Chemical Indices of Imported Frozen Meat

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Abstract:

One hundred random samples of frozen meat (Indian and Brazilian) (50 of each) were collected from different butchers shops at kalyobia governorate. The samples were subjected to chemical examination for detection of spoilage which takes places. Biochemical changes as proteolytic, lipolytic and enzymatic indices were invistigated.

The obtained results revealed an increase in pH of frozen meat to spoilage level (more than 6.3) while the results of extract release volume (E.R.V.), total volatile Nitrogen (T.V.N), urea, creatinine uric acid, thiobarbituric acid number (TBA) Alanine Aminotransferase (ALT or GPT), Aspartate amino transferase (AST or GOT) and Alkaliane phosphatase (AP) were recorded and discussed.
**Introduction**

Meat is considered to be one of the prime protein source. The use of freezing for meat preservation date back to prehistoric times. It was observed by primitive man that at continued low climatic temperatures perishable foods could keep almost indefinitely as long as they were maintained in the frozen state. Preservation was generally assumed to be satisfactory as long as the food was frozen hard, and little attention was paid to quality or national value.

Frozen meat is likely to undergo changes of physical and chemical properties leading to effect on nutritious value and eating quality which is the most important for consumer acceptance (*Miller et al., 1980*).

Freezing and frozen storage of meat produce profound effect on structural and chemical properties of meat including changes in muscle fibers, lipid and protein. These changes significantly influencing the quality attributes of them (*ICMSF, 1980*).

The capability of chemical tests to discover the spoilage before change in colour, odour, texture or taste was of valuable importance.

This study was done as a trial to detect and study the chemical indices of frozen imported meat.

Therefore rapid reliable and practical method for detection of deterioration of imported frozen meat are of vast importance. To achieve these objectives, chemical indices were used mainly:

PH value, extract release volume, total volatile nitrogen, urea, creatinine, uric acid, thiobarbituric acid number, alanine amino transferase, aspartate amino transferase and alkaline phosphatase.
Material and Methods

A One hundred samples of frozen meat (Indian and Brazilian) (50 of each) were purchased from different butchers shops at Kalyobia Governorate. The samples were transported into the laboratory without undue delay to be examined for chemical indices.

The methods used in the present study were classified into:

1. General acceptance indices:
   1.1. Determination of pH value:

       The pH values were determined according to the method recommended by Pearson, (1984) by using electric pH meter (Hanna).

   1.2. Extract Release volume (ERV):

       ERV values were determined according to the method reported by Pearson (1981) by using filter paper (whatman) No1, 18.5cmQ and the filtrate volume, collected in 15 minutes was measured and recorded.

2. Proteolysis indices
   2.1. The total volatile nitrogen (TVN) was determined according to the method reported by FAO (1980).

   2.2. Urea was determined according to the method reported by Fawcett and Scott (1960) using kits provided by Winerlab.

   2.3. Creatinine was determined according to the method recommended by Henary (1974) using kits provided by Diamonde diagnostic company.

   2.4. Uric acid was determined according to the method described by Barham and Trindee (1972) using the Bio Merrexuskits.

3. Lipolysis indices:

   3.1. Determination of thiobarbturic acid (TBA) number was performed according to the method reported by Vyncke (1970).

4. Enzymatic activity indices:

   4.1. Determination of Alanine aminotransferase (ALT or GPT) Aspirate aminotransferase (AST or GOT) were determined by the techniques reported by Reitman and Frankel (1975) by using Bio Merieuxkits.

   4.2. Determination of Alkaline phosphatase (AP) was described by Bilfield and Goldberg (1971).
## Results

*Table (1)*: Statistical analytical results of general acceptance indices [pH and ERV(ml)] in the examined samples of imported frozen meat (n=50).

<table>
<thead>
<tr>
<th></th>
<th>Imported frozen meat</th>
<th>Min</th>
<th>Max</th>
<th>Mean ± SD</th>
<th>E.O.S.</th>
<th>% of acceptable samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1. pH</td>
<td>Indian</td>
<td>5.04</td>
<td>5.50</td>
<td>5.35±0.37 NS</td>
<td>5.6-6.2</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Brazilian</td>
<td>5.12</td>
<td>5.51</td>
<td>5.34±1.48 NS</td>
<td>NS</td>
<td>100%</td>
</tr>
<tr>
<td>1.2. E.R.V</td>
<td>Indian</td>
<td>11.9</td>
<td>59.17</td>
<td>41.47±12.03 S</td>
<td>NS</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Brazilian</td>
<td>49.9</td>
<td>60.0</td>
<td>53.94±13.36 S</td>
<td>NS</td>
<td>-</td>
</tr>
</tbody>
</table>

*Table (2)*: Statistical analytical results of proteolysis indices [(TVN(mg/100ml), urea (mg/dl), creatinine (mg/dl) and Uric acid(mg/dl)] in the examined samples of imported frozen meat (n=50).

<table>
<thead>
<tr>
<th></th>
<th>Imported frozen meat</th>
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<th>% of acceptable samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1. TVN</td>
<td>Indian</td>
<td>2.68</td>
<td>26.88</td>
<td>8.51 ± 1.19 NS</td>
<td>&gt;20mg/100gm</td>
<td>46%</td>
</tr>
<tr>
<td></td>
<td>Brazilian</td>
<td>3.10</td>
<td>28.12</td>
<td>10.35±7.13 NS</td>
<td>NS</td>
<td>48%</td>
</tr>
<tr>
<td>2.2. Urea</td>
<td>Indian</td>
<td>0.69</td>
<td>28.63</td>
<td>8.79±1.36 NS</td>
<td>NS</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Brazilian</td>
<td>3.54</td>
<td>31.86</td>
<td>10.69±1.07 NS</td>
<td>NS</td>
<td>-</td>
</tr>
<tr>
<td>2.3. Creatinine</td>
<td>Indian</td>
<td>1.30</td>
<td>5.90</td>
<td>3.48±0.18 S</td>
<td>NS</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Brazilian</td>
<td>0.28</td>
<td>5.88</td>
<td>3.67±1.52 S</td>
<td>NS</td>
<td>-</td>
</tr>
<tr>
<td>2.4. Uric acid</td>
<td>Indian</td>
<td>0.65</td>
<td>29.3</td>
<td>3.07±0.09 S</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Brazilian</td>
<td>0.02</td>
<td>20.2</td>
<td>18.3±5.36 S</td>
<td>NS</td>
<td>-</td>
</tr>
</tbody>
</table>

*Table (3)*: Statistical analytical results of lipolysis indices [TBA (mg/dl)] in the examined samples of imported frozen meat (n=50).

<table>
<thead>
<tr>
<th></th>
<th>Imported frozen meat</th>
<th>Min</th>
<th>Max</th>
<th>Mean ± SD</th>
<th>E.O.S.</th>
<th>% of acceptable samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1. TBA</td>
<td>Indian</td>
<td>0.32</td>
<td>1.082</td>
<td>0.58±0.19 S</td>
<td>&gt;0.9mg/100gm</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Brazilian</td>
<td>0.39</td>
<td>2.41</td>
<td>1.03±0.54 NS</td>
<td>NS</td>
<td>-</td>
</tr>
</tbody>
</table>

*Table (4)*: Statistical analytical results of Enzymatic activity indices [GPT(I.U/mg), GOT(I.U/mg) and AP(I.U/mg)] in the examined samples of imported frozen meat (n=50).

<table>
<thead>
<tr>
<th></th>
<th>Imported frozen meat</th>
<th>Min</th>
<th>Max</th>
<th>Mean ± SD</th>
<th>E.O.S.</th>
<th>% of acceptable samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1. GPT</td>
<td>Indian</td>
<td>0.04</td>
<td>0.45</td>
<td>0.23±0.03 NS</td>
<td>NS</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Brazilian</td>
<td>0.05</td>
<td>0.53</td>
<td>0.19±0.02 NS</td>
<td>NS</td>
<td>-</td>
</tr>
<tr>
<td>4.2. GOT</td>
<td>Indian</td>
<td>0.03</td>
<td>0.51</td>
<td>0.24±0.03 S</td>
<td>NS</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Brazilian</td>
<td>0.04</td>
<td>0.34</td>
<td>0.15±0.02 S</td>
<td>NS</td>
<td>-</td>
</tr>
<tr>
<td>4.3. AP</td>
<td>Indian</td>
<td>0.03</td>
<td>0.58</td>
<td>0.21±0.04 S</td>
<td>NS</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Brazilian</td>
<td>0.01</td>
<td>0.58</td>
<td>0.21±0.02 S</td>
<td>NS</td>
<td>-</td>
</tr>
</tbody>
</table>

NS: non significant differences.
S: significant differences.
Discussions

There are many causes of meat spoilage not only microbiological but also chemical and physical which lead to retrogressive changes in nature. There is more interest to investigate the biochemical change such as protolytic, lipolytic, enzymatic and PH of frozen meat (Indian and Brazilian).

*General acceptance indices:*

**PH:**

It is obvious from the results obtained in Table (1) that the mean value of examined imported (Indian) frozen meat was 5.53 ± 0.37, while that of (Brazilian) imported meat samples was 5.34 ± 1.48.

These results agreed with those of *Abd-El Moneim (1991)* who found that the maximum pH of examined imported frozen meat was 6.2, the minimum was 5.6 with a mean value of 5.87 ± 0.019 and those described by *Bahlol (1989)*. Nearly similar results were reported by *El-Atal (1986) and Hafiz (1986)* (pH 5.86 and 5.84, respectively).

The rise of the meat pH values at frozen storage period may be due to the possible breakdown of proteins and consequently the increase of ammonia and free amino group produced in meat (*Daveg and Gilbert 1968, 1969 and Cuzzoui and Gazzoni 1984*).

At the same time the observed pH of the majority of samples remained within the acceptable level (5.6-6.2) which they were recommended by *The Egyptian Standards Legalization (2005).*

**Extract release volume:**

Results given in Table (1) revealed that the mean value of imported (Indian) frozen meat was average 41.47 ± 12.03, while for (Brazilian) Samples was 53.94 ± 13.36.

Evaluating the both examined frozen meat groups on that basis for extract release volume, it is evident that only one (Indian) samples were unaccepted and 99 samples of both types were accepted according to *Abd El-Moneim (1991)*, who found that the maximum extract release volume of examined imported frozen meat was 33, the minimum was 17, with a mean value of 29.028 ± 0.470.
A decrease in ERV might be due to the denaturation and/or aggregation of proteins. This phenomenon has been attributed to mechanical losing of the muscle tissue by the formation of ice crystals inside the cells (Carroll et al. 1981) or due to proteolysis in beef during storage (Jay 1966).

**TVN:**

Results given in Table (2) revealed that the mean value of examined imported (Indian) frozen meat was 8.51 ± 1.19, while for (Brazilian) was 10.35 ± 7.13. These results come in contrast with those obtained by Abd-El Moneim (1991) who examined imported frozen meat and found that the maximum, the minimum and the mean values were 19.4, 9.7 and 13.768 ± 0.196, respectively.

The increase in the TVN may be due to denaturation of protein which results from migration of H$_2$O from the cells to form larger intercellular ice crystals resulting in the formation of concentrated salt solution in meat cells (Miller et al. 1980). The changes in TVN could be taken as relatively good index of the changes the protein solubility (El-Gharabawi and Dugan 1965).

At the same time the observed total volatile nitrogen values of the majority of samples remained with in the acceptable level (>0.9mg/100gm) which they were recommended by The Egyptian Standard Legalization (2005).

**Urea:**

It is evident from the results in Table (2) that the mean value of urea in examined (Indian) frozen meat was 8.79 ± 1.36, while that for (Brazilian) samples was 10.69 ± 1.07.

These results are in agreement with those reported by Gardner and Stewart (1966a) who suggested that urea concentration of beef stored at 4,9 and 15°C initially increased then decreased due to conversion of urea to ammonia responsible for bad odor and flavor of spoiled meat.

**Creatinine:**

Creatinine results given in Table (2) showed that the mean value of creatinine in examined (Indian) frozen meat samples was 4.48 ± 0.18, while that for (Brazilian) samples the was 3.67 ± 1.52.

Increase of creatinine with the time of storage was previously reported by Strang and Benedict (1978), who found that creatinine is an indicator of proteolysis.
The present results revealed an increase in the beginning of spoilage of frozen meat. These results are in agreement with those described by Strong and Benedict (1978).

**Uric acid:**

It is obvious from the results obtained in Table (2) that the mean uric acid value of imported (Indian) frozen meat was $3.07 \pm 0.09$, while that for (Brazilian) samples was $18.3 \pm 5.36$.

The high levels of uric acid in liver stored at chilling temperature may be attributed to that most proteins are synthesized in the liver from amino acids derived from feed or tissue catabolism and consequently, uric acid metabolite (Patrick and Schaible 1980).

**Lipolytic indices:**

**TBA:**

Results given in Table (3) revealed that the mean TBA value of examined (Indian) imported frozen meat was $0.58 \pm 0.19$, while for (Brazilian) samples was $1.03 \pm 0.54$.

Evaluating the examined two types of imported frozen meat samples on that basis for TBA of imported meat, there is only 4 samples of (Indian) group were accepted while the remainder samples were unaccepted while all the (Brazilian) examined samples were unaccepted, this result may be due to increasing the time of frozen storage due to formation of malonaldehyde can end product of oxidative operation of fat and the lipid oxidation of frozen meat may be due to increase in surface area of meat cuts or incorporation of air into the meat during its preparation (Caldironi and Bazan 1982).

TBA at the observed total volatile nitrogen values of the majority of samples remained within the acceptable level (20mg/100g) which they were recommended by The Egyptian Standards Legalization (2005).

**Enzymatic indices:**

It is evident from the results obtained in Table (4) that the mean GPT value of examined (Indian) imported frozen meat was $0.23 \pm 0.03$, while for the (Brazilian) was $0.19 \pm 0.02$.

Results given in Table (4) revealed that the mean GOT of examined (Indian)
imported frozen meat was 0.24 ± 0.03, while that for (Brazilian) samples was 0.15 ± 0.02.

Results given in Table (4) revealed that the mean alkaline phosphatase value of imported (Indian) frozen meat was 0.21 ± 0.04, while that for (Brazilian) samples was 0.21 ± 0.02.

The present study interested in determination of the enzymes, ALT, AST and AP in imported (Indian) and (Brazilian) frozen meat samples undergoing aerobic spoilage during freezing storage.
References


الملخص العربي

قد تناولت هذه الدراسة فحص 50 عينة من اللحوم المستوردة من الهند و50 عينة من اللحوم المجدة البرازيلية وفحصها بالاختبارات الكيميائية ومقارنة النتائج للمجموعتين لمعرفة الفارق في القيمة الصحية للحوم المستوردة من كلا البلدين.

تم شراء العينات من محلات بيع اللحوم المجدة والسوبر ماركت المختلفة بمحافظة القليوبية وكانت كل عينة تزن 150 جرام وتم:

1. استبيان حالة الصحة للحوم المجدة المستوردة من الهند والبرازيل.
2. مقارنة نتائج الاختبارات الكيميائية لفحص كلا من العينات من الهند والبرازيل لمعرفة أفضلية كل منها بالنسبة للحالة الصحية.

وقد تم إجراء الاختبارات الكيميائية الآتية على عينات كلا المجموعتان:

- تركيز أيون الأيدروجين، الحجم المستخلص المتصاعد (ملمتر)، تركيز النيتروجين الفلوئي المتصاعد (مجم/100جم).
- تركيز البروتين الذائب (جم%), تركيز اليورييا (مجم/100جم).
- الكرياتين (جم/100جم)، تركيز حمض البيريك (جم/100جم)، قيمة الثائوباربيتوريك (جم/كم).
- خميرة الأسيبرتات وأمينوتراين فيراز (وحدة دولية/جم)، خميرة الألفين وامينو ترانس فيراز (وحدة دولية/جم) وخميرة الفوسفاتين القاعدي (وحدة دولية/جم).

أوضح هذه الدراسة عدم وجود اختلافات جوهرية بين نتائج الاختبارات الكيميائية التي أجريت لفحص حالة الصحية لكلا من نوعي اللحوم المجدة المستوردة من كل من الهند والبرازيل إلا في اختبار حجم المستخلص الذائب والكرياتين وخميرة الأسيبرتات أمينو ترانس فيراز.