

Estimation and comparison the levels of some heavy metals in fast food (Chicken Shawarma) during the morning and evening hours from restaurants in some areas in the city of Tobruk, Libya

www.doi.org/10.62341/mhzt7113

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Abstract

Environmental pollution is one of the main issues that affect human and animal health, and heavy metals are one of the main causes of pollution. The aim of the study was to estimate the concentration of heavy metals: iron, nickel, zinc, lead, copper and cadmium in chicken shawarma in some restaurants in Tobruk, Libya in the morning and evening periods, and the results showed that chicken shawarma contains higher concentrations of heavy metals ranging from (9.66-1.23mg/L) for iron, copper (4.20-8.65mg/L), cadmium (0.011-0.18mg/L) and lead (0.028-0.052mg/L) in morning and evening periods compared to FAO (1983), WHO (2000) and FDA (2001). No value was found for nickel and zinc in the samples

Keywords: Heavy metals, chicken shawarma, atomic absorption Spectrometry (AAS), Tobruk, Libya.

تقدير ومقارنة مستويات بعض المعادن الثقيلة في الوجبات السريعة (شاورما الدجاج) خلال ساعات الصباح والمساء من بعض المطاعم في بعض مناطق مدينة طبرق - ليبيا

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الملخص

يعتبر التلوث البيئي من المشاكل الرئيسية التي تؤثر على صحة الإنسان والحيوان، وتعتبر المعادن الثقيلة أحد الأسباب الرئيسية للتلوث. وقد هدفت الدراسة إلى تقدير تركيز المعادن الثقيلة: الحديد والنيكل والزنك والرصاص والنحاس والكاديوم في شاورما الدجاج في بعض مطاعم طبرق بليبيا في الفترتين الصباحية والمسائية، وأظهرت النتائج أن شاورما الدجاج تحتوي على تركيزات أعلى من المعادن الثقيلة تتراوح بين (9.66 - 1.23 ملجم/لتر) للحديد والنحاس (4.20 - 8.65 ملجم/لتر) والكاديوم (0.011 - 0.18 ملجم/لتر) والرصاص (0.028 - 0.052 ملجم/لتر) في الفترتين الصباحية والمسائية مقارنة بمنظمة الأغذية والزراعة (1983) ومنظمة الصحة العالمية (2000) ومنظمة الأغذية والأدوية (2001). ولم يتم العثور على أي قيمة للنيكل والزنك في العينات.

الكلمات المفتاحية: العناصر الثقيلة، شاورما الدجاج، جهاز مطيافية الامتصاص الذري، طبرق - ليبيا

Introduction:

Chicken is one of the most popular types of poultry meat and is prepared in various forms, including stews, fast food, and processed food. Moreover, many people consume chicken edible giblets such as liver and gizzard as part of their diet, particularly in developing countries [1,2]. Besides being low fat, chicken is also rich in proteins of high biological value, polyunsaturated fatty acids (PUFAs), vitamins (e.g., B2, B6, B12, and A), and minerals (e.g.,

Se, Zn, and Fe). Furthermore, chicken is much cheaper than other meats, making it a suitable choice for low-income families [3]. Heavy metals are not metabolized in the human body and accumulate in tissues such as fats, muscles, bones, and joints; consequently, various health problems arise. In addition, these metals can increase the risk of viral, bacterial, and fungal infections [4 – 7]. Human and natural activities cause the release of heavy metals into the environment. These metals possess high toxicity and are persistent and non-biodegradable in [8,9]. For people who are forced by circumstance to eat away from their homes, ready-to-eat foods prepared and sold by restaurants and street vendors offer a source of readily available, affordable, and nutritional meals without further thermal treatments and at reasonable prices[10]. They also have an agreeable taste and are simple to serve. When it comes to street food, their poor production conditions, use of subpar ingredients, and poor vendor staff hygiene lead to their contamination with toxins, heavy metals, and germs, making them harmful to the health of consumers [11]. The aim of the current study was to estimate the concentration of heavy elements in chicken shawarma sandwiches and to compare the concentration of elements in the morning and evening periods.

Materials and Method:

Ten samples of chicken meat (shawarma) were collected in the morning and evening from fast food restaurants in different areas of Tobruk city from February to April 2024. The study included five different areas as shown in Table (1).

Table1: Source of samples under study

NO	Name of source of samples	Number of samples
1	AL Mukhtar	2
2	Town center	2
3	The Palestine Street	2
4	Western entrance to the city	2
5	Industrial area	2

Sample Preparation:

The process of wet digestion or digestion with acids is called wet digestion. 2 grams of the sample to be digested is placed in a 250 ml beaker, then 3 ml of concentrated nitric acid is added to it, then the beaker is covered with a glass bottle for an hour, and quiet heating is done on an electric heater and the temperature is gradually raised to complete the digestion process, and when the mixture reaches near dryness the beaker was allowed to cool. Add 3 ml of concentrated nitric acid, cover the beaker and continue heating until the digestion process is complete, which is known as obtaining a light- colored distilled solution [12] Evaporation is carried out until near dryness and 5 ml of acid hydrochloric solution is added with water in a 2.5:2.5 ratio and we perform a heating process to dissolve the remaining sample after digestion and then add deionized distilled water for sampling Filtration is done to get rid of any undissolved substances so that no blockage occurs in the atomizer The solution volume is adjusted according to the expected concentration in the samples to a volume of 25 ml, thus making the sample ready for analysis by atomic absorption spectroscopy.

Statistical analysis:

A statistical analysis was conducted using Microsoft Excel, and graphs (Figures 1, 2, 3, and 4) were generated from the data in Table(2,3) The objective was to illustrate the difference in the concentration of heavy elements in the morning and evening periods in different areas of Tobruk city.

Results and discussion

Many local and international studies have shown that there is a significant contamination of foodstuffs with many heavy elements. Samples collected from various areas within the city of Tobruk, mornings and evenings to determine the effects of traffic and traffic pollution in these areas are shown in the following table (2,3) and (figures, from 1-4).

Table2: show the concentration of heavy metals in chicken shawarma samples in the morning

Name of source of samples	Concentration of Iron, mg/L	Concentration of Cadmium, mg/L	Concentration of Copper, mg/L	Concentration of Nickel, mg/L	Concentration of Zinc , mg/L	Concentration of Lead, mg/L
AL Mukhtar	3.35	0.15	5.1	ND	ND	mg/L
Town center	4.92	0.01	4.2	ND	ND	0.052
The Palestine street	1.55	0.18	8.65	ND	ND	0.032
Western entrance to the city	3.66	0.018	5.3	ND	ND	0.035
Industrial area	1.55	0.023	6.35	ND	ND	0.044

ND = Not Detected

Table3: show the concentration of heavy metals in chicken shawarma samples in the evening

Name of source of samples	Concentration of Iron, mg/L	Concentration of Cadmium, mg/L	Concentration of Copper, mg/L	Concentration of Lead, mg/L	Concentration of Nickel, mg/L	Concentration of Lead, mg/L
AL Mukhtar	3.84	0.011	5.6	ND	ND	0.041
Town center	9.66	0.014	4.35	ND	ND	0.039
The Palestine street	1.76	0.015	7.95	ND	ND	0.041
Western entrance to the city	5.15	0.024	4.83	ND	ND	0.035
Industrial area	1.23	0.021	6.74	ND	ND	0.028

ND=Not Detected

The data from this study indicated that there is a difference between the concentration of heavy elements of the morning and evening periods that the highest level of concentration of iron in midtown at night, when people and cars were crowded, it was 9.66mg/L compared to 4.92mg/L in the morning and the lowest concentration of copper in the industrial area was approximately 1.23mg/L, The Palestinian Street area exhibited a higher concentration of copper in the morning period, The concentration of copper in the western entrance area of the city was found to be approximately 4.83 mg/L, which is lower than the concentration observed in the Palestinian Street area, which was approximately 8.65 mg/L, while copper is an essential element, it may have a high exposure function with regard

to neuroanatomy maintenance and anti-infective prevention [13] It is associated with zinc and new body functions[14] The highest concentration of cadmium was observed in the western entrance area of the city, at 0.024 mg/L, during the same period. In contrast, the lowest concentration was recorded in the central area of the city in the morning period, at approximately 0.010 mg/L. Cadmium is typically present in low concentrations in most foods, with higher intakes contributing the most to the population's dietary exposure, estimated to be 0.012 mg per day [13]. Cadmium is regarded as one of the most toxic metals, in addition to its role in the pathogenesis of hypertension. Furthermore, it has been linked to mutations and fetal death [15] The concentration of lead was found to be higher in the Mukhtar area, at approximately 0.052 mg/L, with the lowest concentration observed in the industrial area, at 0.028 mg/L, this is below the threshold level set by the world health organization, the potential adverse effects of lead exposure on intelligence represent a significant public health concern. A study of the effects of lead exposure in children demonstrated that low levels of lead exposure adversely affect intelligence, affecting neurophysiology [16] Nickel and zinc concentrations were estimated and not detected in the samples, although chicken is a good source of zinc, with 85g of chicken containing 2.4mg of zinc, the absence of zinc and nickel in the samples will be investigated in future work.

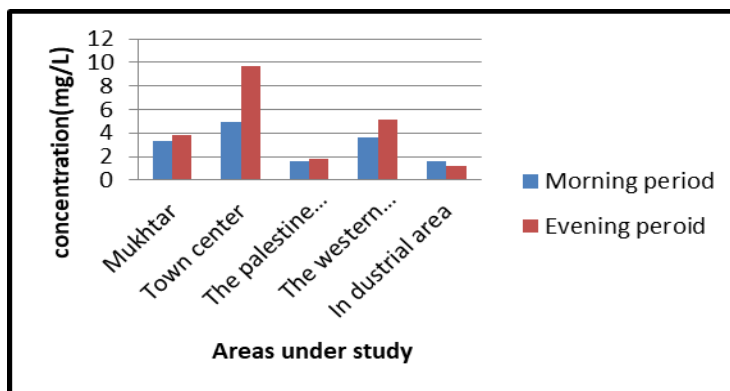


Figure 1. Shows the concentration difference between the morning and evening periods of iron

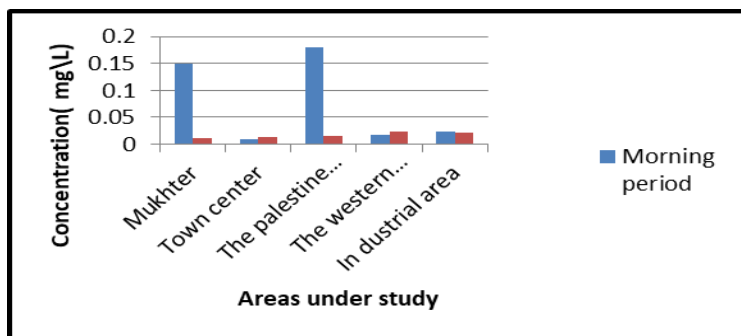


Figure 2. Shows the concentration difference between the morning and evening periods of cadmium

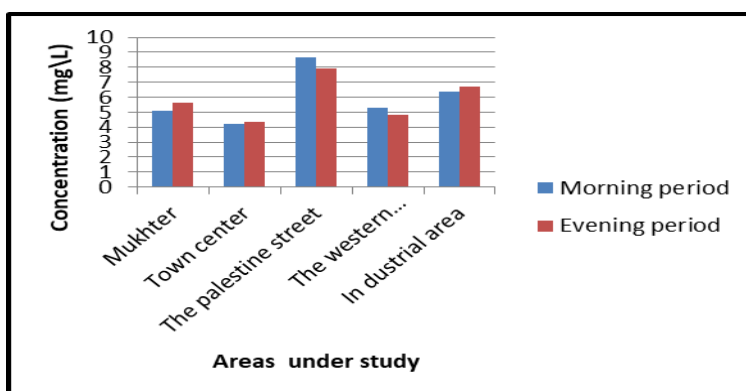


Figure 3. Shows the concentration difference between the morning and evening periods of cupper

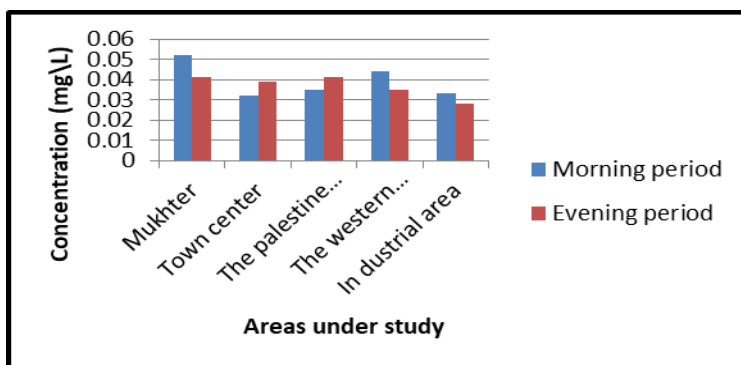


Figure 4. Shows the concentration difference between the morning and evening periods of lead



Conclusion:

Results obtained from the estimate of heavy elements by chicken shawarma sandwiches at various restaurants in the city of Tobruk during the morning and evening period found that the highest level of contamination in some restaurants in the evening was due to their exposure to air was the longest period of time, causing air pollution from car exhausts and resulting from climate warming from restaurants during the number of duties. A food survey should be conducted to determine whether they contain heavy metal elements that pose a long-term risk to human health. It also emphasizes the health control of all restaurants and obliges them to apply the health requirements of their followers. The shawarma must therefore be prepared and presented within the restaurant so that it is not exposed to various environmental pollutants.

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