Detection of *Salmonella typhimurium* in chicken meat imported in the local markets of Diwaniya city By using PCR technique

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**Abstract:**

The aim of this study to detected contamination with *Salmonella spp.* In imported chicken meat in the local markets of Al-Diwaniya city. To protect health of consumer and Determination the most contaminated origin with *salmonella spp.*. A total of 100 chicken meat samples collected from different origin. The bacteria cultured and isolated in enrichment and selective media. Salmonella isolates were subjected to some biochemical tests show positive productive results H2S, TSI, SIM And its given negative for indole, vo-gs Proskauer and ureas. Biochemical identification was carried out using API 20-E test. The result showed isolation sample (33/55) 60% on bismuth sulphate agar and the results of isolation on chromogenic agar were 87.8% (29/33). According to reading Api20-E system the results of confirmation of isolates 92% (25/26) In this study, (23) *Salmonella* isolates were detected by polymerase chain reaction (PCR) by using 16s rRNA and invA gene these primers were selected specifically for the detection of *Salmonella* to amplify a 406bp and 558 bp DNA fragments, respectively. Only 7 isolates out of 23 were identified as *S. typhimurium* the results of this study showed the highest percent of *S. typhimurium* isolates was (50%) (3/6) for India origin and the lowest was Turkish origin.

**Introduction**

Food borne diseases caused typhoid Salmonellosis represent an important public health problem worldwide. It is estimated that approximately 70%–80% of food borne bacterial outbreaks were caused by *Salmonella spp.* in China (1). In the United States Salmonella infections (approximately 32,000 annually) were reported during 1998–2002 (2). Beef and poultry/chicken meat have been recognized as significant sources of human salmonellosis (3). *Salmonella* serotypes, *(S.)* *Typhimurium* is one of the most important agents of food borne Salmonellosis in humans. (4) It was estimated that approximately 75% of human salmonellosis cases were due to contaminated food products, such as beef, pork, poultry and Chicken products are recognized as an important source molecular methods such as polymerase chain reaction (PCR), have shown high sensitivity and specificity for detecting target pathogens, including Salmonella, in different types of foods, and the time required to obtain results can be as short as 12 h (5). The use of 16s r RNA gene or *invA* gene specific PCR method in most diagnostic and research laboratories is possible and through the molecular basis of Salmonella identification techniques, this method is the simplest and less expensive (6) the 16S rRNA genes are highly conserved among isolates belonging to the same bacterial species. (7) *invA* is located on the pathogenicity island 1 of *Salmonella spp.* encoding proteins of a type (T3SS) III secretion system this gene is highly conserved among the *Salmonella spp.* and is associated with the adherence and invasion of mammalian cell.
Material and Methods

1-Collection of samples
Chicken samples were collected from different market in al-diwaniya city with different origin include different trademark (al-kafeel, al-murad, thighs U.S.A, Turkish Chicken, Chicken JD) the sample transport by ice box about 25 g from meat sample were placed in 225 ml of enrichment medium tetrathionate broth in microbiological laboratory in veterinary collage for 18-24 h at 37°C.. this study took place during the period from December 2011 and carry on June 2012.

2- Isolation and identification of salmonella spp.:
The samples were cultivated on to selective medium such as bismuth sulphate agar and chromogenic agar For identification of salmonella colonies, incubation at 37°C for 18-24 hr samples were subjected to biochemical tests such as (TSI), Sulfide-Indole- (SIM), (MRVP), Urea, and finally confirmed by using Api20-E system, Colonies that showed biochemical characteristics similar to that of Salmonella spp. were tested by API20-E system and the confirmation was identified by PCR with 16s rRNA and invA genes primers for the detection of salmonella spp.

3-Specific Primers Sequence Used for PCR Amplification:
The primers used for the detection specific sequence of 16s rRNA gene ribosomal genes of Salmonella spp [8]. And invA gene encoding proteins of a type (T3SS) III secretion system [9] These primers are specific for designed in this study by using NCBI Gene Bank and Primer: online and provided by (Bioneer company, Korea) as following Table (1):

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Orientation</th>
<th>Position</th>
<th>Size of PCR product(bp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CGG,ACG,GGT,GAG,TAA,TGT,CT</td>
<td>Forward</td>
<td>16s rRNA</td>
<td>406</td>
</tr>
<tr>
<td>GTT,AGC,CGG,TGC,TTC,TTC,TG</td>
<td>Reverse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATG,CCC,GGT,AAA,CAG,ATG,ATG,AG</td>
<td>Forward</td>
<td>invA</td>
<td>558</td>
</tr>
<tr>
<td>CTC,GCC,TTC,GTC,GGT,TTC,AG</td>
<td>Reverse</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4- Polymereas chain reaction  PCR
4.1 Genomic DNA extraction
Salmonella spp. isolates were cultured on brain heart broth for 18-24 h at 37°C; the extraction of DNA was performed according to Genomic DNA kit provided by geneaid company (USA ).

4.2 DNA Amplification:
The amplified DNA products from Salmonella spp. specific-PCR were analyzed
with electrophoresis on 1% agarose gels stained with ethidium bromide and visualized by UV illumination, depending on DNA marker (2000 bp DNA ladder).

4.3 Preparation master mix for Detection of 16s rRNA and invA genes

For the detection of *Salmonella* spp. and *S. typhimurium* by PCR. The PCR amplification mixture (20μl) which was used for the detection each gene includes 5 μl of (PCR PreMix Lyophilized), which provided by Bioneer (Korea). Include: bacterially derived Taq DNA polymerase; dNTPs which include: 400 μM of each dATP, dGTP, dCTP, dTTP; 3mM of MgCl2; Yellow and blue dyes as loading dye), 5 μl of template DNA, 1.5 μl of each forward and reverse primers and 7. μl pcr water to complete the amplification mixture to 20 μl. The PCR tubes containing an amplification mixture were transferred to thermocycler and started the program for amplification of the 16s rRNA and invA genes. 30 cycles of PCR, with initial denaturation 1 cycle 95°C for 1 min then 5 min at 95°C (denaturation), 30 s at 55°C (annealing), and 45s at 72°C (extension). And 1 cycle for 7 min at 72°C (final extension).

Results

5.1 Culture methods:

The total percentage of isolation on tetrathionate broth, bismuth sulphate agar, chromogenic agar was 55% (55/100), 60% (33/55), 87.8% (33/29), the highest percent of isolation was from (India origin). The colonies of *salmonella* spp. on chromogenic agar were Variable in size convex and mauve in color. Figure(1). The Results of isolation salmonella spp. using cultural methods. present in table (2).

Figueur (1) Colonies of *salmonella* spp. on chromogenic salmonella agar (The arrow shows variable size and mauve in color.)

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Table (2) Results of *salmonella spp.* Isolation by using culture methods from chicken meat sample.

<table>
<thead>
<tr>
<th>Sample origin</th>
<th>Culture media</th>
<th>Tetrathionate broth</th>
<th>Bismuth sulphate agar</th>
<th>Chromogenic agar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of tested sample</td>
<td>No. of positive</td>
<td>%</td>
<td>No. of tested sample</td>
</tr>
<tr>
<td>Jordan chicken JD</td>
<td>20</td>
<td>12</td>
<td>60</td>
<td>12</td>
</tr>
<tr>
<td>Turkish casken oglo</td>
<td>20</td>
<td>9</td>
<td>45</td>
<td>9</td>
</tr>
<tr>
<td>Brazil al-kafeel</td>
<td>20</td>
<td>10</td>
<td>50</td>
<td>10</td>
</tr>
<tr>
<td>India al-murad</td>
<td>20</td>
<td>11</td>
<td>55</td>
<td>11</td>
</tr>
<tr>
<td>U.S.A. thighs</td>
<td>20</td>
<td>13</td>
<td>65</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>55</td>
<td>55</td>
<td>55</td>
</tr>
</tbody>
</table>

5.2 Confirmatory isolation of *salmonella spp.* and *S.typhimurium* by using Api20-E and PCR technique:

Salmonella isolates were subjected to some biochemical tests show positive productive results H2S, TSI, SIM And its give negative for indole, vo-gs, Proskauer and ureas. The total percentages of these tests 89.6% (29/26). And according to the reading of API 20-E system show that 25 isolated positive to API20-E system from 26 with percentage 96.1%. The results in Table (3).
Table (3) Results of Biochemical test and API20-E system.

<table>
<thead>
<tr>
<th>Sample origin</th>
<th>trademark</th>
<th>No. of tested sample</th>
<th>No. of positive (%)</th>
<th>No. of tested sample</th>
<th>No. of positive (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jordan</td>
<td>chicken JD</td>
<td>6</td>
<td>5</td>
<td>83.8</td>
<td>5</td>
</tr>
<tr>
<td>Turkish casken oglo</td>
<td>5</td>
<td>4</td>
<td>80</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Brazil</td>
<td>al- kafeel</td>
<td>6</td>
<td>6</td>
<td>83.3</td>
<td>6</td>
</tr>
<tr>
<td>India</td>
<td>al-agamard</td>
<td>6</td>
<td>5</td>
<td>83.8</td>
<td>5</td>
</tr>
<tr>
<td>U.S.A.</td>
<td>thighs</td>
<td>6</td>
<td>6</td>
<td>100</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>29</td>
<td>26</td>
<td>89.6</td>
<td>26</td>
</tr>
</tbody>
</table>

5.3 Molecular confirmatory detection using Single plex PCR:

The confirmed diagnosis of *Salmonella* spp. were performed by using single plex PCR to detect 16s rRNA gene. the total percentage was 92% (23/25) for chicken meat and the higher percent for isolation salmonella spp. by 16s rRNA gene was from al-kafeel and U.S.A thighs 100% while the lower percent was from Turkish origin 75%. the total percentage for detect invA gene for *S.typhiimurium* serotype was 30.4% (7/23). And the highest percent of isolation of *S.typhiimurium* was 50% from India origin while the lower was 0% from Turkish origin. (Figure 2) and (Figure 3).
(Figer: -2)) DNA amplification of a 406 bp of salmonella spp. detecting 16s r RNA gene using singleplex PCR. Lane 1 control, lane 2, 11 negative results, lane 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15 positive results as salmonella spp. Lane M 2000 bp marker (ladder).

(Figer 3) DNA amplification of a 558 bp of salmonella spp. detecting invA gene using singleplex PCR. Lane 1 control results, lane 4, 6, 7, 8, 9, 10, 12, positive results as S. typhimurium spp. Lane 2, 3 5, 13 negative result, lane M 2000 bp marker (ladder).
Table (4):- Results of detecting *salmonella spp.* By Single plex PCR *16s rRNA* gene and *in VA* gene

<table>
<thead>
<tr>
<th>Sample origin</th>
<th>Single plex PCR Detect <em>16s rRNA</em> gene</th>
<th>Single plex PCR detect <em>inVA</em> gene</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. tested sample</td>
<td>No. of positive</td>
</tr>
<tr>
<td>Jordan</td>
<td>chickenJD</td>
<td>5</td>
</tr>
<tr>
<td>Turkish</td>
<td>casken oglot</td>
<td>4</td>
</tr>
<tr>
<td>Brazil</td>
<td>al-kafeel</td>
<td>4</td>
</tr>
<tr>
<td>India</td>
<td>al-murad</td>
<td>6</td>
</tr>
<tr>
<td>U.S.A.</td>
<td>thighs</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>

**Discuss**

Chicken meat, one of the most important sources and a good compromise for the growth and transfer of *Salmonella spp.* and causing cases of food poisoning and that its presence in the fresh chicken meat, chilled and not well cooked, pose a threat to public health and a source of contamination of food through the stages of food preparation. To determine the level of contamination with *salmonella spp.* in imported poultry meat in the markets of the city of Al-Diwaniya, this study included several methods to isolate and detect a hundred samples of chicken meat from different origins. The results of isolation on Tetrathionate broth as enrichment media were 55% (55/100) which is compatible with (11) which reported 58.6% from chicken meat when used Tetrathionate broth as pre enrichment media 42 °C, and higher than those obtained by (12) (48%) and, (13) (31.4%). Several bacteriological selective media have been used to isolate *Salmonella spp.* from the bismuth sulphate agar. Where results of isolation on this media 60% (33/55) and this results higher than (14) when use Bismuth sulphate agar to isolated salmonella from a ported chicken in market of Baghdad city which his results was 24.76%.
considers One of the latest techniques that used in recent decade to rapid isolation of pathogenic agent in water and food is. These media are very specific and their component act as substrate for specific enzyme and depending on enzyme exhibit special color. (15) . salmonella spp. Was isolated (29/33) samples when inoculation on this agar with percent (87.8 %) which was significantly higher what has been reached in the study (16). the cause of this difference in the percent of isolated salmonella between studies due to the difference in the number of samples examined and health standards in the massacres . the results of isolation in chromogenic agar were refer to the accuracy and specificity of this media for bacterial isolation of Salmonella spp. in compare with other diagnosis methods chromogenic media have more advantage and can be an appropriate alternative for conventional and routine procedure. Chromogenic media eliminate the need of subculture in addition to shortest period of time pathogenic agent can be identified.

Biochemical test and Api-20 E system :-

The API 20-E diagnostic, which detects 20 biochemical reactions, is a traditional method for the identification of Salmonella enterica and other Enterobacteriaceae (17) . the present study shows that the total percentage of isolation salmonella spp. According to the reading of API 20-E system the confirmation of 25 isolates were done from 27 with percentage 92.5 % and this percentage was very closer to (18) that was his result 99% when evaluated API 20-E as indicator for salmonella enterica. And this results show that API 20 E system is a universal method supported in most laboratories global diagnostic the results don’t show any difference or variation in the characteristics of bacteria (bacteriological .biochemical characteristic) and this gives us more confidence for all subsequent steps related to this research .

Molecular confirmatory detection of salmonella spp.

By using Single plex PCR Technique :

Traditional methods for detection of Salmonella in food have included culturing the food item on selective media followed by characterization of suspect colonies with additional biochemical tests and immunoassays. In general, this process requires multiple days for successful identification of the pathogen. To overcome the protracted nature of traditional detection methods, and to enhance the sensitivity and specificity of detection, a number of molecular diagnostic methods have been developed, including methods that utilize Polymerase Chain Reaction (PCR). The use of 16s r RNA gene or invA gene specific PCR method in most diagnostic and research laboratories is possible and through the molecular basis of Salmonella identification techniques, this method is the simplest and less expensive (19). the results salmonella spp. detection by using 16s r RNA gene in present study from chicken meat samples were 92% (23/25) Table (16) than the percent of isolation serotype S.typhimurium from these sample were 30.4 %/23/25 , the results agreed with previous study (20), (21) obtained the ratio of contamination of salmonella in chicken meat 36%(9/25), 38% respectively when using invA gene . The ability of Salmonella specific primers to detect Salmonella species rapidly and accurately in the present study is primarily due to the primer sequences that are selected from the gene invA of S. typhimurium as reported by (22) The amplified PCR products which were carried out using the universal bacterial 16srRNA and invA primers and visualized by UV illumination showed the expected bands of about 406 bp Figure (6) 558pb Figure (7) The results demonstrated a correct genus identification of examined Salmonella isolates. The final results of
present study were 23% (23/100) it closer to (14) which his result 30% while his result to isolated S.typhimurium were 7.7%(2/26), also similar to previous studies obtained by (23) (20%), While lower than (24) that his result 60% of 192 chicken samples. This variation of results between studies may be associated with different factors such as, season of the study, number of samples and the methods applied. The predominant serotypes differ indifferent countries, hygienic conditions in storage and cross contamination during transport.

References


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عزل وتشخيص جرثومة السالمونيلا تايفيموريم من لحوم الدواجن المستوردة في أسواق مدينة الديوانيه باستخدام تقنية ال PCR

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كريم ناصر طاهر
هدى عبد الهادي النصراوي
كلية الطب البيطري / جامعة القادسية

الخلاصة

الهدف من هذه الدراسة هو الكشف عن التلوث بجرثومة salmonella spp. في عينات لحوم الدجاج المستوردة في أسواق مدينة الديوانيه وذلك لحماية صحة المستهلك. وقد تم جمع 100 عينة من لحوم الدجاج ومن مصادر مختلفة. وقد استخدمت عدة أوساط انتقائية وتقنية ال PCR لعزل الجرثومة. وأظهرت هذه الدراسة عزل 55 عزلة على وسط tetrarathionate و(33 \( \% \)) على وسط bismuth sulphate وكنت نتائج العزل على وسط chromogenic 87.8\( \% \) (29 \( \% \) 33). كما استخدمت عدة اختبارات كيميائية لعزلات السالمونيلا حيث أعطت هذه العزلات نتائج إيجابية للانتاج H2S TSI SIM MRD والبويز ووفقاً لقراءة نظام Api20 E. كانت نتائج العزلات 96.1 \( \% \) (26 \( \% \) 25) في هذه الدراسة قد تم تأكيد عزل 23 عزلة من السالمونيلا من أصل 25 بنسبة 92\( \% \) عن طريق تقنية تفاعل البترول المتسلسل (PCR) باستخدام البادئين النيوكليوتيدي 16s rRNA للسالمونيلا والبادئ النيوكليوتينيدي invA لاتفاوريم. تم اختيار هذه البادئات خصيصاً للكشف عن السالمونيلا لتصخيم الحمض النووي bp 558 وbp 406، على التوالي. وقد تم تحديد 7 عزلات من أصل 23 بنسبة 30.4\( \% \) للنطاق المقصي S.typhimurium 50\( \% \) للنطاق الهندى (6 1) واقل منشأ تلوثاً منشأ التركزي.