

ASSESSMENT OF NUTRITIONAL COMPOSITION OF BEEF AND MUTTON AND IMPORTANCE OF THEIR NUTRITIONAL VALUES

FARHAT-UN NISA SHEHZAD¹, ZAHIN ANJUM¹ AND SAMIA AKHTER

¹*Department of Foods and Nutrition. College of Home Economics, University of Peshawar, 25120 Peshawar. Pakistan*

ABSTRACT: The objective of this study was to determine the nutritional composition of cow meat and mutton available in different markets of Peshawar. Samples were analyzed for Protein, fat, ash, and moisture (Proximate), heavy metals (copper, lead, and nickel) and electrolytes (calcium, sodium, and magnesium, phosphorous, and potassium). There were insignificant difference between moisture, fat, and ash level of cow and mutton meat. But the protein level was significant difference. Moisture, protein, fat and ash content of the cow meat averaged $60.64 \pm 9\%$, $20.69 \pm 1.8\%$, $1.60 \pm 0.2\%$, and $1.11 \pm 0.3\%$, respectively while moisture, protein, fat, and ash content of the cow meat averaged $78.98 \pm 1.8\%$, $25.84 \pm 1.5\%$, $1.15 \pm 0.6\%$, and $1.12 \pm 0.12\%$, respectively. Heavy metal analysis revealed that cow meat contained higher level of copper, zinc and nickel as compared to mutton meat. There is an insignificant difference between calcium, potassium and magnesium and significant difference exist between sodium and phosphorous.

Keywords: Proximate analysis, heavy metal and electrolytes composition, cow meat and mutton.

INTRODUCTION

The demand for meat in domestic market is rising at the rate of 2.8% for beef, 2.9% for mutton, and 6.10% for poultry. Consumption of meat is increasing due to population growth human need for protein and calcium and improving consumption patterns (Sindh Board of Investment 2013). Globally, an estimated 2 billion human population consume meat and an estimated 4 billion live on a plant based diet (Pimental, 2003). The amount of meat consumed in different countries varies enormously with social, economic and political influences, religious beliefs and geographical differences. Meat is a by-product of dairy industry (Bhatti & Khan, 1999) and is the essence of many

dishes. Meat is high nutritional food and contains high quality protein and energy. After digestion, it provides excellent nutrition (Williams, 2007).

Meat quality is dependent upon changes in its chemical components; viz. moisture content, protein, fat, and ash. The chemical properties of meat show a significant variation in respect of animal species, age, sex, feed and the location along with function of these parts in the body (Romans *et al.*, 1994). In recent time, there are some important factors influencing meat and meat products consumer's choice mainly related to health concern (fat content, production of leaner animals), appearance factors (visible fat), development of low fat meat products

(low fat formulation), demographic influences (income, age, ethnicity, convenience, change in distribution, price) and new product development (restructured meat products, low-salt products, vacuum-packaged meat products). Meat improves our nutrition and provides 10 key nutrients: energy, protein, iron, zinc, vitamin A, vitamin B1, B2, B3, B6, and B12 (Romans & Ziegler, 1994). In Pakistan, more than 37 million animals are annually slaughtered. Total meat production includes 1.711, 0.616 and 0.767 million tons beef, mutton and poultry meat, respectively.

Nutrition value is the basic adjustment factor, but the physicochemical properties of meat, which include pH, water holding capacity, cooking loss, color and texture are also important factors for determining meat quality, the processor decision making and consumer quality traits. However, both price and efficiency are also important for economic competitiveness. Chemical composition analysis of cow meat revealed 72% water, 4.4% ash, 6% fat, and 66.4% protein (Mahmud et al, 2011). Similarly (Raiymbek et al 2013) conducted a study in Kazakhstan and found that camel muscles contained 70-77% moisture, 17-18.8% protein, 2-10% fat and 0.9-1.1% ash.

In Pakistan, there are a number of studies found on proximate composition and mineral analysis of fruits, vegetables, and meat of different sources such as bull, crab, goat, fishes, sheep, donkey and snails but very

limited data are available on the composition of meat in Peshawar. The detailed information of these parameters in sheep and goats in the tropics especially from traditional production systems is missing. Such information on inherent meat quality of red meat and mutton is required to help consumers make an informed decision in purchasing meat. Thus, the aim of this study was to compare chemical composition and quality attributes of meat from mature male sheep and goats raised under traditional production system.

Materials and Methods

Meat samples were randomly collected from four different locations of Peshawar. Samples were stored in clean polythene bags at -20°C and transported to the laboratory for final analysis. The proximate chemical composition of the meat was determined to standard methods of Association of Official Analytical Chemists (AOAC). Ash content was determined by ashing samples in a muffle furnace at $500-600^{\circ}\text{C}$. Fat were determined by simple mechanical extraction of the dry sample, using petroleum ether. Protein was determined Kjeldahl Method. Heavy metals (Cu, Pb, and Ni) were analyzed with atomic absorption spectrometry. The data collected was analyzed using state ease version 8. The means of the treatment were subjected to t-test. (Nielsen, S. 2003). Three samples from each meat source were analyzed for moisture, protein, fat, ash and mineral content by the standard procedure of AOAC and Spectrophotometer. Each analysis was done in triplicate.

Table 1 Comparison of proximate composition of mutton and beef meat

Source of Meat	Moisture(%)	Protein(%)	Fat (%)	Ash(%)
Mutton	60.64±9.4	20.69±1.8	1.60±0.2	1.11±0.3
Beef	78.98±1.8	25.84±1.5	2.05±0.6	1.10±0.1
p-value	0.075	0.018	0.168	0.956

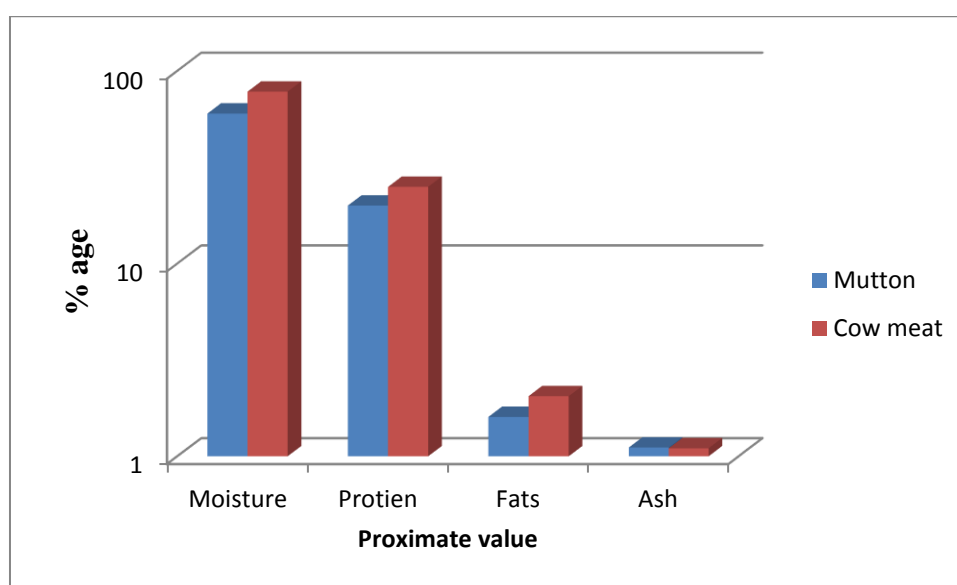


Fig. 1: Comparison of proximate composition of mutton and beef meat

The results of the proximate composition of goat and cow meat presented in Fig.1 The percent moisture content of beef (78.98±1.8 %) was higher than mutton (60.64±9.4%). The protein was 25.69±1.8 % for beef and 20.84±1.5 for goat meat. The percentage of protein in cow meat shows that it is good source of protein. The fat determined was 1.60±0.2% and 1.05±0.6% for mutton and beef, respectively. The ash content was

1.11±0.3% in mutton and 1.10±0.1 for beef. The p-value shows that there is an insignificant different between moisture, fat, and ash level of beef and mutton. But there is significant difference in protein level of beef and mutton meat

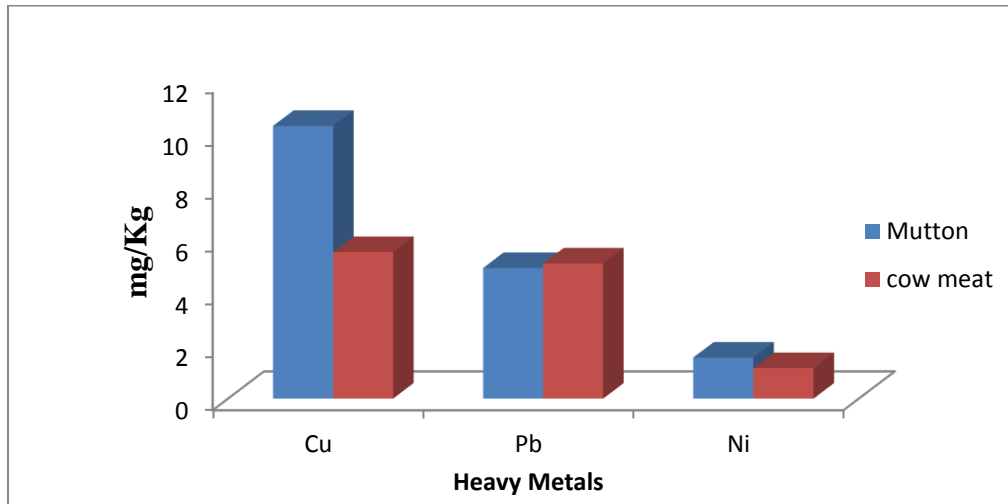


Fig. 2: Concentration of Heavy metal of beef and mutton (mg/kg).

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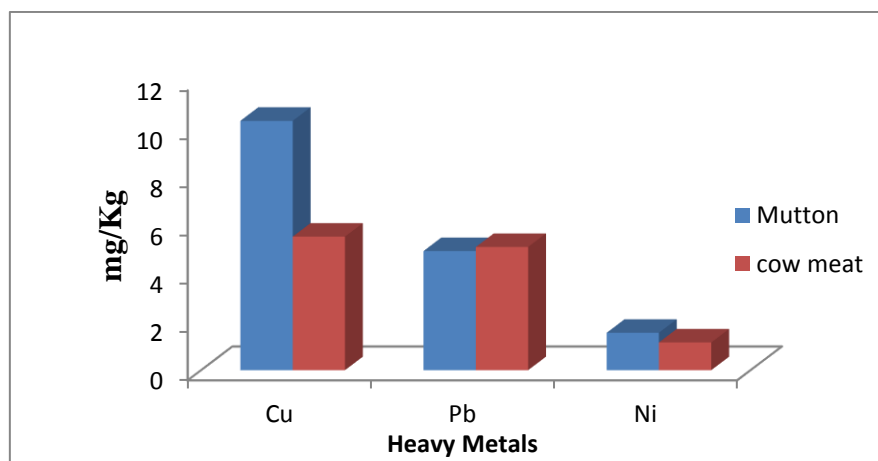


Fig. 2: Concentration of Heavy metal of beef and mutton (mg/kg).

Fig.2 presents the concentration of dietary minerals in beef and mutton taken from different markets of Peshawar. The p.value of t-test shows that there is significant difference between copper value of mutton and beef. And insignificant difference exist between, lead, and nickel value. Beef contained higher level of copper and Pb. Copper and zinc content of beef were reported to be $5.41 \pm 2.0\%$ and 78.04 ± 7.15 , respectively. The high concentration of copper in collected samples might be due to the waste disposal and municipal sewage, the use of fertilizers, pesticides and herbicides in animal feed (Chowdhury et al, 2011). Similar work was reported by Mariam et al 2004. When copper exceeds the maximum permissible limit it causes toxic effects. High

concentration can also cause liver and kidney damage (Badis et al, 2014). The mean value of lead concentration in muscles of beef sample was $4.94 \pm 1.2\%$ and $5.13 \pm 5.4\%$, respectively. The high concentration of lead may be due to the age of animal, place, dietary habits, slaughtering and transportation condition, and exposure to dust (Sabir, 2003). The beef had high mean value of nickel concentration ($1.55 \pm 0.7\%$) whereas the mean value of nickel in beef was $1.15 \pm 0.7\%$. The study done by Alturiqi et al., (2012) focused on concentration of heavy metals (Cu, Mn, Zn, Pb, Cd) in many red and white meat and their product. The results of their study showed that concentration of heavy metal were above the allowable limits that are proposed by WHO/FAO and EC committees.

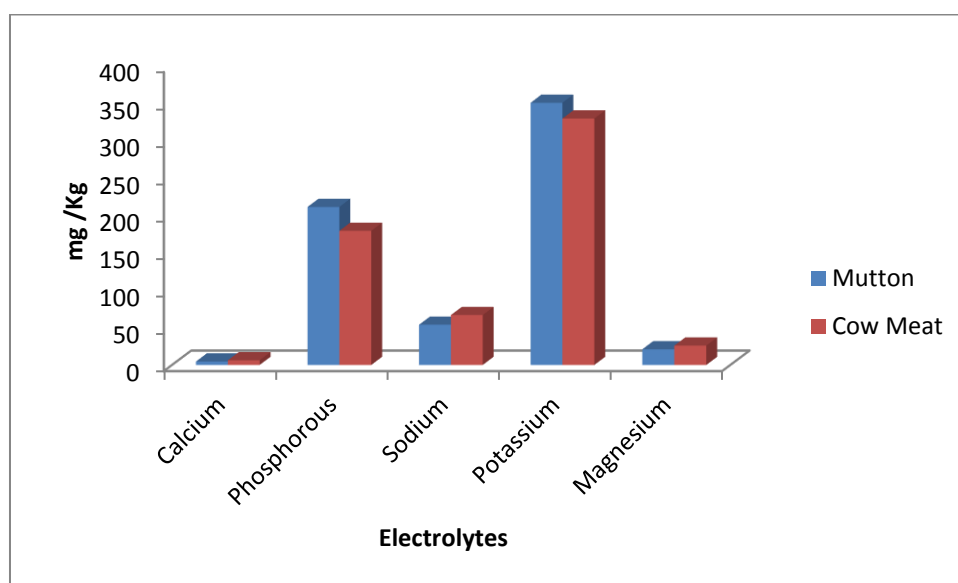


Fig. 3: Comparison of electrolytes in cow and Mutton carcass.

Fig 3 The data shows the high calcium, sodium, and magnesium concentration in mutton meat than cow meat whereas the

potassium and phosphorous content were high in cow meat. The calcium content of cow and goat meat was 4.6 ± 0.8 and 6.3 ± 1.2 ,

respectively. The mean value of phosphorous in cow and goat was found 212.7 ± 14.0 and 181.3 ± 13.2 , respectively. There is an insignificant difference between calcium, sodium, and magnesium and significant difference exist between potassium and phosphorous. Meat is a good source of dietary phosphorous but low in calcium (Pearson and Gillett, 1999). Calcium is an important component of the skeleton and teeth (Aganga et al., 2003). That's why the calcium content was low in flesh of beef. The data presented revealed the maximum potassium concentration was found in goat meat i.e. 351.6 ± 20.9 whereas the concentration of potassium was 333.7 ± 27.6 in cow meat. The sodium and magnesium content of cow meat were higher than mutton meat i.e. 67.4 ± 2.7 and 26.7 ± 3.3 , respectively.

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