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

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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) [50].
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 (Kiranmayi *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) [26].
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 (PHLS, 1998) [40]. Total coliforms count using Most Probable Number (MPN) (AOAC, 1980) [7]. Total *Staph. aureus* count on Baired Parker agar supplemented with egg yolk tellurite emulsion (50 ml/ L) (Baird-Parker, 1962) [9]. 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) [25]. E. *coli* O157:H7 onto MacConkey Sorbitol Agar (Samadpour *et al.,* 1991) [43]. *L. monocytogenes* onto oxford agar supplemented with listeria supplement (Hitchins, 1990) [21].

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 (MacFaddin, 2000) [35], Detection and typing of *Staph. aureus* enterotoxins by ELISA (Shingaki *et al.*, 1981) [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) [31], Serological identification of Salmonella was carried out according to Kauffman – White scheme (Kauffman, 1974) [28], Confirmation of *Salmonella* spp. by Polymerase Chain Reaction (PCR) (Singh *et al.*, 2013) [47].

2.6. Identification of *E. coli* O157:H7: identified by morphological examination, biochemical identification, Sugar Fermentation Test) (sorbitol) (Kreig and Holt, 1984) [32]. Serological identification was done according to (Kok *et al*., 1996) [33].

2.7. Identification of *L. monocytogenes:* identified by morphological examination, biochemical identification, Catalase reaction test, The Christic-Atkins-Munch-Peterson (CAMP) test (MacFaddin. 2000) [35], Detection of haemolysis, Serological identification of *Listeria* spp. (Pagotto *et al*., 2001) [38], Confirmation of *L. monocytogenes* by Polymerase Chain Reaction (PCR) (Kaur *et al*., 2007) [29].

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).

Samples	APC	Coliforms count	*Staph. Aureus* count	Yeast count	Mould count
Beef shawerma	6.37^{ab}±0.06	2.15^{a}±0.14	3.55^{a}±0.15	4.37^{a}±0.1	3.67^{a}±0.11
Beefburger	6.30^{b}± 0.08	2.08^{a}±0.14	4.68^{b}±0.18	4.54^{ab}±0.12	3.54^{a}±0.07
Hawawshi	6.30^{b} ± 0.06	1.9^{a}± 0.11	3.38^{a}±0.17	4.65^{ab}±0.06	3.23^{b}±0.10
liver (kibda)	6.56^{a} ± 0.05	2.25^{a}±0.13	3.51^{a}±0.14	4.81^{b}±0.17	3.60^{a}±0.08

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

Samples	No of coagulase positive/DNAase positive		No of strains Producing enterotoxins		Types of Produced Enterotoxins			
	No	%	No	%	A	B	C	D
Beef shawerma	8	26.6	2	12.5	A	B	-	-
Beefburger	5	16.6	1	20	-	-	-	D
Hawawshi	6	20	1	16.6	-	-	C	-
liver (kibda)	7	23.3	2	28.5	A	-	C	-
Total (n=120)	26	21.6	6	23	A	B	C	D

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

Samples	*Salmonella* spp.		*S.* Typhimurium		*S.* Enteritidis		*S.* Montevideo	
	No	%	No	%	No	%	No	%
Beef shawerma	1	3.3	1	3.3	0	0	0	0
Beefburger	1	3.3	0	0	1	3.3	0	0
Hawawshi	0	0	0	0	0	0	0	0
Liver (Kibda)	2	6.6	0	0	1	3.3	1	3.3
Total (n=120)	4	13.3	1	0.8	2	1.6	1	0.8

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

Samples	*E.coli* serotypes		O157: H7	O121:H7		O26:H11		O44:H18		O111:H2		O128:H2	
	No	%	No %	No	%	No	%	No	%	No	%	No	%
Beef shawerma	0	0	0 0	0	0	0	0	0	0	0	0	0	0
Beefburger	1	3.3	0 0	0	0	1	3.3	0	0	0	0	0	0
Hawawshi	5	16.6	0 0	1	3.3	0	0	1	3.3	2	6.6	1	3.3
Liver (Kibda)	1	3.3	0 0	0	0	0	0	0	0	0	0	1	3.3
Total (n=120)	7	5.8	0 0	1	0.8	1	0.8	1	0.8	2	1.6	2	1.6
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).

Samples	*Listeria* spp.		*L. monocytogenes*	*L.welshimeri*		*L.ivanovii*		*L. grayi*		*L. seeligeri*		*L.innocua*	
	No	%	No %	No	%	No	%	No	%	No	%	No	%
Beef shawerma	0	0	0 0	0	0	0	0	0	0	0	0	0	0
Beefburger	5	16.6	1 3.3	1	3.3	1	3.3	0	0	0	0	2	6.6
Hawawshi	2	6.6	1 3.3	1	3.3	0	0	0	0	0	0	0	0
Liver (Kibda)	6	20	2 6.6	0	0	0	0	1	3.3	1	3.3	2	6.6
Total (n=120)	13	10.8	4 3.3	2	1.6	1	0.8	1	0.8	1	0.8	4	3.3

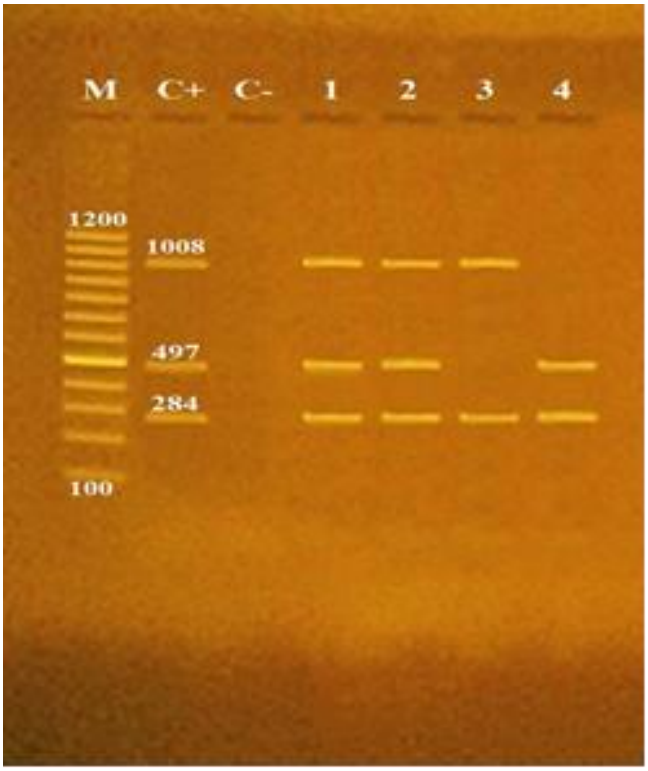

Fig 1: Agarose gel electrophoresis of multiplex PCR of *invA* (284 bp), *hilA* (497 bp) and *fimH* (1008 bp) virulence gene for characterization of *Salmonella* species.

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.
Lane 3 (*S.* Typhimurium)**:** Positive strainfor *invA*&*fimH* genes.
Lane 4 (*S.* Montivideo)**:** Positive strain for *invA*and *hilA* genes.

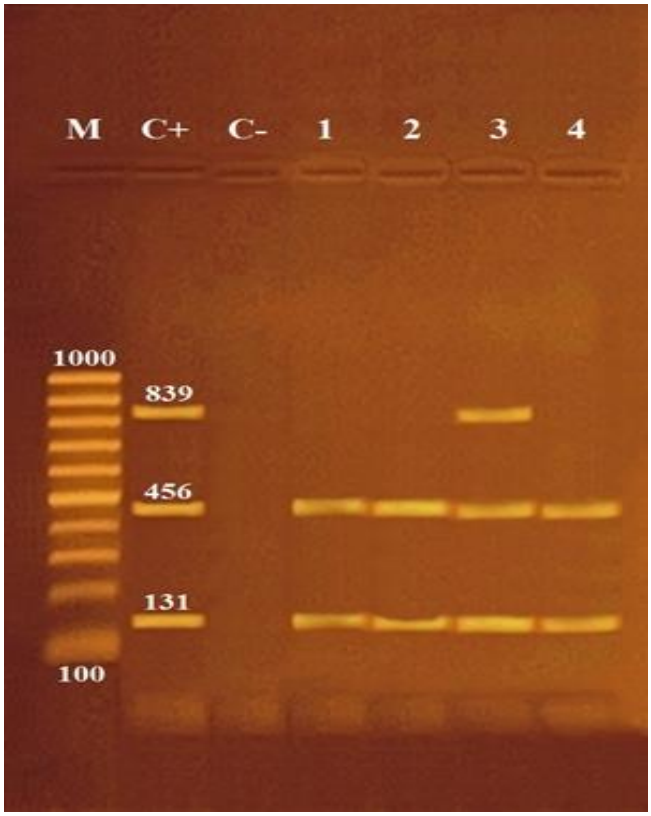

Fig 2: Agarose gel electrophoresis of multiplex PCR of *iap* (131 bp), *hylA* (456 bp) and *actA* (839 bp) virulence genes for characterization of *Listeria monocytogenes*.

Lane M: 100 bp ladder as molecular size DNA marker
Lane C+: Control positive *L. monocytogenes* for *iap*, *hylA* and *actA* genes.
Lane C-: Control negative.
Lanes 1, 2 & 4: Positive *L. monocytogenes* strains for *iap* and *hylA* genes.
Lane 3: Positive *L. monocytogenes* strain for *iap*, *hylA* 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 6.37±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) [36] 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 Beefburger 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±0.17 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) [27] (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 (Hassanin *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) [34]. 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) [36] 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 (Büyükyörük *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) [2]**.** 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%), *L.ivanovii* (3.3%), *L.innocua* (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%), *L.innocua* (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) [37]**,** from Beefburger by Zaghloul *et al.*, (2014) [51] (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

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