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**Research Article**

# Antioxidant activity of meat from chicken and goat cooked in microwave cooking system

**Ali Mirzaei[1], Mehrzad Jafari Barmak*[1] and Asfandeyar Afshoon[1]**

[1]Cellular and Molecular Research Centre,
Yasuj Medical Sciences University, Yasuj, Iran
*Corresponding Author Email: mehrzadj14@gmail.com

## ABSTRACT

**Introduction:**During microwave processing, food quality is one of the most important consumer concerns. Meat as a food consumed in cooked state by human.Composition and structure of meat like antioxidant activity affect in microwave cooking system. The purposes of present study were to estimate of antioxidantactivity of chicken and male goat meats cooked in microwave system.

**Materials and Methods:** Eight-month castrated male goat breast meat (12kg) and Ten 120-day chickens were collected and then cooking in the microwave was followed, their breast meat was separated at standard conditions, and 10 grams of each sample without additional fat were selected. The homogenization was prepared from meat samples using 0.05 M phosphate buffer for analysis. The total phenol and flavonoid of samples were measured. To evaluate the antioxidant activity, Dipheny-picrylhydrazyl (DPPH), Trolox equivalent antioxidant activity (TEAC), and Reduced glutathione (GSH) were used on homogenized samples. To measure the peroxidation of lipids, Malondialdehyde (MDA) was used. ANOVA was appliedfor statistical data analysis.

**Results:** DPPH in raw red and chicken meats was 42 % and 30% respectively. TEAC in raw red and chicken meats was 93% and 80% respectively without significant difference. DPPH in cooked red and chicken meats was 31 % and 22.3% respectively. Radical scavenging activity in TEAC was 83% in cooked red meat, while it was reported 70% in chicken meat. The MDA levels in cooked red and chicken meats was 6.27 and 4.23 respectively.Significant difference was not seen between red and chicken meat. Reduced glutathione content of cooked red meat was 93.5, while it was reported 78 nmol in chicken meat.

**Conclusion:**All meat samples cooked by microwave oven were showed high antioxidant activity via different antioxidant assays.It could be stated that cooking some foods with microwave associated without significant degradation and losses.

**Keywords**: antioxidant activity, chicken, goat, red meat, microwave system

## INTRODUCTION

Food consumed in cooked and raw forms. Some of the foods cannot be consumed in raw form for many reasons. The most important reasons for cooking food is easier digestion, improving the appearance, structure, color, and taste. There are different ways to cook of foods. If food is not cooked correctly, a large amount of its nutrient is lost. Therefore, the correct method of food cooking should be used for maintenance of all the nutrients. Most of families and restaurants used microwave device formeal preparation, thaw, cook and reheat foods.In microwave cooking system could increase free radical's formation due to accelerate oxidative reactions.However, there is concern about the formation of harmful chemicals in food and nutritional quality during microwave cooking (1).

Meat as a food consumed in cooked state by human. In attention to chemical composition, complex physical structure and beside to prone to oxidation, cooking of meat is very important inhuman nutrition. Meat provide high quality proteins and essential amino acids upon

digestion. It also provides essential unsaturated fatty acids and some, vitamins and minerals (2).
Meat composed hydrophilic and lipophilic compounds such as superoxide dismutase, catalase and glutathione peroxidase, vitamin E, vitamin C, carotenoids, ubiquinols, polyphenols and cellularthiols.Meat also contain pro-oxidant substances which susceptible to oxidation like polyunsaturated fatty acids (PUFA), cholesterol, proteins and pigments.The composition of meat can differ among different animal species. Also the diet of the animal which supply by pasture or grain is an important factor in composition of meat (3-4).
Composition and structure of meat like antioxidant activity affect in cooking procedures such as microwave cooking system.The purposes of present study were to estimate of antioxidantactivity of chicken and male goat meats cooked in microwave system.

## MATERIALS AND METHODS

Eight-month castrated male goat breast meat (12kg) and fresh meat of chickens were collected. The chickens cultured traditionally in villages around Yasuj that their food was supply mainly by vegetables grown around village and hidden seeds and cereals. Ten 120-day chickens werepurchasedand slaughtered immediately (separating the chicken head from the trunk using a sharp knife) and then cooking in the microwave was followed, their breast meat was separated at standard conditions, and 10 grams of each sample without additional fat were selected. The samples were kept for 24 hours at 4 ° Cbefore the test. Then, homogenization was prepared from meat samples using 0.05 M phosphate buffer and then it was centrifuged for 20 minutes at 4 ° C at 5000 rpm. This solution was used for analysis. Red meat was purchased from the butcher and it was cooked in standard conditions in microwave cooking system. The total phenol and flavonoid of samples were measured. To evaluate the antioxidant activity, Dipheny-picrylhydrazyl (DPPH), Trolox equivalent antioxidant activity (TEAC), and reduced glutathione (GSH) were carried out on homogenized samples. For evaluation of lipid peroxidation, Malondialdehyde (MDA) was used.
The total phenolic content of the samples was determined and Gallic acid was used as a standard (5). Thetotal flavonoid content was assayed with aluminum chloride (AlCl3) according to method (Kosalec et al., 2004). The total flavonoid values were determined in terms of Rutin equivalents/g meat (6). The antioxidant activity of samples was assessed with slight modification. (7). the antioxidant activity was measured using TEAC based on Re method with some modification. Percent of inhibition same DPPH method was calculated. The percentage of inhibition was calculated as follow: % Inhibition = [(A0 - A1)/A0] × 100. A0 is the absorbance of control and A1 is the absorbance of the samples (8). Glutathione (GSH) content was estimated according to Jollow et al method. The values were expressed in micro moles/mg protein(9).MDA was assayed in samples using the Hoyland method at 535 nm by a Spectrophotometer (10).

## STATISTICAL ANALYSIS

Statistics analysis between different groups was accomplished by analysis of variance using the ANOVA and followed by post hoc tests. The data were expressed as mean ± (SD). *P*-values lessthan0.05 were considered significant.

## RESULTS:

Phenol and flavonoid value was measured only in cooked meat samples but the antioxidant activities were measured in two samples of castrated goat meat and chicken meat at two cooked and raw states. The phenol levels in red and chicken meatswas 1.31, and 0.85 mg Gallic acid / gram respectively and significant difference was not found between them. The red and chicken meat flavonoid was 2.5 and 1.73 mg/ Rutin equivalent / gram respectively without significant difference between them (table 1).
Radical scavenging potential of DPPH in rawred and chicken meats was 42 % and 30% respectively. No significant difference was reported in samples. Radicalscavenging activity by of TEAC in raw red and chicken meats was 93% and 80% respectively without significant difference (table 2).

Radical scavenging potential of DPPH in cooked red and chicken meats was 31 % and 22.3% respectively. No significant difference was reported in samples. Radical scavenging activity by TEAC in red and chicken meats was 83% and 70% respectively without significant difference (table 2).

The MDA content in raw red meat was 4.9, while it was reported 4.8 in rawchicken meat. The MDA levels in cookedred and chicken meatswas 6.27 and 4.23 respectively.Significant difference was not seen between red and chicken meat.Reduced glutathione content of cooked red meat was 93.5, while it was reported 78 nmol in chicken meat. Significant difference was not observed between red and chicken meat.

**Table 1.**Total phenol and flavonoid of chicken breast and goat filet cooked in microwave cooking system

| State of sample | Cooked | |
|---|---|---|
| Teats | Total phenol (mg Gallic acid *) | Flavonoid ( mg Rutin* ) |
| Goat | 1.31 ± 0.42 | 2.5 ± 0.28 |
| Chicken | 0.85 ± 0.23 | 1.73 ± 0.15 |

All the values are expressed in mean ± S.D. Statistical analysis was carried out by One-way ANOVA followed by Tukey's multiple.*:per gram of meat

**Table 2.**Antioxidant activitiesof raw and cooked chicken breast and goat filetcooked in microwave cooking system

| State of sample | Raw | | | Cooked | |
|---|---|---|---|---|---|
| Tests | DPPH | TEAC | MDA | DPPH | ABTS |
| Goat | 42 ± 4.7 | 93 ± 7.2 | 4.9 ± 0.19 | 31 ± 4.1 | 83 ± 6.3 |
| Chicken | 30 ± 3.2 | 80 ± 5.3 | 4.8 ± 0.3 | 22.3 ± 2.4 | 70 ± 4.7 |

All the values are expressed in mean ± S.D. Statistical analysis was carried out by One-way ANOVA followed by Tukey's multiple.

DPPH: Dipheny-picrylhydrazyl; TEAC:Trolox equivalent antioxidant activity;MDA:Malondialdehyde

**Table 3.**Reduced glutathione (GSH) and mallondialdehyde (MDH) levels of cooked chicken breast and goat filet in microwave cooking system

| State of sample | Cooked | |
|---|---|---|
| Tests | GSH | MDA |
| Goat | 93.5 ± 4.1 | 6.27 ± 0.28 |
| Chicken | 78 ± 2.8 | 4.23 ±0.41 |

All the values are expressed in mean ± S.D. Statistical analysis was carried out by One-way ANOVA followed by Tukey's multiple. GSH (nano mole / gram meat);MDA (micro mole / gram meat)

## DISCUSSION

All meats as a foods are susceptible to oxidation. Among meat products, poultry compared to red meat is susceptible to oxidation, due to higher content of phospholipids. Phospholipids are rich in unsaturated fatty acids and present in the cellmembranes. Unsaturated fatty acids induce lipid peroxidation, and leads to low quality of meat (11-12). MDA is widely used to estimate lipid peroxidation in membrane and biological systems.Lipid peroxidation is one of the mainreasons of quality deterioration in meat and meat products, as it mainly associated to loss of nutritional value and safety in meat samples (13-14).In present study, MDA in red meat of goat in cooked state was reported higher than raw state due to chemical muscle spoilage and lipid peroxidation. However, there was not significant difference reported in terms of chicken lipid peroxidation in raw and cooked states.TEAC is extensively applied to estimate of antioxidant activity in different systems and biological samples with good repeatability. In this method antioxidants in different systems reacts with $ABTS^{+}$ free radical cation which produce a color at 645 and 734 nm wavelength.The method issimple and rapid to performwhich treat in wide range of pH in both aqueous and organic solvent system (15).

The DPPH assay is a rapid,simple, inexpensive and a stable free radical which widely used to determine antioxidant activity of different biological systems. In present study, antioxidant activity by DPPH and TEAC inraw samples was higher than cooked state in both samples.Several compounds create antioxidant properties. According to laboratory evidence, proteins havea potent antioxidant property due to free

radicals scavenging and metals chelating potential (16-17). In the present study, chicken meat was rich in histidine peptides such as carnosineand anserine with antioxidant property. The presence of these antioxidant peptides in chicken meat can be considered due to high antioxidant activity in TEAC (18). The lower antioxidant activity in cooked samples compare to raw samples is due to nature of protein that changes at molecular structure upon heating. This resultswere reported to parallel to chan and Dekerstudy (19).

In a study antioxidant activity of chicken breast meat in the hydrophilic part was 10.3, while it is 5.6 mm trolex in lipophilic part (18). Some researchers such as Yamamitu reported that hydrophobic radicals have less ability to attack macromolecules such as proteins in solutions (20). DPPH reacts more with hydrophobic radicals, while TEACinteract more with hydrophilic radicals. As a result, TEACactivity were reported high in present samples that with mainlyaqueous environment.

Reduced glutathione (GSH) is a tripeptide and major free thiol in living system with antioxidant activity and free radical scavenger.It is a health sensitive indicator inside cells mainly in the reduced form.It plays a vital and protective role against bacteria, viruses, pollutants and free radicals (21). In this study, in cooking conditions, in short-term heating, the glutathione was released in samles and result in , high levels of GSH was reported in cooked samples. In addition, in short-term heating, degradation ofprotein structure not fully occurd and cosequently antioxidant activity of samples was intack with high level.

## CONCLUSION

In this research, all meat samples cooked by microwave oven were showed high antioxidant activity via different antioxidant assays.it could be stated that, cooking some foods with microwave associated without significant degradation and losses. As antioxidant properties are maintained in this method, it can be used as safe method.

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