Chemical and biological study on the effect of yoghurt on most common consumed ready meat products

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ABSTRACT

This research occurred to estimate nitrite and nitrate in some ready meat products, investigate the chemical composition of sausage and basterma and also study the effect of consumption of yoghurt on the side effect of nitrite and nitrate at heavy consumed basterma and sausage. Thirty five male albino rats (Sprague Dawley strain), weighing 110±6g were classified into five groups as basterma, sausage, basterma with yoghurt, Sausage with yoghurt and basterma with sausage with yoghurt groups. The obtained results showed that nitrate and nitrite were present in the ready –made meat product with variable levels. Sausage contains high level of nitrate while basterma contains high level of nitrite among ready-made meat products under study (luncheon, Basterma, Sausage, Burger and Kofta). The chemical composition of basterma and sausage showed that the moisture, protein and ash contents were increased but fat was decreased in basterma compared to sausage. Rat groups which fed on basterma with yoghurt, sausage with yoghurt, and both basterma and sausage with yoghurt showed a significant higher in values of body weight gain, food intake and FER also showed a significant higher in value of hemoglobin and total protein concentration but showed a significant decrease in some liver function enzymes (ALT, AST, γ GT and ALP), kidney parameters concentration (creatinine, urea and uric acid) and glucose in comparison with rat groups which fed on either basterma or sausage. It is advised to consume yoghurt to improve liver and kidney function and nutritional status especially in heavy consumed ready meat product.

Key wards: nitrite, nitrate, some ready meat products, basterma, sausage, yoghurt.

Introduction

Meat and meat products represent an important part of the human diet. Basterma is characterized as fresh non cooked and manufactured under the addition of salt, phosphate, nitrite, ascorbic acid, sugars and different seasoning. The blood and salt is then squeezed out of the meat which is then covered with a cumin paste prepared with crushed cumin, fenugreek, garlic, and hot paprika, followed by thorough air-drying. In Egypt, Basterma is used for breakfast, with fried eggs. It is also used as a topping for pizza, and a filling for a variety of oven prepared stuff dough dishes, whether they are made from regular bread like dough, or a flaky multilayered puff pastry like dough (ANONYMOUS 2005). Sausages are very common and popular processed meat products manufactured from lower-value trimmed meat to produce a higher-value product. They may be partially dried or smoked and should be consumed only after heat processing either frying or grilling (Papadima and Blouka 1999 and Ambrosiadis et al ., 2004). Basterma is fermented during the partially drying process under climatic conditions. Combination of drying and fermentation is known as the ripening period. The main changes take place during this period affects the quality attribute of basturma and continue in the storage period (Bozkurt and Erkmen, 2002).

Food additives are used to accomplish certain functions such as coloring, antimicrobial, antioxidative, preservation, improved nutrition, increased emulsification, and altered flavor (Davidson 2001). Nitrates (NO₃) and nitrites (NO₂) are chemicals that can be found naturally in our food and water and are important plant nutrients. Nitrites cause a colour reaction in the meat and add an appealing pink colour to cooked products. Meat products without nitrates/nitrites are brown or gray coloured. Nitrites undergo a chemical reaction and are converted to nitrites. Then, nitrites react with the protein of the meat (myoglobin), and are converted to nitrosomyoglobin (bright red). When cooked, nitrosomyoglobin is converted to nitrosohemochrome (pink pigment). The use of combination of nitrite and nitrate, gives a source of additional nitric oxide and should the nitrite be depleted during curing. The slower release of nitric oxide from nitrate gives them an additional safety factor over nitrite alone. Nevertheless, many highly successful operators use nitrite alone with excellent results (Jakszyn and Gonzalez 2006 and Pinar and Terken 2010). In addition, nitrite develops cured meat flavor and

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colour and retards the development of rancidity and off-odours and off-flavours during storage of cured meats. Nitrite prevents the growth of a harmful bacterium called Clostridium botulinum and it may also have preservation effects on other harmful and spoilage bacteria (Hyttia et al. 1997 and Manassaram et al., 2006).

Unfortunately, Nitrates may react with amines in the food to form potentially cytotoxic carcinogenic nitrosamines. And this leads to a sharp increase in cancer risk for those who eat them (Bozkurt and Erkman 2002).

Therefore, the objective of this study was to estimate nitrite and nitrate in basterma and sausage and the effects of yoghurt in lowering the side effect of nitrite and nitrate at heavy consumption of some ready - made meat products.

Materials And Methods

A – Materials:

The ready-made meat products (luncheon, Basterma, Sausage, Burger and Kofta) and yoghurt were bought from different supermarkets in Riyadh.

Thirty five male albino rats (Sprague Dawley strain), weighing 110±6g were provided from experimental animals center in Medicine collage of King Saud University in Riyadh. Casein, cellulose, starch, vitamins and biochemical kits were obtained from Alkan Co. for Chemicals and Biodiagnostics, in Riyadh. Animal diets were formulated based on AIN 1995. The basal diet (g/kg diet) consisted of 140 gm casein (> 80 % protein), 100 gm sucrose, 50 gm corn oil, 50 gm cellulose, 35 gm mineral mixture, 10 gm vitamin mixture, 1.8 gm L-cystine, 2.5 gm choline bitartrate and the remainder is corn starch according to Reeves et al., 1993. The experimental diet formed from basal diet but basterma and sausage were added to basal diet instead of casein.

B- Methods:

Yoghurt prepared according to mentioned method of Abd El-Ghany et al., 2012. Lactobacillus delbrueckii subsp. bulgaricus CH-2 (Chr. Hansen’s Lab, (Denmark) was cultivated in 25 ml of MRS broth medium at 37°C for 24 h. Streptococcus thermophilus ST-36 (Chr. Hansen’s Lab) grown in 25 ml M17 broth at 40°C for 24 h. Skim milk powder was obtained from Rich Food Co. (Richmond, Virginia, USA). The milk preparations were heated at 90°C for 5 min and then cooled to 42°C and inoculated with 1% each of the lactobacilli and streptococci starter cultures. After incubation at 40°C (about 4 hr), the coagulated yoghurts were for 36 h under refrigeration (5°C). Yoghurt was added to basal diet at dose 180 cc / kg body weight /day with taking into consideration their content of protein and carbohydrate (Robinson 1991 and Abd El-Ghany et al., 2012).

The nitrite and nitrate contents were determined in experimental readymade- meat products immediately after purchase in triplicate by rapid method of improved accuracy according to Follett and Ratcliff method. Nitrate is determined by reduction to nitrite with cadmium, and subsequent development of the dye Orange I obtained with I-naphthol/sulphanilic acid reagent. Nitrite present does not interfere and is separately determined with the same colorimetric reagent. In meat, a range of concentrations of nitrate and nitrite up to the equivalent of 2000 p.p.m. sodium nitrite may be determined (Follett and Ratcliff 1963). Results of residual nitrate in experimental ready-made meat products were ranked as follows: sausage > (burger & kofta) >basterma> luncheon but results of nitrite were basterma> (burger & sausage) > kofta > luncheon. From these results, sausage and basterma were of choice for biological study as shown in table 1.

Approximate chemical composition of basterma and sausage moisture, ash, crude protein, and fat were determined according to the methods of the (A.O.A.C. 2005). While total carbohydrates were estimated by subtracting the difference from initial weight of the samples as follows:- Carbohydrates% = 100 - (% moisture + % protein + % fat +% ash).

Then, sausage and basterma were sliced, dried with hot air oven (40–60°C) and grinded to powder for adding to experimental diet.

Rats fed on basal diet for a week as adaptation period in wire cages under the normal laboratory conditions then rats were classified as following:

Basterma group: Administered experimental diet containing basterma powder.
Sausage group: Administered experimental diet containing sausage powder.
Basterma + yoghurt group: Administered experimental diet containing basterma powder and yoghurt.
Sausage+ yoghurt group: Administered experimental diet containing sausage powder and yoghurt.
Basterma + Sausage+ yoghurt group: Administered experimental diet containing both basterma and sausage powder with yoghurt.

The food intake was calculated daily and the body weight gain was recorded weekly. Food efficiency ratio (FER) was calculated according to Chapman et al., (1950). The rats were sacrificed at the end of the experiment (45days) for collection of blood samples. Part of blood was centrifuged at 3000 rpm/ 15 minutes to obtain serum
for some biochemical analysis. Hemoglobin (HG) and packed cell volume (PCV) were estimated in heparinized blood for according to Drabkin (1949) and Mc Inory (1954), respectively. Glucose was estimated in blood mixed with potassium oxalate and sodium fluoride by O-toluidine method (Sasaki et al., 1972). Serum alanine and aspartate amino transferase (ALT & AST), alkaline phosphatase (ALP) and γ-glutamyl transferase(γ GT) enzymes activity were performed according to the method of Bergmeyer and Horder (1980), Kind and King (1954) and Henry, (1974), respectively.

Serum creatinine, urea and uric acid were estimated according to Bonsens and Taussky (1984), Patton and Crouch, (1977) and Fossati et al., (1980), respectively. Serum total protein, albumin and globulin were determined as described by the method of Weichselbaum (1946), Bartholomev and Delany (1966) and Coles (1974), respectively. Albumin / globulin (A/G) ratio was calculated according to the methods of Friedwald et al., (1972).

Collected data are expressed as mean ±SE. Statistical analysis was done by using analysis of variance (ANOVA) followed by student’s t-test and P values of 5% and less were considered to be significant (Artimage and Berry 1987).

Results:

Table 1: Mean values ± SD of residual levels of nitrates and nitrites in different ready-made meat products

<table>
<thead>
<tr>
<th>Variables</th>
<th>Samples</th>
<th>Luncheon</th>
<th>Basterma</th>
<th>Sausage</th>
<th>Burger</th>
<th>Kofta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrates(mg/kg)</td>
<td>73.77±17.81&lt;sup&gt;a&lt;/sup&gt;</td>
<td>193.74±22.11&lt;sup&gt;b&lt;/sup&gt;</td>
<td>388.45±33.41&lt;sup&gt;c&lt;/sup&gt;</td>
<td>255.76±41.17&lt;sup&gt;d&lt;/sup&gt;</td>
<td>209.41±21.25&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Nitrites(mg/kg)</td>
<td>18.83±3.21&lt;sup&gt;a&lt;/sup&gt;</td>
<td>180.44±18.77&lt;sup&gt;b&lt;/sup&gt;</td>
<td>85.99±7.87&lt;sup&gt;b&lt;/sup&gt;</td>
<td>91.63±9.26&lt;sup&gt;b&lt;/sup&gt;</td>
<td>50.60±5.37&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

Mean values in each raw having different superscript (a, b, c, d) are significant.

From results in table 1, nitrate and nitrite were present in the ready –made meat product with variable levels. Sausage contains high level of nitrate while basterma contains high level of nitrite among ready-made meat products under study.

It is known that humans are exposed to a wide range of nitrite and nitrate from diet (cured meat products, fried food, smoked preserved foods, foods subjected to drying, pickled, and salty preserved foods), tobacco smoking, work place, and drinking water (Jakszyn and Gonzalez 2006). The obtained results of nitrate and nitrite content in ready-made meat products were somewhat agreed with Gutierrez et al., (1994), Hussein (1998) and Parolari (2004) but differed than results obtained with Saber (1999) because of the difference in source and varieties of these products.

Table 2: Chemical composition of basterma and sausage

<table>
<thead>
<tr>
<th>Variables</th>
<th>Protein</th>
<th>Fat</th>
<th>Moisture</th>
<th>Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basterma</td>
<td>25.68</td>
<td>5.80</td>
<td>63.22</td>
<td>5.30</td>
</tr>
<tr>
<td>Sausage</td>
<td>17.51</td>
<td>21.60</td>
<td>57.79</td>
<td>3.10</td>
</tr>
</tbody>
</table>

The chemical composition of basterma and sausage were illustrated in table (2). The moisture, protein and ash contents were increased in bastrema compared to sausage. The fat content was higher in sausage in comparing to bastrema.

The results of the chemical composition of bastrema showed increase protein content of bastrema makes up 25.68% of its weight. These prove that bastrema is a good source of high quality protein that mainly depends on the cut of meat (Newton and Gell 1981). The lower value of the protein of sausage 17.51% and the fat content was 21.60% in our results because sausages as processed meat products are manufactured from lower-value trimmed meat to produce a higher-value product and substitution with non-meat components, since meat proteins are relatively more expensive than non-meat component (Jihad et al., 2009). The obtained protein and fat results were agreed with Dharmaveer et al., (2007) who estimated 18.36% protein in sausages but sausage may contain up to 30% fat which is the maximum amount. As fat provides sausage with flavor, texture and juiciness and its role in meat emulsion. The ash results were somewhat agreed with Pal and Agnihotri (1996) who reported that ash content of sausage was 2.06-2.21%. The obtained moisture result was decreased than that found by Agnihotri (2002) and Agnihotri and pal (2000) who mentioned that the moisture content of sausage is (66.7%). As using water improves tenderness and juiciness and it serves as a processing aid when the product is made.
minerals in a texture. The culturing of milk proteins during fermentation makes these proteins easier to absorb. Yogurt is a balanced source of protein, fats, carbohydrates, and yoghurt increases the absorption of calcium and B-vitamins. The lactic acid in the yogurt aids in the digestion of certain infections. Yogurt may be anticarcinogenic and antiatherogenic in some circumstances. It may also be useful in some gastrointestinal disorders and in some with allergies and asthma due to the highly nutritive value of meat products and yoghurt beside yoghurt was beneficial for gastrointestinal health and improve utilization. Yogurt may have a variety of positive immunologic effects and may help fight certain infections. Yogurt may be anticarcinogenic and antiatherogenic in some circumstances. It may also be useful in some gastrointestinal disorders and in some with allergies and asthma (Meydani and Ha 2000).

### Table 3: Mean values ± SD of body weight gain, food intake and FER of the experimental rat groups

<table>
<thead>
<tr>
<th>Groups Variables</th>
<th>Basterma</th>
<th>Sausage</th>
<th>Basterma+yoghurt</th>
<th>Sausage+yoghurt</th>
<th>Basterma+yoghurt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight gain(g)</td>
<td>56.14±5.41</td>
<td>60.31±6.21</td>
<td>99.66±8.21</td>
<td>104.38±8.77</td>
<td>101.31±9.11</td>
</tr>
<tr>
<td>Food intake(g/w)</td>
<td>13.61±1.31</td>
<td>14.11±1.26</td>
<td>15.31±1.40</td>
<td>15.91±1.41</td>
<td>16.41±1.60</td>
</tr>
<tr>
<td>FER</td>
<td>0.09±0.003</td>
<td>0.09±0.001c</td>
<td>0.14±0.01c</td>
<td>0.145±0.021c</td>
<td>0.137±0.015c</td>
</tr>
</tbody>
</table>

Significant with basterma group * P<0.05 ** P<0.01 *** P<0.001
Mean values in each raw having different superscript (a, b, c, d) are significant

It is clear from table (3) that rat group which fed on sausage showed a non significant higher values of body weight gain, food intake and FER (p>0.05) compared to rat group which fed on basterma. Rat groups which fed on basterma with yoghurt, sausage with yoghurt, and both basterma and sausage with yoghurt showed a significant higher in values of body weight gain (p<0.01&0.001), food intake (p<0.05&0.01) and FER (p<0.001&0.01) compared to rat groups which fed on either basterma or sausage. There were non significant difference in these parameters among basterma with yoghurt, sausage with yoghurt, and both basterma and sausage with yoghurt groups.

Many researchers began to refocus attention on the yogurt as it is pasteurized milk that’s been fermented by lactic bacteria, a process that converts the milk’s sugar, or lactose, into lactic acid, resulting in its pudding-like texture and distinctive, slightly sour flavor. Yogurt improves the bioavailability of other nutrients. Culturing of yogurt increases the absorption of calcium and B-vitamins. The lactic acid in the yogurt aids in the digestion of the milk calcium, making it easier to absorb. Yogurt is a balanced source of protein, fats, carbohydrates, and minerals in a texture. The culturing of the milk proteins during fermentation makes these proteins easier to digest also S. thermophilus showed significant increase in rat weight gain (David and Helen 1985) The increase in nutritional results in groups which fed on meat products (basterma and sausage) with yoghurt were mainly due to the highly nutritive value of meat products and yoghurt beside yoghurt was beneficial for gastrointestinal health and improve utilization. Yogurt may have a variety of positive immunologic effects and may help fight certain infections. Yogurt may be anticarcinogenic and antiatherogenic in some circumstances. It may also be useful in some gastrointestinal disorders and in some with allergies and asthma (Meydani and Ha 2000).

### Table 4: Mean values ± SD of HG, PCV and glucose of the experimental rat groups

<table>
<thead>
<tr>
<th>Groups Variables</th>
<th>Basterma</th>
<th>Sausage</th>
<th>Basterma+yoghurt</th>
<th>Sausage+yoghurt</th>
<th>Basterma+yoghurt</th>
</tr>
</thead>
<tbody>
<tr>
<td>HG (mg/dl)</td>
<td>8.81±1.14c</td>
<td>8.01±1.21c</td>
<td>10.11±1.33c</td>
<td>10.71±1.41c</td>
<td>10.96±1.14c</td>
</tr>
<tr>
<td>PCV %</td>
<td>22.41±2.99a</td>
<td>23.31±3.11a</td>
<td>27.77±3.04a</td>
<td>28.57±3.71a</td>
<td>29.41±3.61a</td>
</tr>
<tr>
<td>Glucose (mg/dl)</td>
<td>170.14±12.44d</td>
<td>175.34±15.54a</td>
<td>130.45±11.76d</td>
<td>125.61±10.25d</td>
<td>120.34±13.40d</td>
</tr>
</tbody>
</table>

Significant with basterma group * P<0.05 ** P<0.01 *** P<0.001
Mean values in each raw having different superscript (a, b, c, d) are significant

Data in table (4) showed that rat group which fed on sausage showed a non significant higher in values HG, PCV and glucose (p>0.05) compared to rat group which fed on basterma. Rat groups which fed on basterma with yoghurt, sausage with yoghurt, and both basterma and sausage with yoghurt showed a significant higher in value of HG (p<0.05&0.01) and a significant lower in value glucose (p<0.001) compared to rat groups which fed on either basterma or sausage. Rat groups which fed on sausage with yoghurt or both basterma and sausage with yoghurt showed a significant higher in value of PCV while rat group which fed on basterma with yoghurt showed non significant higher in value of PCV compared to rat groups which fed on either basterma or sausage. There were non significant difference in values HG, PCV and glucose among rat groups which fed on yoghurt with sausage and basterma.

Our results are in perfect agreement with those of Bogard et al., 1986 and Batina (1990) who reported that nitrite induced haemoglobin oxidation is one of the principal factors of nitrite toxicity and one of the ways of its metabolism in an organism. Oxygenated free radicals are produced and could induce a peroxidation of the unsaturated fatty acids of phospholipids. Thus, it appears like an osmotic brittleness of the erythocyte membrane as well as a disturbance of membrane transport which leads to the hemolysis. Wiechetal et al. (1993) recorded significant increase in glucose level was observed at 3rd,4th and 5th weeks in rat feeding at diet containing 2% of KNO3.

The obtained results are consistent with those of the previous study of Wong et al.,(1983), Oda et al.,1994 and Yadav et al.,(2006) who recorded that in nutritional experiments with rats, high values for true digestibility, biological value and net protein utilization were obtained for yogurt. Hemoglobin regeneration efficiency was significantly higher in the fermented product-given rats than in the skim milk-supplied rats. L. acidophilus is effective for increasing of iron bioavailability in rats. Yogurts have higher protein content (whey) that can prevent blood sugar levels from rising too high because it stimulates the release of more insulin from your pancreas. Yogurts delay the progression of fructose-induced diabetes and dyslipidemia in rats and that these
may be useful as antidiabetic food supplements that can be included in daily meals of the diabetic as well as normal population.

**Table 5:** The Mean values ± SD of serum ALT, AST, ALP and γ GT of the experimental rat groups

<table>
<thead>
<tr>
<th>Groups Variables</th>
<th>Basterma</th>
<th>Sausage</th>
<th>Basterma+ yoghurt</th>
<th>Sausage+ yoghurt</th>
<th>Basterma+Sausage+ yoghurt</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALT (γ/ml)</td>
<td>55.71±3.61*</td>
<td>52.33±4.21*</td>
<td>31.61±3.61**</td>
<td>29.41±3.71***</td>
<td>27.31±2.98***</td>
</tr>
<tr>
<td>AST (γ/ml)</td>
<td>70.14±8.99*</td>
<td>72.17±9.61*</td>
<td>45.71±6.03***</td>
<td>46.71±5.99***</td>
<td>41.33±3.60***</td>
</tr>
<tr>
<td>ALP (γ/ml)</td>
<td>81.33±9.18*</td>
<td>79.41±10.14*</td>
<td>56.67±7.32***</td>
<td>58.11±8.11***</td>
<td>51.61±3.17***</td>
</tr>
<tr>
<td>γ GT (γ/ml)</td>
<td>8.44±1.68*</td>
<td>9.03±2.11*</td>
<td>6.38±1.31***</td>
<td>6.01±1.22***</td>
<td>5.67±1.31***</td>
</tr>
</tbody>
</table>

Significant with basterma group * P<0.05 ** P<0.01 *** P<0.001
Mean values in each raw having different superscript (a, b, c, d) are significant

From data presented in table (5), it could be noticed that rat group which fed on sausage showed a non significant higher in values of AST, ALT and γ GT and a non significant lower in values ALT and ALP (p>0.05) compared to rat group which fed on basterma. Rat groups which fed on basterma with yoghurt, sausage with yoghurt, and both basterma and sausage showed a significant decrease in ALT, AST, γ GT and ALP enzymes concentration (p<0.001&0.01) in comparison with rat groups which fed on either basterma or sausage but showed non significant difference among these groups.

Many researchers proved that the increase in liver Enzymes ALT, AST, AGT and GTT levels in the bloodstream indicate temporary or chronic damage. As cells are destroyed, they release their contents into the bloodstream. Nitrate and nitrite and dimethyl amine may react in the gastrointestinal tract synthesizing, the harmful dimethylnitrosoamine substances which had adverse effects on animal and human organs. Nitrate and nitrite were also reported to cause pathological changes in rat liver and kidney (Kasprzyk et al., 2005 and Azeez et al., 2011). Lactobacillus of yoghurt promotes inflammatory response during tissue repair in rodents. Yogurt consumption may have a healthful influence on the host because proteolytic activity produces toxic metabolites in the intestine (Clinton et al., 1991 and Macfarlane et al., 1992).

**Table 6:** Mean values ± SD of creatinine, urea and uric acid of the experimental rat groups

<table>
<thead>
<tr>
<th>Groups Variables</th>
<th>Basterma</th>
<th>Sausage</th>
<th>Basterma+ yoghurt</th>
<th>Sausage+ yoghurt</th>
<th>Basterma+Sausage+ yoghurt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creatinine (mg/dl)</td>
<td>1.66±0.34*</td>
<td>1.71±0.25*</td>
<td>0.77±0.01***</td>
<td>0.89±0.03***</td>
<td>0.79±0.02***</td>
</tr>
<tr>
<td>Urea (g/dl)</td>
<td>60.77±6.84*</td>
<td>63.71±6.61*</td>
<td>39.61±4.31****</td>
<td>40.11±4.16****</td>
<td>38.61±3.43****</td>
</tr>
<tr>
<td>Uric acid (mg/dl)</td>
<td>4.55±0.71*</td>
<td>5.11±0.77*</td>
<td>2.99±0.43****</td>
<td>3.11±0.44****</td>
<td>3.10±0.35****</td>
</tr>
</tbody>
</table>

Significant with basterma group * P<0.05 ** P<0.01 *** P<0.001
Mean values in each raw having different superscript (a, b, c, d) are significant

From data presented in table (6), it could be noticed that rat group which fed on sausage showed a non significant higher in values of creatinine, urea and uric (p>0.05) compared to rat group which fed on basterma. Rat groups which fed on basterma with yoghurt, sausage with yoghurt, and both basterma and sausage with yoghurt showed a significant decrease in creatinine, urea and uric acid concentration (p<0.001&0.01&0.05) in comparison with rat groups which fed on either basterma or sausage.

**Table 7:** Mean values ± SD of total protein, albumin and globulin of the experimental rat groups

<table>
<thead>
<tr>
<th>Groups Variables</th>
<th>Basterma</th>
<th>Sausage</th>
<th>Basterma+ yoghurt</th>
<th>Sausage+ yoghurt</th>
<th>Basterma+Sausage+ yoghurt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total protein(g/dl)</td>
<td>6.33±0.66b</td>
<td>5.99±0.48c</td>
<td>7.61±0.63b</td>
<td>7.71±0.55b</td>
<td>7.51±0.57b</td>
</tr>
<tr>
<td>Albumin (g/dl)</td>
<td>3.71±0.22a</td>
<td>3.43±0.33b</td>
<td>3.88±0.21b</td>
<td>3.99±0.28b</td>
<td>3.54±0.26b</td>
</tr>
<tr>
<td>Globulin (g/dl)</td>
<td>2.62±0.15c</td>
<td>2.56±0.13c</td>
<td>3.73±0.21b</td>
<td>3.72±0.18c</td>
<td>3.97±0.11c</td>
</tr>
<tr>
<td>A/G</td>
<td>1.42±0.19a</td>
<td>1.34±0.16b</td>
<td>1.04±0.20d</td>
<td>1.07±0.22d</td>
<td>0.89±0.17c</td>
</tr>
</tbody>
</table>

Significant with basterma group * P<0.05 ** P<0.01 *** P<0.001
Mean values in each raw having different superscript (a, b, c, d) are significant

In general, urea is a breakdown product of a normal protein diet and is excreted by the kidney. Creatinine is also derived from muscle protein but is less influenced by diet and in particular is used to measure the health of the kidneys. On the other side, uric acid is a waste product produced after protein digestion. Levels can be raised as a result of a high protein diet and by excessive alcohol intake. Too high a level can lead to excess uric acid being deposited as crystals in the tissues of the body. When this occurs in joints, it causes the painful condition gout. More rarely, deposits in the kidneys can cause kidney damage. Excessive quantities of nitrate and nitrite consumption through food can be harmful to health (Marcus et al., 1983). Consumption of yoghurt culture, which increases faecal lactobacilli, raises lactobacilli in the colon and may be an easy way to increase the
concentration that may be sufficient to produce several physiologic benefits and may prove useful in prevention of various infectious diseases, in stimulation of the immune system, and in protection against some carcinogens (Sanders 1993 and Bottazzi and Mercenier, 1994).

Table (7) showed that rat group which fed on sausage showed a non significant difference in values of total protein, albumin, globulin and A/G ($p>0.05$) compared to rat group which fed on basterma. Rat groups which fed on basterma with yoghurt, sausage with yoghurt, and both basterma and sausage with yoghurt showed a significant increase in total protein concentration ($p<0.05$) but showed non significant difference in value of albumin ($p>0.05$) in comparison with rat groups which fed on either basterma or sausage. Rat group which fed on basterma with yoghurt showed non significant difference in values of globulin and A/G ($p>0.05$) while Rat group which fed on sausage with yoghurt showed a significant increase in globulin ($p<0.05$) and non significant decrease in A/G ($p>0.05$) in comparison with rat groups which fed on either basterma or sausage. Rat group which fed on both basterma and sausage with yoghurt showed a significant increase in globulin concentration $(p<0.05)$ but showed significant decrease in value of A/G $(p>0.001)$ in comparison with rat groups which fed on either basterma or sausage.

Clinical research has confirmed that when the liver is damaged or diseased, it affects the protein levels in the blood. Albumin will drop and is a dramatic sign of poor health and slowing down of liver function. It will also increase the likelihood of muscle wasting, loss of vitality and will affect any of the systems which are trying to compensate for the decreased liver function (Marcus et al., 1983). Several clinical studies documented hepatorenal and/or hepatotoxicity in humans were associated with excess nitrate intake. The study of short term (3 days intoxication) and midterm (over 21 days) NH4NO3 exposure to wistar rats at the dose of 250 mg/Kg. Under these conditions, methemoglobinemia, increase in serum nitrates as well as a hepatic cytotoxicity indicated by an increase in bilirubin and transaminases levels were observed. Nitrate may be endogenously transformed into nitrite which in turn can react with amines and amides to produce nitrosamines and free radicals. Such products may increase lipid peroxidation, which can be harmful to different organs including liver and kidney (Singhal et al., 2001; Manassaram et al., 2006; Samira et al., 2006; Santamaria, 2006 and Pinar and Terken 2010).

Lactobacilli in yoghurt exerts their protective or therapeutic effect through production of antimicrobial compounds, reduction of gut pH by stimulating the lactic acid producing microflora, competition for binding of receptor sites that pathogens occupy, stimulation of immunomodulatory cells and competition with pathogens for available nutrients (Oyetayo et al., 2003).

It can be recommended that heavy meat products consumer should consume yoghurt to lower side effects of meat preservative as nitrite and nitrate.

Reference


