Effect of Boiling on Sulfonamide Residues in Chicken Meat-Balls

M.R. Ismail-Fitry[1], S. Jinap[2*], B. Jamilah[1] & A.A. Saleha[3]

[1]Department of Food Technology, Faculty of Food Science and Technology, Universiti Putra Malaysia, 43400 UPM, Serdang, Malaysia.

[2]National Food Safety Research Center, Faculty of Food Science and Technology, Universiti Putra Malaysia, 43400 UPM, Serdang, Malaysia.

[3]Department of Veterinary Pathology and Microbiology, Faculty of Veterinary Medicine, Universiti Putra Malaysia, 43400 UPM, Serdang, Malaysia.

*E-mail: jinap@putra.upm.edu.my.

Introduction

The practice of sulfonamide (SAs) treatment in animal husbandry is purposely to prevent diseases and at the same time, it can act as growth promoter for the animal. The residues had lead to adverse effect to human health such as allergens and antibiotic resistant. To ensure the safety level of the food, sulfonamide residues have been restricted to 0.1 µg/g of food producing animal (EEC Regulation, 1990 and Malaysian Food Regulation 1985, 2006).

Lan et al. (2001) found that microwaving and roasting of tilapia meat had up to 90 and 85 % of sulfamethazine reduction, respectively. Furusawa and Hanabusa (2002) carried out the heat treatments on sulfadiazine, sulfamethoxazole, sulfamonomethoxine and sulfaquinoxaline in chicken thigh muscle; the sulfonamides had reduction of 45-61% by boiling, 38-40 % by roasting except for sulfadiazine and 35-41 % by microwaving.

The objectives of the work were to determine the effect of boiling in reducing sulfadiazine (SDZ), sulfamethazine (SMZ), sulfamethoxazole (SMX) and sulfaquinoxaline (SQX) residues concentration in chicken meat-balls and to study the relationship of boiling time and temperature, internal temperature and weight loss of the chicken meat-balls as the factors of the SAs residues reduction.

Materials and methods

Chicken meat-balls production was carried out according to formulation developed in the Faculty of Food Science and Technology, Universiti Putra Malaysia. The chicken meat was pre-fortified with sulfonamide mix standards solution at 0.5 µg/g. The boiling processes were carried out at the temperatures of 80±1, 90±1 and 100±1 °C for 3, 6 and 9 minutes each. Each treatment was repeated three times.

The internal temperatures of the samples during boiling were recorded and the weights of chicken meat-balls were measured before and after every boiling process. The sulfonamide extraction was carried out using the modified method of Stoev and Michailova (2000), Kao et al. (2001), Furusawa and Hanabusa (2002), and Hela et al. (2003). High Performance Liquid Chromatography (HPLC) Analysis was carried with Photo diode array detector. Data collected from the boiling processes were analyzed for 2-way ANOVA and Pearson Correlation by using SAS version 9.1 (2002-2003).

Results and discussion

Boiling of chicken meat-balls at 80 °C resulted in significant reduction ($p<0.05$) of SDZ, SMZ and SQX compared to the control. Chicken meat-ball needed to be boiled at 90 °C to reduce SMX significantly ($p<0.05$) compared to the control. Boiling of chicken meat-balls at the maximum temperature (100 °C) resulted in significant reductions ($p<0.05$) for SDZ against 80 °C. At 100 °C also, SMZ and SQX in the chicken meat-ball were reduced significantly ($p<0.05$) against 80 °C and 90 °C of boiling.

For SDZ and SMZ, boiling for 3 min resulted in significant reduction ($p<0.05$) against the control. At boiling treatment for 6 min, significant reduction ($p<0.05$) was observed for SDZ, SMZ and SQX compared to 3 min. No significant reduction ($p>0.05$) was observed for boiling for 9 min compared to 6 min for all type of SAs.

A Pearson correlation coefficient analysis shows that as the temperature and time increase, the lesser the SAs concentration. However, time factor showed greater effect in reducing SAs compared to temperature factor. The increased in internal temperature resulted in decreased of SAs concentration. Meanwhile, result between SAs concentration and weight changes indicated that the SAs concentration decreased as the weight increased.

In ascending order, the percent of reductions were 80 °C (3 min) < 90 °C (3 min) < 100 °C (3 min) < 80 °C (6 min) < 80 °C (9 min) < 90 °C (6 min) < 90 °C (9 min) < 100 °C (6 min) < 100 °C (9 min). The maximum reductions recorded for SDZ, SMZ, SMX and SQX were 29.4, 15.3, 13.1 and 14.7 %, respectively.

Conclusions

The differences of results on SAs concentration indicate that both temperature and time factors played important role on boiling against the SAs residues. The internal temperature and weight changes of the chicken meat-balls also had supported the information on SAs reduction. The reduction of SAs might be due to the break down of protein-SAs binding which enabled the SAs to leach out into water medium. By having the information on effect of boiling on sulfonamide residues in chicken meat-balls, step of precaution and the best boiling treatment could be taken.

References

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