of burger and sausage meat products indicated such meat products were contaminated with hormone residues, heavy metal residues and organochlorine pesticide residues (OCPs), while these products were free from antibiotic residues and organophosphorus pesticide residues (OPPs)when they are investigated. Although most of these residues (Hormone residues, heavy metal residues and organochlorine pesticide residues (OCPs) occurred at very low concentrations in the examined samples, they accumulate to higher levels in human beings who consume these products. So, it is recommended that: 1-Strict analysis of meat products at different localities and the presence of antibiotics, hormones, heavy metals, and pesticides in such products above the recommended permissible limits (MRL) should be rejected. 2-Also, better selections of the raw material including an analysis of toxic chemicals prior to processing could sourly improve situation. 3- meat products must be labeled by official organization to indicate the levels of antibiotics, hormones, heave metals and pesticides.

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