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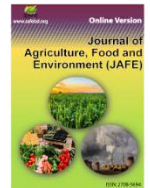

Original Article

Assessment of the quality of raw and cooked beef through laboratory analysis

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ABSTRACT

This study aims to investigate the effect of traditional cooking method on nutritional content of raw beef. In the first part of the study 1 kg of fresh beef was divided into two equal parts and stored at -20°C for 24 hours. Then one sample was cooked properly while another left undisturbed as it was in raw condition. Finally, both the raw and cooked sample were analyzed to determine the proximate components along with their physicochemical, biochemical and microbiological property. The findings of this study demonstrated that every proximate components increased in cooked beef than fresh beef after cooking except moisture ($p<0.05$). As the other available nutrients become concentrated in the cooked beef subsequently the moisture content was reduced ($p<0.01$). pH also increased in the cooked beef ($p<0.05$). Fresh beef pH was 5.37 while the cooked sample had a pH value of 6.08. Cooking loss observed around 41% in average. FFA and POV values also found higher in cooked beef than that of fresh beef ($p<0.05$, $p<0.01$). TVC, TCC and TYMC count were lower in cooked beef than that of raw beef ($p<0.01$, $p<0.05$). With all these findings, the proposed study demonstrates a standard comparison of nutrient in raw and cooked beef which will make people nutritionally conscious about their daily meat consumption.

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Keywords

Beef, raw, cooked, nutritional change, meat quality

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Introduction

Meat is the most valuable livestock product and for many people serves as their first choice of animal protein source (Tsegay, 2015). Meat is any flesh of animal that is used for food. Demand for meat and meat products have been increasing rapidly in Bangladesh due to urbanization and increases in per capita income (Hossain and Deb, 2014). At such socio-economic condition of Bangladesh, this is the high time for the people to know about the nutrient content of cooked meat along with meat products.

With the increased earning ability, now-a-days people are more conscious about the quality and nutritional content of any food product rather than its quantity. Meat is nutritious and highly attractive in appearance. Preferential consumption exists in spite of the importance of meat as a source of protein with high biological value. Earlier reports (Koppert and Hladik, 1990) classified factors that affect the consumption of meat as economic, social and cultural. Ojewola and Onwuka (2001), specifically highlighted religion, age, sex, socio-economic factors, individual variation and income as major factors. For instance, pork is unpopular in the Muslim country (Ikeme, 1990).

Demand for meat and meat products has been increasing rapidly in Bangladesh as in other developing countries, propelled by income and population growth and urbanization. Although nearly 40% of the populations live below the poverty line, reasonably good economic growth during the past few years has also created an expanding middle and high income population, especially in the urban areas, where dietary patterns have been changing rapidly toward higher levels of consumption of high value products. Per capita daily consumption of meat 10 gm. to 18 gms during the same period (Hossain and Deb, 2009). However, very few researches had done to know the change of nutritional status of beef before cooking and after cooking. Therefore, in this study the observation was conducted over nutrient content of raw and cooked Beef through necessary laboratory analyses that includes proximate, physicochemical, biochemical and microbial analysis to evaluate the nutritional and bio-chemical change occurred due to traditional cooking style.

Materials and methods

Experimental site

The experiment was carried out in the laboratory of the Department of Animal Science at Bangladesh Agricultural University (BAU), Mymensingh, Bangladesh.

Experimental Samples

The beef which was used for the experiment, collected from the "Bangladesh Agricultural University Sheshmore bazar" of Mymensingh Sadar. The bull was brought to convenient place and slaughtered by Halal method. The sample was obtained from a bull carcass which was around 2 years and weighing live weight of 250 ± 5 kg. After that, the meat sample was quickly shifted to the "Animal Science Laboratory" and carried out for sensory, proximate, physicochemical, biochemical and microbial analysis.

Sample Preparation

Preparation of beef sample

At first, 500 gm. of fresh beef sample was taken for the preservation of beef. All visible fat and connective tissue were trimmed off as far as possible with the help of knife and the sample was cut into small pieces. Then the beef sample was taken properly as per experimental design.

Proximate Components

Proximate components such as Dry Matter (DM), Ether Extract (EE), Crude Protein (CP) and Ash were carried out according to the methods (AOAC, 1995). All determination was done in triplicate and the mean value was reported.

Crude Protein (CP)

CP was determined by micro kjeldahl method. Total nitrogen content of each sample was determined in triplicate by using kjeldahl apparatus. In this case total nitrogen was determined by digestion the samples with 20 ml concentrated sulfuric acid (H_2SO_4) in presence of K_2SO_4, $CuSO_4$and selenium powder followed by distillation of ammonia liberated by alkali (NaOH) into boric acid and titrated with standard HCl. The nitrogen values thus obtained were converted to total crude protein by multiply with a factor of 6.25.

Ether Extract

Ether extract content was determined by Soxhlet apparatus using diethyl ether. At first empty flask weight was taken. Then 2 gm. sample was taken in a thimble and added 200 ml acetone in a Soxhlet. Extraction was done at 40-45°C which took about 7-8 hours. After extraction the flask were taken out and dried in oven for 30 minutes at 100°C. The flask containing ether extract was cooled in desiccators and weighed. The calculated value for ether extract content was obtained as percent of the sample.

Ash

The weighed samples were taken in porcelain crucibles and preashed at 100°C in an electric oven. The crucibles were then placed in a muffle furnace and heated at 550°C for 6 hours. The crucibles were then cooled in desiccators. The average weight in percentage of each sample of the remaining material was taken as ash.

Physicochemical properties

Raw meat pH

Beef Samples (5 g) were homogenized in 25 ml of distilled water using a grinder (SFM1500NM, Shinil Co. China) for 1 min. Sample solutions were centrifuged for 15 min at 2000 × *g*, and the pH was measured using a pH meter (Seven Easy pH, Mettler-Toledo GmbH, Switzerland).

Cooking loss

The beef samples were weighted (initial weight). Firstly weighted meat was boiled at water bath to 100℃ . After completed the boiling of meat samples secondary weight was measured. The loss of weight was calculated as cooking loss. Cooking loss was practiced at 0th day, 15 day, 30 day and 60 day.

Biochemical analysis

The biochemical analyses were measured by three ways. These are Free Fatty Acid (FFA), Peroxide Value (POV). These two types of analysis are discussed below.

Free Fatty Acid (%) analysis

Free fatty acid value was determined according to Rukunudin *et al.*, (1998). Five grams of sample was dissolved with 30 mL chloroform using a homogenizer (IKA T25digital Ultra- Turrax, Germany) at 10.000 rpm for 1 min. The sample was filtered under vacuum through Whatman filter paper number 1 to remove meat particles. After five drops of 1% ethanolic phenolphthalein were added as indicator to filtrate, the solution was titrated with 0.01 N ethanolic potassium hydroxide. The formula is mentioned below:

FFA (%) = ml titration× Normality of KOH × 28.2/g of sample

Peroxide Value (POV) analysis (meq/kg)

Peroxide value (POV) was determined according to Sallam *et al.*, (2004). The sample (3 g) was weighed in a 250-mL glass stopper Erlenmeyer flask and heated in a water bath at 60°C for 3 min to melt the fat, then thoroughly agitated for 3 min with 30 mL acetic acid chloroform solution (3:2 v/v) to dissolve the fat. The sample was filtered under vacuum through Whatman filter paper number 1 to remove meat particles. Saturated potassium iodide solution (0.5 mL) was added to filtrate and continue with addition of starch solution. The titration was allowed to run against standard solution of sodium thiosulfate (25/1). The formula is mentioned below:

POV was calculated and expressed as mill equivalent peroxide per kilogram of sample:

$$\text{POV (meq/kg)} = \frac{S \times N}{W} \times 100$$

Where, S is the volume of titration (mL), N the normality of sodium thiosulfate solution (n = 0.01) and W the sample weight (g).

Microbial assessment

The microbial assessment of total viable count, total coliform count and total yeast-mold count were undertaken. To determine these parameters the procedures which were followed are described below:

Preparation of samples for TVC, TCC and Yeast-Mold count

A quantity of 10g of beef sample was aseptically excised from stored stock samples. Each of the stored beef samples were thoroughly and uniformly macerated in a mechanical blender using a sterile diluent (0.1% peptone water) as per recommendation of International Organization for Standardization (ISO, 1995). A quantity of ten (10) gram of the minced meat sample was taken aseptically transferred into a

sterile container containing 90 ml of 0.1% peptone water. A homogenized suspension was made in a sterile blender. Thus 1:10 dilution of the samples was obtained. Later on using whirly mixture machine different serial dilutions ranging from $10^{-2}$to 10^{-6}were prepared according to the instruction of the standard method (ISO, 1995).

Media and reagent employed for TVC, TCC and Yeast-Mold count

Solid media and reagents

The media employed for these bacteriological analysis included plate count agar (PCA), MacConkey agar (MA) and potato dextrose agar (PDA). The commercial media were prepared according to the direction of the manufacturers. The diluent used during the study was 0.1% peptone water.

Preparation of media

A quantity of 11.50 g of PCA agar and 15.6 g of MA agar were dissolved in 500 ml and 300 ml of cold distilled water in two separate conical flasks and heated to boiling for dissolving the ingredients completely. In case of PDA, 200 g of previously peeled and sliced potato was taken in 1000 ml of distilled water and boiled for an hour. After boiling, sieving was done through clean cheesecloth. 20 g of commercial dextrose and 15g of agar were added to the potato infusion solution and heated up to boiling to dissolve the ingredients completely. Later, the media were sterilized at 121°C (6.795 kg pressure/sq. inch) for 15 minutes in an autoclave. The final reaction was adjusted to pH 7.0 ± 0.1. The agar was then ready for pouring. Before pouring, the medium was kept in a boiling water bath at 45ºC.

Enumeration of total viable count (TVC)

For the determination of total bacterial counts, 0.1 ml of each ten-fold dilution was transferred and spread on triplicate PCA agar using a sterile pipette for each dilution. The diluted samples were spread as quickly as possible on the surface of the plate with a sterile glass spreader. One sterile spreader was used for each plate. The plates were then kept in an incubator at 35°C for 24-48 hours. Following incubation, plates exhibiting 30-300 colonies were counted. Colonies were counted with the aid of a colony counter. The average number of colonies in a particular dilution was multiplied by the dilution factor to obtain the total viable count. The total viable count was calculated according to ISO (1995). The results of the total bacterial count were expressed as the number of organism of colony forming units per gram (CFU/g) of beef samples.

Enumeration of total coliform count (TCC)

For the determination of total coliform counts, 0.1 ml of each ten-fold dilution was transferred and spread on triplicate MA agar using a sterile pipette for each dilution. The diluted samples were spread as quickly as possible on the surface of the plate with a sterile glass spreader. One sterile spreader was used for each plate. The plates were then kept in an incubator at 35° c for 24-48 hours. Following incubation, plates exhibiting 30-300 colonies were counted. Colonies were counted with the aid of a colony counter. The average number of colonies in a particular dilution was multiplied by the dilution factor to obtain the total coliform count. The total coliform count was calculated according to ISO (1995). The results of the total coliform count were expressed as the number of organism of colony forming units per gram (CFU/g) of meat samples.

Enumeration of Yeast-Mold count

For the determination of yeast and mold counts, 0.1 ml of each ten-fold dilution was transferred and spread on triplicate PDA agar using a sterile pipette for each dilution. The diluted samples were spread as quickly as possible on the surface of the plate with a sterile glass spreader. One sterile spreader was used for each 20 plate. The plates were then kept in an incubator at 25° c for 48-72 hours. Following incubation, plates exhibiting 30-300 colonies were counted. Colonies were counted with the aid of a colony counter.

The average number of colonies in a particular dilution was multiplied by the dilution factor to obtain the yeast and mold count. The yeast and mold count was calculated according to ISO (1995). The results of the yeast and mold count were expressed as the number of organism of colony forming units per gram (CFU/g) of meat samples.

Results and discussions

Proximate analysis

The whole meat sample was divided into two parts for the determination of proximate analysis. They were treated as T_1 (fresh beef sample that represent the control group) & T_2 (cooked beef). At the beginning both samples were stored at -20^0c for 24 hours. Then one sample was cooked properly while the other was left undisturbed as it was in fresh state. Finally the DM, CP, EE, ASH were determined for both fresh & cooked sample gradually by following the appropriate procedure. The values of proximate components are shown in Table 1.

Dry Matter (DM)

The dry matter content of both treatments is shown in Table 1. The range of observed DM content at both treatments ranges from 23.25 to 37.55%. Superscripts observed from both treatments were totally different from each other ($p<0.01$). The DM content was increased in cooked beef as the moisture content is reduced in the cooking process (Wahrmund-Wyle *et al.*, 2000). Both the samples were observed to have highly preferable DM. Similar results were reported for raw & cooked beef from the research findings by Martin *et al.*, (2013). So the DM content is actually higher in the cooked beef than the fresh beef which was discovered in this study too.

Moisture

There exists an inverse relationship in moisture content of fresh beef with a cooked one. As the DM goes high in the cooked beef through the cooking process, it is obvious that the moisture content decreases in the cooked beef. The mean values for fresh & cooked sample were 76.75 & 62.45% consecutively, which were significantly different from each other ($p<0.01$). The finding of lower moisture content in cooked beef than raw beef from this study is supported by some previous results of research by Smith *et al.*, (2011). He reported that during cooking process, nutrients become more concentrated due to moisture loss. Again these results agreed with the previous studies indicating that the moisture content is reduced in cooked beef with a greater total DM & fat content (Martin *et al.*, 2013).

Crude Protein (CP)

The CP content of both treatments is shown in Table 1. The range of observed CP content at both treatments was 22.925 to 31.85%. The totally different superscript was observed from both treatments indicates there were significant differences ($p<0.01$) of CP content between these treatments. The

most preferable CP content was observed from T_2. Higher amount of CP content indicates this product is most preferable for consumers' health. The data show that the protein content goes high through the cooking process which is good for health. Similar result of higher protein content in beef meat ball than the raw beef were reported before by Purnomo and Rahardiyan (2008).

Data from current study indicated that protein content is greater in cooked cuts than in raw cuts. Previous studies determined that during the cooking process, nutrients become more concentrated due to moisture loss, leading to greater protein content in cooked cuts compared to raw cuts (Smith *et al.*, 2011; Wahrmund-Wyle *et al.*, 2000).

Ether Extract (EE)

The EE content of both treatments is shown in Table 1. The range of observed EE content for both treatments was 1.85 to 9.8% which is significantly different ($p<0.01$). T^2 was the most preferable as higher fat content is injurious to health issue. The lowest amount of EE content indicates this product is most preferable for consumers' health. The study clearly shows that the fat content rises higher in the cooked meat than in the raw meat. This result is exactly similar with the previous findings by both Martin *et al.* (2013) & Acheson *et al.* (2015).

Ash

Table 1 represents the ash content for both the treatments. The range of observed ash content for two treatments was 1.06 to 3.12%. The totally different superscript was observed from both treatment groups indicates there were significantly differences ($p<0.01$) of ash content. Ash content was observed from T_2 was preferable for cooked meat. This study indicates a comparatively higher amount of ash in cooked beef than in raw beef. The ash content of Malaysian commercial beef meatballs ranged from 1.76 to 3.40% which is clearly greater than the ash content of raw beef found in this study. Similar results were also reported by Serdaroglu *et al.* (2005) on the ash content of koefte beef meatballs, which ranged from 2.6 to 2.8%. However, an earlier report by Serdaroglu and Degirmencioglu, 2004 showed slightly lower ash content in koefte beef meatballs, ranging from 1.7 to 2.2% which is also higher than the ash content of raw beef. The main source of ash is bone and salt. As salt was added during the cooking process, higher ash content was observed in cooked beef. The cooked beef was stored in refrigerator before the determination of ash content. The same trend was also observed by Konieczny *et al.* (2007) and they reported that ash content increases during frozen storage.

Table 1. Comparison of proximate components in fresh and cooked beef.

Parameters	Treatment		Level of significance
	$T_{1=}$ Fresh	$T_{2=}$ Cooked	
DM %	$23.25^b \pm 0.21$	$37.55^a \pm 0.21$	p<0.01**
MOISTURE %	$76.75^b \pm 0.21$	$62.45^a \pm 0.21$	p<0.01**
CP %	$23^b \pm 0.56$	$30.53^a \pm 1.08$	<0.05*
EE %	$1.63^b \pm 0.17$	$9.23^a \pm 0.54$	<0.05*
ASH %	$1.06^b \pm 0.04$	$3.12^a \pm 0.13$	p<0.01**

*Significant at 5% level, p <0.05; **Significant at 1% level of significance, p<0.01

Physicochemical properties

The physicochemical properties such as raw pH, cooked pH and cooking loss were determined and the results obtained are shown in Table 3.

pH of raw and cooked beef

In Table 2, the mean of raw pH from both treatments are shown. The mean of raw beef pH is 5.37 & the cooked beef pH mean is 6.08. Superscripts observed from both treatments were totally different from each other ($p<0.05$). The flesh of animals prior to slaughter has a pH value of 7.1. After slaughtering, some of the glycogen in the meat turns into lactic acid. As a result, the pH value is lowered. The increasing acidity of the maturing carcass varies in its speed, depending on a number of factors such as type of animal, breed, rearing characteristics and treatment of the animal prior to slaughter. A low pH discourages the development of undesirable micro-organisms. As a result of this, the desirable lacto-bacteria and microbes have a chance to develop, which improves the taste and keeping characteristics. Some findings about beef pH by Aberle *et al.* (2001) where pH of living muscle is 7.1, dark cutting meat ranged 5.71-6.90 as well as pH in meat with good appearance ranged 5.30-5.70. This study exactly shows the similar result of higher value pH through cooking process. Aksu and Kaya, 2005 reported a study related to Kavurma, a cooked Turkey meat product that is usually sliced and consumed. They found that the pH of Kavurma slightly increased after 300 days of storage time. McCarthy *et al.*(2001) and Carpenter *et al.*(2007) reported no difference in the pH of control and test antioxidants like grape seed, bearberry and rosemary extracts incorporated raw and cooked pork meat products.

Table 2. Comparison of pH value in fresh and cooked beef.

Parameters	Treatment		Level of significance
	$T_{1=}$ Fresh	**$T_{2=}$ Cooked**	
pH	$5.37^b \pm 0.04$	$6.08^a \pm 0.02$	p<0.05*

*Significant at 5% level, p <0.05

Cooking Loss

After cooking of raw beef, mean cooking losses was found 41.07 %. Cooking loss refers to the reduction in weight of meatballs during the cooking process (Jama *et al.*, 2008). Major components of cooking losses are thawing, dripping and evaporation. Thawing loss refers to the loss of fluid in meatballs resulting from the formation of exudates following freezing and thawing (Jama *et al.*, 2008). Such losses are lower following a rapid freezing compared with slow freezing. This is because of small crystallization formed by the rapid freezing (Hui, 2004). Dripping is the loss of fluid from meatballs and water evaporation from the shrinkage of muscle proteins of actin and myosin (Yu *et al.*, 2005). Cooking loss in meat cuts is important for maintaining an attractive retail display of meat. Normally, fresh postrigor meat exudes fluid, or drip, from cut surfaces (Lawrie, 1991). Asghar *et al.* (1991) reported less drip loss from thawed pork chops obtained from pigs supplemented with vitamin E. The meat also tended to shrink during the cooking process due to the denaturation of meat protein; the loss of water and fat also contributed to the shrinking process (Serdaroglu *et al.*, 2005).

Biochemical properties

There are three types of biochemical properties. These are Free Fatty Acid value (FFA %), Peroxide Value (PV-meq/kg) & TBARS value. They indicate the good or bad quality of meat. The value of biochemical components are shown in Table 3.

Free Fatty Acid (FFA)

The FFA content of both treatments is shown in Table 3. FFA values of fresh and cooked beef were 0.01 and 0.03 respectively. Superscripts were totally different from each other (p<0.02). The content of chemical components in meat is reflected in meat quality, including organoleptic characteristics (Nowak *et al.*, 2012). The palatability of meat is a result of the combination of two sensory factors: aroma and taste. Aroma, sensed more easily than taste, is deemed a more important and more characteristic feature. The aroma of meat is determined, in the first place, by proportions between saturated and unsaturated fatty acids, and by aldehydes, ketones and alcohols (Ramarathnam *et al.*, 1993). Polyunsaturated fatty acids increase sensitivity to peroxidation, leading to unpleasant odors (Coulon and Priolo, 2002). Changes in proportions between saturated and unsaturated acids are also an adverse phenomenon from the dietary point of view. This study shows a higher curve of FFA in cooked than in the raw meat.

Peroxide value (POV)

The POV content of both treatments are shown in Table 3. POV values of fresh and cooked beef were 5.51 and 7.57 respectively. Superscripts observed from both treatments were totally different from each other (p<0.05). During storage, the peroxide value increased in all treatments. Other studies have also reported an increasing peroxide value over storage time in products with or without antioxidants. However, antioxidant treatments, generally, can minimize the peroxide value in the food sample during storage compared with the control. Sallam *et al.* (2004) reported an initial peroxide value of 6.32; however, after 21 days of storage, peroxide values ranged from 4.92 to 5.22 in fresh garlic-formulated samples to 4.68–5.91 in garlic powder samples, 5.74– 6.88 in garlic oil samples and 5.21 in BHA formulated samples. Novelli *et al.* (1998) also showed increasing peroxide values with longer storage time in a sausage product. They noted that peroxide values of 1.67, 4.02 and 4.20 meq/kg fat were found at 0, 1 and 3 months of frozen storage with no antioxidant treatments. Georgantelis *et al.* (2007) found the peroxide value of frozen (-18°C) beef burger treated with rosemary to be 0.24, 0.45, 0.66, 1.05, 1.27, 1.46 and 1.59 meq peroxides/kg fat at storage days 0, 30, 60, 90, 120, 150 and 180, respectively.

Table 3. Biochemical parameter of fresh and cooked beef.

Parameters	Treatment		Level of significance
	$T_{1=}$ Fresh	$T_{2=}$ Cooked	
FFA %	0.01^b±0.0	0.03^a±0.06	p<0.05*
POV %	5.51^b±0.09	7.57^a±0.08	p<0.01**

*Significant at 5% level of significance, p< 0.05; **Significant at 1% level of significance, p< 0.01

Microbiological assessment

The present study observed the presence of micro-flora (TVC) and food borne pathogens (Coliform and Yeast-Mold) on both (fresh and cooked) treatment group. Microbiological assessment is shown in table 4.

Total viable count (TVC)

The present study is divided into two parts: firstly, a cross validation test for determining the total viable count (TVC) on samples of fresh frozen beef (minced), frozen cooked beef (minced). Table 4 shows the total viable counts (TVC): For fresh cut beef samples as well as cooked beef sample. Amongst three replications of fresh beef sample TVC ranges from 1.211 to 1.247 while in cooked sample the value ranges from 1.067 to 1.11. The mean values for TVC in fresh and cooked sample were 1.31 & 1.01 respectively. According to a statistical analysis using the paired t test, there was no significant difference between the TVC values from fresh and cooked minced beef samples (p>0.05). This study clearly indicates that TVC count reduced in cooked sample. The exact similar result was found by Abdallah *et al.* (2013) in between fresh beef and beef sausage where TVC count declined in the beef sausage.

Total coliform count (TCC)

The TCC count procedure is also divided into two parts like TVC. Firstly a cross validation test for determining the total coliform count (TCC) on samples of fresh frozen beef (minced) & frozen cooked beef (minced). Table 4 shows the total coliform counts (TCC) for fresh cut beef samples as well as cooked beef sample. Amongst three replications of fresh beef sample TCC ranges from 4.22 to 4.31 while in cooked sample the value ranges from 4.08 to 4.16. The mean values for TCC in fresh and cooked sample were 4.25&4.12 respectively. According to a statistical analysis using the paired t test, there was significant difference between the TYMC values from fresh and cooked minced beef samples (p<0.05).

This study represents a lower count of TCC in cooked minced beef sample than that of the fresh minced beef. The antioxidant compounds blocked the deteriorating of fat and helped prevent the metabolism of fat by bacteria. In the cooked beef ginger was used as a spice which has a strong antioxidant property. As a result, bacterial growth was lower in cooked beef treated with antioxidants. However, a number of studies have demonstrated that compounds existing in many spices also possess antimicrobial activity (Zhang *et al.*, 2009).

Total yeast-mold count (TYMC)

Following the previous ones, this procedure was also divided into two parts. Firstly a cross validation test for determining the total yeast-mold counts (TYMC) on samples of fresh frozen beef (minced), frozen cooked beef (minced). Table 4 shows the TYMC: For fresh cut beef samples as well as cooked beef sample. Amongst three replications of fresh beef sample TYMC ranges from 5.20 to 5.26 while in cooked sample the value ranges from 5.08 to 5.11. The mean values for TYMC in fresh and cooked sample were 5.23&5.09 respectively. According to a statistical analysis using the paired t test, there was significant difference between the TYMC values from fresh and cooked minced beef samples (p<0.05).

This study represents a lower count of TYMC in cooked minced beef sample than that of the fresh minced beef which might be due to the use of spices in cooked beef. For the antifungal property of spices a comparatively lower number of yeast-mold counts were found in cooked beef. A fellow

research shows that, dichloromethane root extract of *C. caudatus* showed antifungal activity against *Cladosporium cucumerinum* and *Candida albicans* in bio autographic assay on thin layer chromatography (Homans and Fuchs, 1970; Rahalison *et al.*, 1991).

Table 4. Microbiological parameter of fresh and cooked beef.

Parameters	Treatment		Level of significance
	$T_{1=}$ Fresh	$T_{2=}$ Cooked	
TCC (log CFU/g)	$3.42^{a}\pm0.03$	$1.00^{b}\pm0.08$	p<0.01**
TYMC (log CFU/g)	$4.45^{a}\pm0.01$	$1.75^{b}\pm0.11$	p<0.01**
TVC(log CFU/g)	$6.40^{a}\pm0.04$	$2.33^{b}\pm0.05$	p<0.01**

** means Significant at 1% level of significance, p<0.01

Summary and Conclusion

The hypothesis of the proposed study was to find out the differences between fresh and cooked beef which will let people to know about the nutrient content of fresh beef and cooked beef by analyzing various proximate, physicochemical, biochemical and microbial parameters.

This result from proximate analyses indicates that nutrient content in cooked beef is higher due to cooking, moisture loss increase nutrient density and than that of fresh beef which means a proper cooking process will make more nutrients available to people to get.

For pH value same pattern was observed like the cooked meat pH was higher than fresh meat sample. Mean value of pH for fresh sample was found 5.37 which indicates that the meat was characterized with good visual appeal and of preferable eating quality. Cooking loss was recorded 41% which was a bit higher than normal. But it is possible to maintain the cooking loss below 35%. The lowest amount of cooking loss or the highest cooking yield indicates that the product is most preferable for consumer's health than other treatment groups.

The free fatty acid and peroxide value of both the treatments were also within the standard range. The plate count in the controlled group (T_1) was significantly higher than the other treatment (T_2). The TVC and TYMC were both satisfactory. Both of those values indicate this product is most preferable for consumers' health. The spice and antioxidant compounds blocked the deteriorating of fat and helped prevent the metabolism of fat by bacteria. As a result, bacterial growth was lower in cooked beef than that of the fresh beef.

Results from this study provide relevant nutrient information based on current practices in the beef market of Bangladesh. These findings will be used as an update of nutrient content for both fresh and cooked beef which can be used both domestically and internationally to provide consumers with information on the nutrient composition of retail beef cuts and cooked beef. So in this present study, a very relevant comparison has been shown in between fresh and cooked beef. Through this study people will come to know about the nutrient content of fresh beef as well as the amount of nutrient they are receiving from it through cooking process.

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