# REDUCING EFFECT OF HAWTHORN EXTRACT ON HETEROCYCLIC AROMATIC AMINES FORMATION IN BEEF

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**Abstract – Hawthorn fruit and leaves are rich in flavonoids and procyanidin content which have antioxidant activities/free radical scavenging. In this study, reducing effects of hawthorn extract on HCAs formation were investigated. Proximate composition, creatine/creatinine, reducing sugar of samples were analyzed for all treatments (0.5% and 1% hawthorn extract) in pan-fried and oven cooked beef.**

**Key Words – antioxidants, cooking methods, meat**

## I. INTRODUCTION

Meats are a very important part of our meals contributing valuable nutrients which are beneficial to health. Meats are an excellent source of high quality protein, all essential amino acids, niacin, vitamin B6, vitamin B12, iron, zinc, selenium and phosphorus and sources of a range of endogenous antioxidants and other bioactive substances including taurine, carnitine, carnosine, ubiquinone, glutathione, creatine (1). Several epidemiological studies (both case-control and cohort) have shown that the consumption of meat and cooking practices are associated with the increase risk of human colon, breast, prostate and pancreatic cancers (2,3,4). It is recommended that human exposure to these compounds should be minimized (2,5,6). The aim of this study was to determine the inhibitory effect of hawthorn extract on HCAs formation in beef.

## II. MATERIALS AND METHODS

Proximate composition, creatine/creatinine, reducing sugar of samples were analyzed for all treatments (0.5% and 1% hawthorn extract) in pan-fried and oven-cooked beef. HCAs (IQx, IQ, MeIQx, MeIQ, 4,8-DiMeIQx, 7,8-DiMeIQx, Norharman, Harman, Trp-P-2, PhIP, AαC, MeAαC) analyzed from meat samples by HPLC.

## III. RESULTS AND DISCUSSION

The total amount of HAAs was found nd-11.38 ng/g in beef. The mean total amount of HAAs in the control samples (without extract), pan cooked beef at 150, 200 and 250ºC temperature was detected as 5.66, 8.27, and 10.96 ng/g, oven cooked beef at 150, 200 and 250°C temperature as 1.32, 2.79, 17.60 ng/g respectively. In this study, total level of HCAs in control group at 250ºC for was determined as 11.38 ng/g, and the addition of 0.5% and 1% hawthorn extract to beef before cooking inhibited the formation of the total HCA compounds by 42.53% and 35.57% respectively. When comparing the cooking methods, the total HCA amounts in pan-fried samples were higher than oven-cooked samples. The addition of 0.5% and 1% of the hawthorn extract before cooking showed both inhibitory and promoting effects on the formation of HCAs. By comparing the control group, both treatments (0.5% and 1% hawthorn extract) resulted in the reduction of IQ (up to 54%), Trp-P-2 (up to 51%), Norharman (up to 100%), PhIP (up to 26%), 7,8-DiMeIQx (up to 42%) level at different cooking methods. Prior to cooking, effects of marinades with foods that contain antioxidant properties on the formation of HAA were studied in the literature and previous studies have showed that by marinades before cooking, is effective to reduce the level of HAAs (7,8,9).When creatine levels decreased, the contents of creatinine increased with heating process for all treatments. It was observed that cooking temperature increased, the moisture content decreased. In addition, the increase in pH values of samples by cooking was found.

Table 1 Levels of HAA of beef samples with/without hawthorn extract cooked at different temperatures (ng/g).

| Cooking Methods | Cooking Temperature (°C) | Level (%) | Total HAAs | Inhibition (%) |
|---|---|---|---|---|
| Pan-cooking | 150 | Control | nd | - |
| | | 0.5 | nd | - |
| | | 1 | nd | - |
| | 200 | Control | 4.33 | |
| | | 0.5 | 4.84 | +11.78 |
| | | 1 | 4.88 | +12.70 |
| | 250 | Control | 11.38 | |
| | | 0.5 | 6.54 | -42.53 |
| | | 1 | 7.56 | -35.57 |
| Oven-cooking | 150 | Control | nd | - |
| | | 0.5 | nd | - |
| | | 1 | nd | - |
| | 200 | Control | nd | - |
| | | 0.5 | nd | - |
| | | 1 | nd | - |
| | 250 | Control | 0.10 | |
| | | 0.5 | nd | -100.0 |
| | | 1 | 0.08 | -20.0 |

*+: increase, -: decrease*

## IV. CONCLUSION

Various scientists used antioxidant substances in different studies to prevent HCAs formation and concluded that these antioxidants could play an important role in reducing quantities of HCAs because of their free radical scavenging activities.

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