Assessment of microbiological quality of ready to eat meat sandwiches in new valley governorate

Sotohy Sotohy1, Esraa Mohamed2, Ashraf Abd EL-Malek3

1 Department of Animal Hygiene and Zoonosis, Faculty of Veterinary Medicine, Assiut University, Assiut, Egypt
2 Department of Food Hygiene (Meat Hygiene), Faculty of Veterinary Medicine, New Valley University, New Valley, Egypt
3 Department of Food Hygiene (Meat Hygiene), Faculty of Veterinary Medicine, Assiut University, Assiut, Egypt

Abstract
In this study, one hundred and twenty samples of meat sandwiches including 30 samples each of Beef shawerma, Beefburger, Hawawshi and Liver (kibda) were randomly collected from the vending shops and different restaurants in New Valley governorate to evaluate their bacteriological quality. The results revealed that the mean values of APC, Coliforms and Staph. aureus, yeast and mould counts (log CFU/g) were 6.37±0.06, 2.15±0.14, 3.55±0.15 and 4.02±0.35 for Beef shawerma, 6.30±0.08, 2.08±0.14, 4.68±0.18 and 4.04±0.5 for Beef burger, 6.30±0.06, 1.9±0.11, 3.38±0.17 and 3.94±0.71 for Hawawshi, 6.56±0.05, 2.25±0.13, 3.51±0.14 and 3.60±0.08 for Liver (kibda) sandwiches, respectively. Staph. aureus was isolated with an incidence of 33.3%, 30%, 26.6% and 33.3% from the examined samples of Beef shawerma, Beefburger, Hawawshi and Liver (kibda), respectively. Also, the incidences of isolation of Salmonella spp. from the same examined samples were 3.3%, 3.3% and 6.6%, respectively but Salmonella couldn’t be isolated from Hawawshi sandwiches. Furthermore, the incidences of isolation of E. coli from the same samples were 3.3%, 16.6% and 3.3%, respectively but E. coli couldn’t be detected in Beef shawerma sandwiches. Moreover, the incidence of Listeria spp. in the same samples was 16.6%, 6.6% and 20%, respectively. But Listeria spp. couldn’t be found in Beef shawerma sandwiches. The obtained results indicated that consumption of RTE sandwiches may cause a public health hazard to the consumer. Thus, measures to control the quality of the raw material, environmental and hygienic conditions during preparation and serving should be taken.

Keywords: RTE meat sandwiches, microbiological quality, Staph. aureus, Salmonella spp., E. coli, Listeria spp

1. Introduction
Ready-to-eat foods that prepared and sold on restaurants and street vendors provide a source of available, inexpensive and nutritional meals without further thermal treatments and reasonable price, agreeable taste and easily serving (Hussein et al., 2018) [22]. Concerning street foods, the inadequate quality, bad condition at which it prepared and produced in as using raw materials of poor quality and inadequate personnel hygiene of vendors, they are contaminated with bacteria and other microbes, making them unsafe for consumers’ health (Younis et al., 2019) [20].

RTE foods have been implicated in outbreaks of foodborne illnesses all over the world as this food have been found to be contaminated of public health concern pathogens such as fecal coliforms, Staph. aureus, Salmonella spp., and E. coli O157:H7 (Osaili et al., 2014) [37]. The major source responsible for microbial contamination are the place of preparation, utensils for cooking and serving, raw materials, time and temperature abuse of cooked foods and the personal hygiene of sellers (Rane, 2011) [41].

Staphylococcus aureus intoxication reported in several food poisoning outbreaks due to consumption of meat products contaminated with this organism causing symptoms include hyper salivation, nausea, vomiting, and abdominal cramping with or without diarrhea (never diarrhea alone) (Shaltout et al., 2017) [45]. Salmonella are important food borne pathogens and salmonellosis is one of the most common and widely distributed food borne diseases and it is the second food borne disease in Europe which cause substantial economic loss resulting from mortality, morbidity, and poor growth (Parvej et al., 2016) [39]. Escherichia coli O157:H7 is an emerging public health concern in most countries of the world. E. coli O157:H7 was known to be a human pathogen for about 24 years (Kirannayi et al., 2010) [30]. Regarding, L. monocytogenes, it is cause a disease called listeriosis which characterized by high case-fatality rate which can exceed 30%. It also carries one of the highest hospitalization rates among known foodborne pathogens, 91% (Jemmi and Stephan, 2006) [29]. Therefore, this study aimed to evaluate the microbial quality of RTE meat sandwiches (including Beef shawerma, Beefburger, Hawawshi and liver (kibda)) in New Valley Governorate and to highlight the public significance of consuming such food products.

2. Materials and methods
2.1. Collection of Samples: One hundred and twenty samples of RTE Beef shawerma, Beefburger, Hawawshi and Liver (kibda) sandwiches were randomly collected from local retail establishments in New Valley governorate as restaurants and street vendors. The samples were collected under aseptic conditions, wrapped in sterile plastic bags, sealed, labeled and kept in ice boxes (APHA, 2001) [8].

2.2. Preparation of Samples: Ten grams of sample were weighed under aseptic condition, homogenized with 90 ml of sterile distilled water by using mortar and pistol. Serial dilutions were prepared and spread plate technique was used on appropriate selective media (APHA, 2001) [8].
2.3. Microbial Analysis: samples were analyzed for total bacterial count (TBC) on standard plate count agar (PMLS, 1998) [40]. Total coliforms count using Most Probable Number (MPN) (AOAC, 1980) [7]. Total Staph. aureus count on Baird Parker agar supplemented with egg yolk tellurite emulsion (50 ml L) (Baird-Parker, 1962) [3]. Total yeast and mould count on Sabouraud Dextrose Agar (Cruickshank et al., 1975) [11]. Isolation of Staph. aureus on Mannitol salt agar (Singh and Prakash, 2008) [48]. Salmonella onto Xylose Lysine Desoxycholate (XLD) agar (ISO – 6579:2002) [39]. E. coli O157:H7 onto MacConkey Sorbitol Agar (Samadpour et al., 1991) [43]. L. monocytogenes onto Oxford agar supplemented with listeria supplement (Hitchins, 1990) [51].

2.4. Identification of Staph. aureus: Staph. aureus was identified by morphological examination, biochemical identification, catalase activity test, and detection of haemolysis, mannitol test, coagulase test (MacFadden, 2000) [35]. Detection and typing of Staph. aureus enterotoxins by ELISA (Shingaki et al., 1998) [46].

2.5. Identification of Salmonella spp.: identified by morphological examination, biochemical identification, Triple sugar iron (TSI) agar reaction, Lysine Iron Agar (koneman et al., 1992). Serological identification of Salmonella was carried out according to Kauffman – White scheme (Kauffman, 1974) [25]. Confirmation of Salmonella spp. by Polymerase Chain Reaction (PCR) (Singh et al., 2013) [27].

2.6. Identification of E. coli O157:H7: identified by morphological examination, biochemical identification, Sugar Fermentation Test (sorbitol) (Krieg and Holt, 1984) [32]. Serological identification was done according to (Kok et al., 1996) [31].


2.8. Statistical Analysis: The obtained results were statistically analyzed by "ANOVA" that was conducting using SAS software (SAS, 2014).

3. Results and Discussion

Table 1: Statistical analytical values of APC, Coliforms count, Staph. aureus, yeast and Mould count log CFU/g in the examined samples of RTE meat andwiche (No, of each =30).

<table>
<thead>
<tr>
<th>Samples</th>
<th>APC</th>
<th>Coliforms count</th>
<th>Staph. Aureus count</th>
<th>Yeast count</th>
<th>Mould count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef shawarma</td>
<td>6.37 ±0.06</td>
<td>2.15 ±0.14</td>
<td>3.55 ±0.15</td>
<td>4.37 ±0.11</td>
<td>3.67 ±0.11</td>
</tr>
<tr>
<td>Beefburger</td>
<td>6.30 ±0.08</td>
<td>2.08 ±0.14</td>
<td>4.68 ±0.18</td>
<td>4.54 ±0.12</td>
<td>3.54 ±0.07</td>
</tr>
<tr>
<td>Hawawshi</td>
<td>6.30 ±0.06</td>
<td>1.9 ±0.11</td>
<td>3.38 ±0.17</td>
<td>4.53 ±0.06</td>
<td>3.23 ±0.10</td>
</tr>
<tr>
<td>liver (kibda)</td>
<td>6.56 ±0.05</td>
<td>2.25 ±0.13</td>
<td>3.51 ±0.14</td>
<td>4.81 ±0.17</td>
<td>3.60 ±0.08</td>
</tr>
<tr>
<td>(n=120)</td>
<td>26.6</td>
<td>16.6</td>
<td>23.3</td>
<td>13.1</td>
<td>21.6</td>
</tr>
</tbody>
</table>

Table 2: Incidence of Staph. aureus isolated from the examined samples of RTE meat sandwiches (No, of each =30).

<table>
<thead>
<tr>
<th>Samples</th>
<th>No of coagulase positive/DNAase positive</th>
<th>No of strains Producing enterotoxins</th>
<th>Types of Produced Enterotoxins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef shawarma</td>
<td>8</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>Beef burger</td>
<td>5</td>
<td>1</td>
<td>B</td>
</tr>
<tr>
<td>Hawawshi</td>
<td>6</td>
<td>1</td>
<td>C</td>
</tr>
<tr>
<td>Liver (kibda)</td>
<td>7</td>
<td>2</td>
<td>D</td>
</tr>
<tr>
<td>Total (n=120)</td>
<td>26</td>
<td>6</td>
<td>C</td>
</tr>
</tbody>
</table>

Table 3: Incidence of Salmonella spp. isolated from the examined samples of RTE meat sandwiches (No, of each =30).

<table>
<thead>
<tr>
<th>Samples</th>
<th>Salmonella spp.</th>
<th>S. Typhimurium</th>
<th>S. Enteritidis</th>
<th>S. Montevideo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef shawarma</td>
<td>1</td>
<td>3.3</td>
<td>3.3</td>
<td>0</td>
</tr>
<tr>
<td>Beef burger</td>
<td>1</td>
<td>3.3</td>
<td>3.3</td>
<td>0</td>
</tr>
<tr>
<td>Hawawshi</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Liver (kibda)</td>
<td>2</td>
<td>6.6</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total (n=120)</td>
<td>4</td>
<td>13.3</td>
<td>1.0</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Table 4: Incidence of E. coli serotypes isolated from the examined samples of RTE meat sandwiches (No, of each =30).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef shawarma</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Beef burger</td>
<td>1</td>
<td>3.3</td>
<td>0</td>
<td>0</td>
<td>3.3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hawawshi</td>
<td>5</td>
<td>16.6</td>
<td>0</td>
<td>3.3</td>
<td>0</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Liver (kibda)</td>
<td>1</td>
<td>3.3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total (n=120)</td>
<td>7</td>
<td>5.8</td>
<td>0</td>
<td>1</td>
<td>0.8</td>
<td>1</td>
<td>2.15</td>
</tr>
</tbody>
</table>

Isolate characterization: EHEC, EHEC, EHEC, EPEC, EHEC, ETEC.
Table 5: Incidence of *Listeria* spp. isolated from the examined samples of RTE meat sandwiches (No. of each =30).

<table>
<thead>
<tr>
<th>Samples</th>
<th><em>Listeria</em> spp.</th>
<th><em>L. monocytogenes</em></th>
<th><em>L. welshimeri</em></th>
<th><em>L. ivanovii</em></th>
<th><em>L. grayi</em></th>
<th><em>L. seeligeri</em></th>
<th><em>L. innocua</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
<td>%</td>
<td>No</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>Beef shawarma</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Beefburger</td>
<td>5</td>
<td>16.6</td>
<td>1</td>
<td>3.3</td>
<td>1</td>
<td>3.3</td>
<td>0</td>
</tr>
<tr>
<td>Hawawshi</td>
<td>2</td>
<td>6.6</td>
<td>1</td>
<td>3.3</td>
<td>1</td>
<td>3.3</td>
<td>0</td>
</tr>
<tr>
<td>Liver (Kibda)</td>
<td>6</td>
<td>20</td>
<td>2</td>
<td>6.6</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total (n=120)</td>
<td>13</td>
<td>10.8</td>
<td>4</td>
<td>3.3</td>
<td>2</td>
<td>1.6</td>
<td>1</td>
</tr>
</tbody>
</table>

Fig 1: Agarose gel electrophoresis of multiplex PCR of *invA* (284 bp), *hilA* (497 bp) and *fimH* (1008 bp) virulence gene for characterization of *Salmonella* species.

Lane M: 100 bp ladder as molecular size DNA marker.
Lane C+: Control positive strain for *invA*, *hilA* and *fimH* genes.
Lane C-: Control negative.
Lanes 1 & 2 (*S. Enteritidis*): Positive strains for *invA*, *hilA* and *fimH* genes.
Lanes 3 (*S. Typhimurium*): Positive strain for *invA* & *fimH* genes.
Lane 4 (*S. Montivideo*): Positive strain for *invA* and *hilA* genes.

Fig 2: Agarose gel electrophoresis of multiplex PCR of *iap* (131 bp), *hytA* (456 bp) and *actA* (839 bp) virulence genes for characterization of *Listeria monocytogenes*.

Lane M: 100 bp ladder as molecular size DNA marker
Lane C+: Control positive *L. monocytogenes* for *iap*, *hytA* and *actA* genes.
Lane C-: Control negative.
Lanes 1, 2 & 4: Positive *L. monocytogenes* strains for *iap* and *hytA* genes.
Lane 3: Positive *L. monocytogenes* strain for *iap*, *hytA* and *actA* genes.
The bacteriological analysis of examined RTE sandwiches

3.1 Aerobic plate count
The data presented in table (1) revealed that the mean values of total APC of the examined samples of RTE Beef shawerma, Beefburger, Hawawshi and Liver (kibda) sandwiches were 5.8 ± 0.06, 6.30 ± 0.08, 6.30 ± 0.06 and 6.56 ± 0.05 log CFU/g, respectively. The current results were nearly similar with those obtained by Shaltot et al., (2015) [44] who found that, the mean values of APC in Hawawshi sandwiches was 6.8 log CFU/g. While lower results were recorded by Hussein et al., [2018] [22] found that the mean value of APC in Beef shawerma and Hawawshi were 5.56 and 5.9 log CFU/g, respectively, Mohamed et al., (2015) [20] who obtained mean value of APC in liver sandwiches was 5.8 log CFU/g and Hassanin et al., (2015) [20] who found mean values of APC in Beefburger and Beef shawerma were 4.8 and 4.4 log CFU/g, respectively. Furthermore, APC is used as a microbiological hygiene indicator of general quality assessment, including that of extended shelf-life foods. High counts may suggest quality issues and possible inadequate temperature control (Imperiale, 2017) [24]. So, the high bacterial counts of examined samples may be attributed to neglected sanitary measures during their processing, handling, serving of such products. The variation in bacterial counts between different types of meat products could be attributed to difference of ingredients and steps involved in their formulation and preparation (Ibrahim et al., 2014) [23].

3.2 Total coliforms count
Members of coliforms groups are considered as general indicator microorganisms to measure the potential presence of enteric pathogens in foods which constitute public health hazard, besides the measuring of fecal contamination of food products and responsible for inferior quality of meat products resulting in economic losses (Shaltot et al., 2015) [44]. The result declared that the mean values of total coliforms count in the examined samples of Beef shawerma, Beefburger, Hawawshi and Liver (kibda) sandwiches were 2.15 ± 0.14, 2.08 ± 0.14, 1.9 ± 0.11, 2.25 ± 0.13 log CFU/g, respectively. the obtained results were relatively agree to some extent with those obtained by El-Dosoky et al., (2013) [13] who found that the mean value of total coliforms count of RTE Beef burger was 2.9 log CFU/g and Shaltout et al., (2017) [45] who found mean value of coliforms count for Beef shawerma was 2.9 log CFU/g, also they obtained higher results from liver sandwiches which was 4.9 log CFU/g, besides, Hassanin et al., (2015) [20] revealed higher result from Hawawshi sandwiches which was 3.6 log CFU/g. While lower results were obtained by Hussein et al., (2018) [22] (1.2 log CFU/g) for Beef shawerma. So, the Presence of coliforms are indication of unsanitary conditions, unhygienic practices during and after production and poor source of water used (Upadhyaya et al., 2017) [49].

3.3 Total Staph. aureus count
Total Staph. aureus count can be referred as index of sanitary conditions under which meat and its products are processed and handled (Ibrahim et al., 2014) [23]. Also, the presence of Staph. aureus in heat treated food is a pointer to largely poor personal hygiene, improper storage facilities, and unhygienic environment. (Achi and Madubuike, 2007) [3]. It’s obvious from the results obtained in table (1) that the mean values of total Staph. aureus count in the examined samples of RTE Beef shawerma, Beefburger, Hawawshi and Liver (kibda) sandwiches were 3.55 ± 0.15, 4.68 ± 0.18, 3.38 ± 0.10 and 3.51 ± 0.14, respectively. The current results are nearly similar to that obtained by Ahmed et al., (2015) [4] (3.7 log CFU/g) for Beef shawerma and Ibrahim et al., (2014) [23] (3.9 log CFU/g) for Hawawshi. While lower results were recorded by Shaltot et al., (2015) [44] (3.4 log CFU/g) for Beefburger, Hassanin et al., (2015) [20] who obtained lower results from Beef shawerma (2.7 log CFU/g) and Khater-Dalia et al., (2013) [21] (2.36 to 2.76 log CFU/g) for liver sandwiches. Moreover higher results were obtained by Ibrahim et al., (2014) [23] (4.2 log CFU/g) for Beef shawerma. So, the fact that most of the food handlers do not use hair net, gloves and other protective gear when preparing and serving. Sellers usually take money with the same hand used to serve food. Without considering washing of hands after, these sellers eventually prepare the next foods to be served thus, adding up to food contamination (Djibrine et al., 2018) [12].

3.4 Yeast and mould count
The results obtained in table (1) showed that the mean values of total Yeast count (log CFU/g) in the examined samples of RTE Beef shawerma, Beefburger, Hawawshi and Liver (kibda) sandwiches were 4.37 ± 0.1, 4.54 ± 0.12, 4.65 ± 0.06, 4.81 ± 0.17, respectively. While total mould count (log CFU/g) of the same samples were 3.67 ± 0.11, 3.54 ± 0.07, 3.23 ± 0.10, 3.60 ± 0.08, respectively. The current results are higher than that obtained by Salem et al., (2016) [42] (2.3 log CFU/g) for Beef shawerma. While higher results were recorded by Abd-El-Malek (2014) [1] (5.6 log CFU/g) for liver sandwiches, Khater-Dalia et al., (2013) [27] who obtained lower results from liver (2.26 to 3.31 log CFU/g). Moreover, the presence of yeast/ mould in the food sample is due to its disperse in the form of spores which are abundant in the environment and can be introduced through dust and soil and their presence in RTE food samples is a serious public health concern as these fungi may be associated with the production of mycotoxin (Anthony et al., 2009) [6].

3.5 Incidence of coagulase positive and enterotoxigenic Staph. aureus
Regarding to results illustrated in table (2), the highest incidence for isolation of coagulase positive Staph. aureus in the examined samples of RTE meat sandwiches was recorded in Beef shawerma (26.6%) followed by liver (23.3%), Hawawshi (20%) and Beefburger (16.6%). Furthermore, enterotoxigenic Staph. aureus was detected in 12.5%, 20%, 16.6% and 28.5% of the coagulase positive Staph. aureus strains for Beef shawerma, Beefburger, Hawawshi and liver sandwiches, respectively. The enterotoxins produced were identified as staphylococcal enterotoxin A, B, C, D. Also Staph. aureus could be isolated from Beef shawerma sandwiches by El Rahman et al., (2018) [16] (20%), from Beefburger by Hassanin et al., (2015) [20] (46.67%), from Hawawshi sandwiches by El-Shenawy et al., (2016) [14] (20%) and from liver sandwiches by Shaltout et al., (2017) [45] (44%). While, enterotoxins A, B, C and D failed to be detected in Beef shawerma samples by Hassan et al., (2015) [19] who obtained an incidence (22.8%). The presence of Staph. aureus in RTE foods indicate its contamination from food handlers and
inadequately cleaned equipments (Hassan et al., 2015) [20].

3.6 Incidence of Salmonella spp.
Salmonella has been recognized as an important food-borne pathogen for humans over more than a century, causing human food-borne illness as well as high medical and economical costs (Lee et al., 2015) [18]. According to results obtained in table (3), the incidence of Salmonella spp. in RTE Beef shawerma, Beefburger, and liver (kibda) sandwiches were 3.3%, 3.3% and 6.6%, respectively. Salmonella couldn’t be detected from Hawawshi sandwiches. The isolated strains were classified as S. Typhimurium (3.3%) from Beef shawerma, S. Enteritidis (6.6%) from Beefburger and liver sandwiches and S. Montevideo (3.3%) was identified from liver sandwiches. Moreover, m-PCR was used to detect invA, hila and fimH genes of Salmonella spp. isolated from RTE sandwiches and the results was positive. Besides, Salmonella spp. could be isolated from Beef shawerma sandwiches by Younis et al., (2019) [50] (3.3%), from Beefburger by El Rahman et al., (2018) [16] (8%) and serotyping of the obtained isolates classified into S. Enteritidis, S. Typhimurium, from Hawawshi sandwiches by El-Shenawy (2016) [14] (30%), Mohamed et al., (2015) [30] failed to detect Salmonella spp. from examined liver sandwiches. The presence of this organism indicates poor food preparation and handling practices such as inadequate cooking or cross contamination, consideration may also be given to investigating the health status of food handlers who may have been suffering from salmonellosis or asymptomatic carriers of the organism (Büyüköyörük et al., 2014) [10].

3.7 Incidence of E. coli O157:H7:
E. coli in the food is considered as indicator of fecal contamination and poor sanitation during processing and its presence in RTE foods indicates that the food has been prepared under poor hygienic conditions (Hussein et al., 2018) [22]. As well as, The presence of E. coli in the food induce severe diarrhea in infants and young children as well as cases of food poisoning and gastroenteritis among consumers (Abdalhamid et al., 2013) [1]. From the results illustrated in table (4) it’s obvious that the incidences of E. coli isolated from the examined samples of RTE meat sandwiches were 3.3%, 16.6% and 3.3% for the examined samples of Beefburger, Hawawshi and liver (kibda) sandwiches, respectively. E. coli failed to be isolated from Beef shawerma. Also data obtained in the same table (4) revealed that the isolated serotypes of pathogenic E. coli from the examined samples of Beefburger sandwiches were O26: H11 (3.3%), while in examined samples of Hawawshi O121: H7 (3.3%), O44:H18 (3.3%), O111:H2 (6.6%) and O128:H2 (3.3%) were identified. Moreover, in the examined samples of liver sandwiches O128:H2 (3.3%) were identified. E. coli was previously isolated from Beef shawerma by Hussein et al., (2018) [22] (13.3%), from Hawawshi by El-Shenawy (2016) [14] (10%), from liver sandwiches by Hassan et al., (2015) [19] (43.33%) and Younis et al., (2019) [50] who could isolate E. coli from Beefburger with an incidence of 6.6% which identified as E. coli O111:H4. The presence of E. coli in meat and its products reflects the unsatisfactory hygienic condition during manufacturing and handling of these products by human carriers (Al-Mutairi, 2011) [5].

3.8. Incidence of Listeria spp.:
RTE foods are vulnerable to recontamination with Listeria during handling, processing or packaging at the retail level, or in the domestic streets environment and the ability of this organism to grow at low temperatures during any period of storage during preparation of the final food product, support its presence/persistence (El-Shenawy et al., 2016) [15]. Regarding to results obtained in table (5), the incidence of listeria spp. in RTE Beefburger, Hawawshi and liver (kibda) sandwiches were 16.6%, 6.6% and 20%, respectively. Listeria couldn’t be detected from Beef shawerma sandwiches. The isolated strains were classified as L. monocytogenes (3.3%), L. welshimeri (3.3%), Livanovii (3.3%), Limnocua (6.6%) from Beefburger, L. monocytogenes (3.3%), L. welshimeri (3.3%) from Hawawshi and L. monocytogenes (6.6%), L. grayi (3.3%), L. seeligeri (3.3%), Limnocua (6.6%) were identified from liver sandwiches. Besides, m-PCR was used to detect iap, hyla and actA genes for 4 strain of L. monocytogenes recovered from examined RTE sandwiches. Moreover, listeria spp. could be isolated from Beef shawerma sandwiches by Osaili et al., (2014) [51], from Beefburger by Zaghlouli et al., (2014) [41] (30%), Eldaly et al., (2016) [17] failed to detect Listeria spp. in Hawawshi and shawerma sandwiches, while El-Shenawy et al., (2016) [15] could isolate listeria from liver sandwiches with an incidence (30%). Furthermore, the presence of listeria in RTE sandwiches revealed to Cross-contamination, improper holding temperatures, and retail practices may lead to product contamination and growth of L. monocytogenes (Gallagher et al., 2016) [18].

4. Conclusion
The obtained results of the present study indicated that consumption of RTE sandwiches such as Beef shawerma, Beefburger, Hawawshi and Liver (kibda) may be constitute a potential hazard to human health, as it may be associated with high bacterial load and food poisoning microorganisms such as enterotoxigenic Staph. aureus, Salmonella spp., E. coli O157:H7 and L. monocytogenes. Thus, measures to control the quality of the raw material, environmental and hygienic conditions during preparation and serving should be taken for the production of relatively safe street-vended foods with low bacterial counts. Also, health agency personnel, vendors and consumers of the street vended food need to be informed of the hazards and appropriate preventive measures. Also, cross contamination between raw foods containing pathogens and cooked meals should be avoided as possible as we can by using color coded boards and knives and food handlers should have the necessary knowledge and skills to enable them to handle food hygienically.

5. References
3. Achi O, Madubuike C. Prevalence and antimicrobial resistance of Staphylococcus aureus isolated from retail
38. Osaili TM, Al-Nabulsi AA, Shaker RR, Jaradat ZW,


