Chemical and microbial assessment of beef and chicken shawarma sandwiches in Ismailia governorate and its impact on consumer health

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Abstract

A total of 40 random beef and chicken shawarma sandwiches samples (20 of each) from different fast food restaurants in Ismailia governorate were collected and examined chemically by estimation of moisture %, carbohydrate %, protein %, fat%, and lead values. The obtained results indicated that the mean values in the examined samples were 45.53 ± 0.12 - 45.44 ± 0.11; 25.38 ± 0.11 - 24.02 ± 0.07; 18.48 ± 0.04 - 18.44 ± 0.06; 9.21 ± 0.03 - 10.38 ± 0.04 and 0.106 ± 0.013 - 0.059± 0.008 ppm respectively. The results of this Study indicated that ready-to eat Shawarma Sandwiches have Pb values within the tolerance limit set by the EOS (2005).

The obtained results revealed that the mean values of aerobic plate count, Enterobacteriaceae and Staph. aureus counts of beef and chicken shawarma were 4.8 x 10^4 ± 3.6 x 10^3, 4.2 x 10^4 ± 2.8 x 10^3, 6.8 x 10^3 ± 0.2 x 10^2, 1.3 x 10^3 ± 0.2 x 10^2 and 5.2 x 10^3 ± 1.5 x 10^2, 3.6 x 10^3 ± 0.8 x 10^2 respectively.

Salmonella represented 10% of beef shawarma sandwiches samples and 15% of chicken shawarma. The isolated serotypes of Salmonella were S. typhimurium and S. enteritidis. The public health significance and the possible sources of contamination of shawarma sandwiches, as well as some recommendations to improve the quality of such food articles were discussed.

Key words: beef shawarma, chicken shawarma, heavy metals, lead, Bacterial contamination, salmonella, aerobic plate count, Enterobacteriaceae count, Staphylococcus count.

INTRODUCTION

Shawarma is one of the most ready to eat sandwiches sold in fast food restaurants in Egypt. It is a wrap of shredded meat (beef or chicken) prepared by alternately stacking strips of fat and pieces of seasoned meat on a rotating vertical skewer. The meat is roasted from the outside, while most of the inside remains rare. Shavings are cut off the block of meat for serving, and the remaining block of meat is kept heated on the rotating skewer.
Shawarma sandwiches are manipulated extensively during processing and therefore have a potential for high bacterial contamination levels on the surface and the depth of the meat. As a result, there is an increased risk of pathogens surviving and transferring not only by cross-contamination, but also by undercooking as observed in this kind of fast-food industry (Nimri et al., 2014).

Environmental pollution is a major global problem posing serious risk to man and animals. The development of modern agricultural technology and the rapid industrialization are among the foremost factors for environmental pollution. The environmental pollutants are spread through different channel, many of which finally enter into food chains of livestock and man (Kaplan et al., 2011). Various anthropogenic activities such as burning of fossil fuel, mining and metallurgy, industries and transport sectors redistribute toxic heavy metals into the environment, which persist for a considerably longer period and are translocated to different components in environment (Kotwal et al., 2005).

Lead is not an essential human element and it has no known beneficial or necessary function within living systems (Daland, 2000). It is a metabolic poison and a neurotoxin that binds to essential enzymes and several other cellular components and inactivates them (Cunningham and Saigo, 1997). Inhibiting oxygen and calcium transport and altering nerve transmission in the brain (Daland, 2000). Lead also interacts with several essential elements—notably calcium, iron, and zinc—and dietary deficiencies of both calcium and iron are known to enhance the absorption of lead (Goyer, 1996). Toxic effects of lead are seen on haemopoietic, nervous, gastrointestinal and renal systems (Baykov et al., 1996). In addition, Lead can be transferred to the fetus through the placenta (Goyer, 1990). Adults absorb approximately 5–15 % of ingested lead into the circulation; of this amount, less than 5 % is retained in the body. Young children can absorb considerably more 30–40 % of ingested lead; this explains their enhanced susceptibility to the potential effects of lead (Goyer, 1996).

So, precautions should be taken to limit childhood exposure.

The importance of food as a vehicle for the transmission of several diseases has been documented, especially in developing countries where hygienic standards are not strictly followed or enforced (Harakeh et al., 2005). The knowledge of microbiology of meat and its products is very important to control the growth of undesirable microorganisms and retarding the conditions favourable for their growth and activity (Farooq et al., 2013).

Shawarma sandwiches beef or chicken are more consuming, combining with sedentary life style, are a major health risk factor as more quantity with less quality food can cause people to high prevalence of obesity, diabetes mellitus and coronary heart disease. Nutritional analysis is done to assist you in making the right food choices for your personal needs.
The purpose of this study was to determine, provide information and awareness about the shawarma sandwiches from chemical and microbial conditions and its impact on the consumer health.

MATERIAL AND METHODS

1- **Collection of samples:** A total of 40 random beef and chicken shawarma sandwiches (20 of each) were collected from different fast food restaurants in Ismailia governorate. The collected samples were directly transferred to Ismailia Provincial laboratory for further examination.

2- **Chemical examination:**
   - **Moisture %, Carbohydrate %, Protein % and Fat%** were determined according to the AOAC(2000).
   - **Lead assay:** Each sample was ground and homogenised according to (Al-Baggou', 2002). The digested samples were analyzed for lead by using Unicam 969AA spectrometer England according to (Iwegbue, 2008).

3- **Bacteriological examination:**
   - **Preparation of samples:** according to ISO, 6887-2, 2003 the shawarma sandwiches were taken under aseptic condition and 10 grams from each sample was transmitted to sterile blender jar containing 90 ml of sterile peptone water 0.1% to be homogenized.
   - **Preparation of serial dilution:** Ten fold serial dilutions were prepared from homogenate 1/10 (original dilution) by transferring one ml to tube containing 9 ml of sterile peptone water.
   - **Bacteriological count:**
     - **Total aerobic plate count:** (APHA, 2001) spreading technique using standard plate count agar, incubated at 37°C for 24-48 hr.
     - **Total Enterobacteriaceae count:** (APHA, 2001) spreading technique using violet red bile glucose (VRBG) agar, incubated at 37°C for 24-48 hr.
     - **Staphylococcus aureus count:** (FDA, 2002) spreading technique using Baird-Parker agar incubated at 37°C for 24-48 hr. The presumptive S.aureus colonies were confirmed by coagulase test using staph. Kit (Oxoid).
     - **Isolation of salmonellae (ISO, 6579, 2002)** enrichment in rappaport vasiliades at 35°C for 24 hr., platting on XLD agar at 42°C for 24 hr. The presumptive colonies were confirmed bio chemically and serologically.

4- **Statistical analysis:** The results are expressed as mean ± standard Error (SE). Data were statistically analyzed using statistical analysis system software (SAS version 9.1, SAS Institute, Inc., 2003).

RESULTS AND DISCUSSION

Table (1) clarifies the mean value of lead in meat and chicken meat shawarma sandwiches were 0.106 ± 0.013 and 0.059± 0.008 ppm, respectively, which is lower than that recorded by (Morshdy et al., 2000; Iwegbueet al., 2008 and Hala and...
while the results in this study were nearly close to those reported by (Fatin, 1998; Sharkawy and Amal, 2003 and Essa et al., 2007). This approximate lead value obtained from beef and chicken shawarma sandwiches not exceeded the permissible limits 0.1mg/kg that was recommended by EOSQS (2005) for Pb level. In recent years, the dominant focus has been on effects of low level lead exposure related to child development and behavior (Dalad, 2000).

Table (2) represented the chemical analysis of examined beef and chicken shawarma sandwiches samples. The mean values of Moisture % were 45.53 ± 0.12; 45.44 ± 0.11, Carbohydrate % 25.38 ± 0.11; 24.02 ± 0.07, Protein% 18.48 ± 0.04; 18.44 ± 0.06 and Fat % 9.21 ± 0.03; 10.38 ± 0.04 respectively. The protein % was lower than that recorded by (Sulieman et al., 2012). The variation of protein content could be attributed to the type of meat and the additives used. High fat content have bad effect on consumer health.

Table (3) represent the bacteriological results of this study, the total aerobic plate count (APC) were ranged from 6 x 10^3 to 3.4 x 10^5 with mean value 4.8 x 10^4 ± 3.6 x 10^3 in beef shawarma while in chicken shawarma were ranged from 5.2 x 10^3 to 2.6 x 10^5 with mean value 4.2 x 10^4 ± 2.8 x 10^3, The APCs were lower than that recorded by (Odu and Akano, 2012) and higher than that recorded by (Nimri et al., 2014).

Despite the preparation of shawarma by heating, there were still pathogenic microorganisms observed on the samples enumerated. This is as a result of the fact that some of the observed microorganism can survive high cooking temperature to which Shawarma products is exposed which is not sufficient to eliminate harmful microorganisms (Abdelhai et al., 2015). Shawarma showed poor microbiological quality since the raw meat used for the processing of Shawarma is of a low quality meat. The Enterobacteriaceae mean counts were 6.8 x 10^2 ± 0.2 x 10^2; 1.3 x 10^3 ± 0.2 x 10^2 in beef and chicken shawarma respectively. These results were similar to that recorded by (Odu and Akano, 2012) and lower than that recorded by (Eman and Sherifa, 2012).

S. aureus is Gram positive cocci resistant to heat, drying. They produce heat stable enterotoxins that renders the food dangerous (Prescott et al., 2005). The Staph. aureus counts were ranged from 1.5 x 10^3 to 9.3 x 10^3 with mean value 5.2 x 10^3 ± 1.5 x 10^3 in beef shawarma while in chicken shawarma were ranged from 1.8 x 10^3 to 8.3 x 10^3 with mean value 3.6 x 10^3 ± 0.8 x 10^2.

Table (4) represented the percent of positive Salmonella microorganisms shawarma sandwiches in this study and they constituted 10 % and 15 % from beef and chicken Shawarma sandwiches, respectively. The identified strains were S. typhimurium in beef shawarma sandwiches and S. typhimurium and S. enteritidis in chicken shawarma. These results were in accordance with results of studies by many researchers in meat products (Torky, 2004; Siriken et al., 2006 and Farooq et al., 2013) but higher than that recorded by (Abdel-Rahman et al., 2011 and Abdalhamid et al., 2013) who couldn’t detect Salmonella.
Conclusion and Recommendation

High quality meat less fat content has to be used to process shawarma sandwiches. Health education and intervention program that aim to promote a healthy diet is needed. Prevention is the best way to deal with lead poisoning. Made intensive efforts to remove sources of lead from food items must be done.

Table (1): Lead levels (ppm) in beef and chicken shawarma sandwiches samples relative to EOSQC, (2005).

<table>
<thead>
<tr>
<th>Element (ppm)</th>
<th>Mean ± SE</th>
<th>EOSQC,2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pb in chicken shawarma</td>
<td>0.059± 0.008</td>
<td>0.1 mg/kg</td>
</tr>
<tr>
<td>Pb in beef shawarma</td>
<td>0.106± 0.013</td>
<td></td>
</tr>
</tbody>
</table>

(EOSQC) Egyptian Organization for Standardization and Quality control.

Table (2): Proximate chemical analysis of examined beef and chicken shawarma sandwiches samples

<table>
<thead>
<tr>
<th></th>
<th>Beef shawarma</th>
<th>Chicken shawarma</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min.</td>
<td>Max.</td>
</tr>
<tr>
<td>Moisture %</td>
<td>40.35</td>
<td>49.65</td>
</tr>
<tr>
<td>Carbohydrate %</td>
<td>23.57</td>
<td>31.41</td>
</tr>
<tr>
<td>Protein %</td>
<td>16.34</td>
<td>19.43</td>
</tr>
<tr>
<td>Fat %</td>
<td>8.43</td>
<td>10.95</td>
</tr>
</tbody>
</table>

sandwiches samples  (N= 20 of each).
Table (3): Statistical analytical results of bacteriological counts (cfu/g) of examined beef and chicken shawarma sandwiches samples (N= 20 of each).

<table>
<thead>
<tr>
<th></th>
<th>Sample</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total bacterial count</strong></td>
<td>B.</td>
<td>6 x 10³</td>
<td>3.4 x 10⁵</td>
<td>4.8 x 10⁴ ± 3.6 x 10³</td>
</tr>
<tr>
<td></td>
<td>C.</td>
<td>5.2 x 10³</td>
<td>2.6 x 10⁵</td>
<td>4.2 x 10⁴ ± 2.8 x 10³</td>
</tr>
<tr>
<td><strong>Enterobacteriaceae count</strong></td>
<td>B.</td>
<td>2.3 x 10²</td>
<td>1.7 x 10³</td>
<td>6.8 x 10² ± 0.2 x 10²</td>
</tr>
<tr>
<td></td>
<td>C.</td>
<td>7.5 x 10²</td>
<td>2 x 10³</td>
<td>1.3 x 10³ ± 0.2 x 10²</td>
</tr>
<tr>
<td><strong>Staph. aureus Count</strong></td>
<td>B.</td>
<td>1.5 x 10³</td>
<td>9.3 x 10³</td>
<td>5.2 x 10³ ± 1.5 x 10²</td>
</tr>
<tr>
<td></td>
<td>C.</td>
<td>1.8 x 10³</td>
<td>8.3 x 10³</td>
<td>3.6 x 10³ ± 0.8 x 10²</td>
</tr>
</tbody>
</table>

B- beef shawarma  C- chicken shawarma

Table (4): The incidence and Serotyping of isolated salmonella from examined beef and chicken shawarma sandwiches samples (N= 20 of each).

<table>
<thead>
<tr>
<th></th>
<th>Beef shawarma</th>
<th>Chicken shawarma</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>%</td>
<td>Identified strains</td>
</tr>
<tr>
<td><strong>Salmonella</strong></td>
<td>2</td>
<td>10% - S. typhimurium (2)</td>
</tr>
</tbody>
</table>

No. - No. of positive samples

References


