# DMHF GENERATED FROM THE MAILLARD REACTION IN COOKED MEATS PROMOTES APPETITE

Issei Yokoyama[1*], Motoko Ohata[2], Yusuke Komiya[1], Jun Nagasao[1] and Keizo Arihara[1]

[1] Department of Animal Science, School of Veterinary Medicine, Kitasato University, Towada, Japan

[2] Department of Food Bioscience and Biotechnology, College of Bioresource Sciences, Nihon University, Fujisawa, Japan.

*Corresponding author email: ma16009@st.kitasato-u.ac.jp

## I. INTRODUCTION

The Maillard reaction is a critical chemical reaction occurred during cooking of meats, and generates numerous chemicals which affect sensory properties of meats. Although many studies have been reported that brown pigments have bioactivities (e.g., antioxidative activity), there have been few studies of such activities of the Maillard reaction odor [1]. Odors can affect physiological activity (e.g. blood pressure, heart rate and appetite) via the autonomic nervous system [2, 3]. 2,5-Dimethyl-4-hydroxy-3(2*H*)-furanone (DMHF) is one of the major odor components generated from the Maillard reaction and affects the palatability of cooked meats [4]. Previously, we reported that the odors generated from the Maillard reaction decreased blood pressure in rats and DMHF was identified as an important odor component to contribute it [5]. However, it is unclear whether DMHF affects autonomic nervous system. In addition, the autonomic nervous system is closely related to appetite regulation, but effects of DMHF on dietary intake have not reported. In this study, we investigated the effects of DMHF on the autonomic nervous system and dietary intake of rats.

## II. MATERIALS AND METHODS

Experiment 1: Effects of DMHF on the autonomic nervous system were evaluated as follows: After exposure of DMHF (5.7 ppm) to male Wistar rats, the renal sympathetic nerve and gastric vagal nerve activities were measured for 60 min. The distal ends of the renal sympathetic nerve and gastric vagal nerve were ligated respectively and connected to a pair of silver wire electrodes for recording efferent nerve activity (Figure 1). Statistical analysis was performed using ANOVA with repeated measures and the Mann-Whitney *U* test.

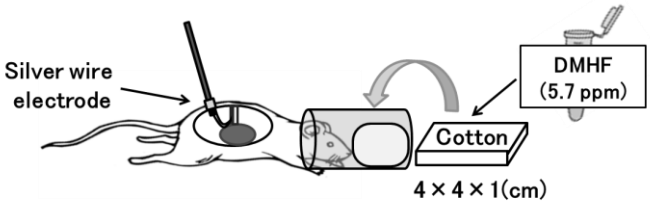


**Figure 1. Exposure of DMHF to rats and autonomic nervous activity measurement**

Experiment 2: Effects of DMHF on dietary intake were evaluated as follows: DMHF was exposed to Wistar rats every other day during feeding. The cotton soaked with DMHF (5.7 ppm) was placed above the cage for 15 min. Dietary intake and body weight of rats were measured every day for 6 weeks. Statistical analysis was performed by Student's *t*-test.

## III. RESULTS AND DISCUSSION

In experiment 1, the exposure of DMHF decreased the renal sympathetic nerve activity and increased gastric vagal nerve activity significantly (Figure 2). The excitation of the sympathetic adrenal nerve stimulates renin secretion, which increases blood pressure. Our result suggests that exposure of DMHF may decrease blood pressure by suppressing the activity of the renal sympathetic nerve and inhibiting the secretion of renin.

In experiment 2, the exposure of DMHF to rats significantly increased dietary intake from 2 to 6 weeks (Figure 3). Surprisingly, body weight gain was suppressed after 6 weeks feeding (Figure 4). An increase in activity of the parasympathetic gastric nerve promotes gut movement [6]. Our result suggests that exposure of DMHF promotes appetite via the parasympathetic nerve activity.

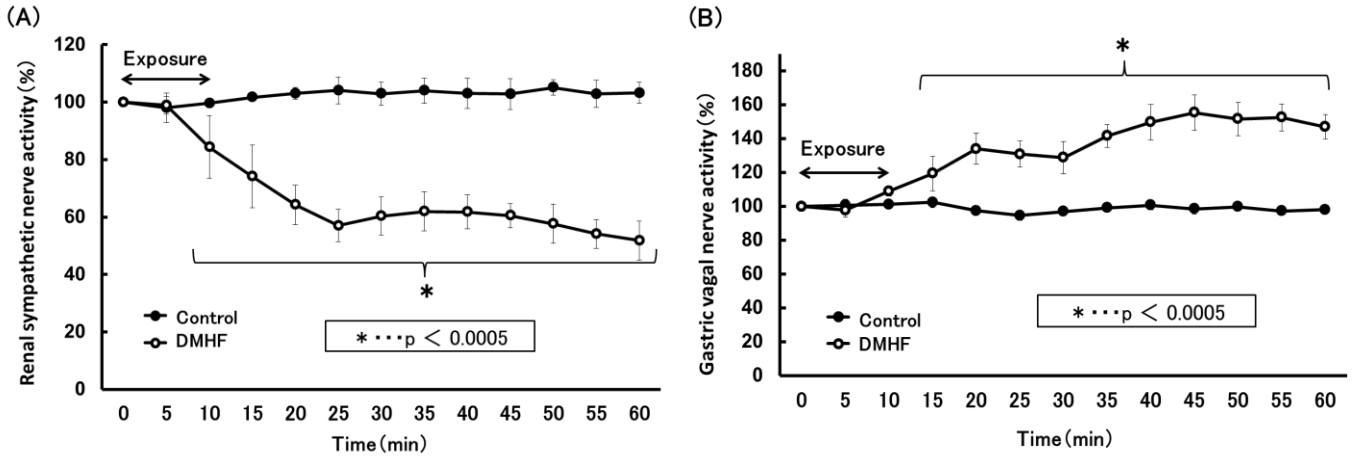


Figure 2. Changes of renal sympathetic nerve activity (A) and gastric vagal nerve activity (B)
Control: Distilled water, DMHF: 2,5-Dimethyl-4-hydroxy-3(2*H*)-furanone

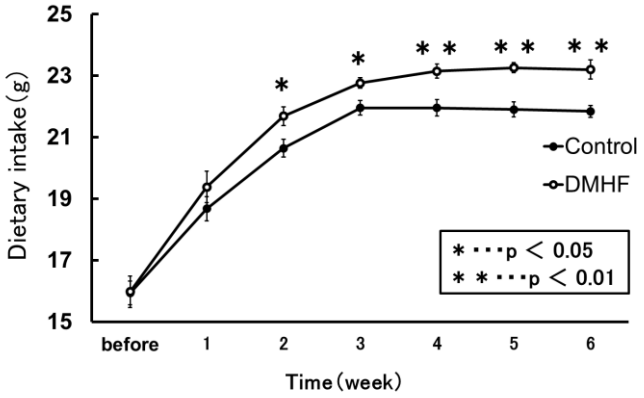


Figure 3. Change of dietary intake in rats
Control: Distilled water
DMHF: 2,5-Dimethyl-4-hydroxy-3(2*H*)-furanone

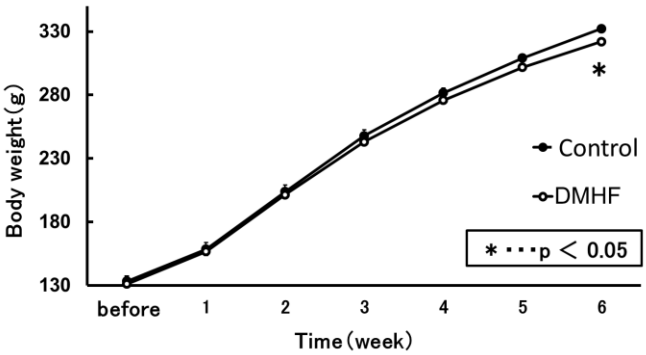


Figure 4. Change of body weight in rats
Control: Distilled water
DMHF: 2,5-Dimethyl-4-hydroxy-3(2*H*)-furanone

## IV. CONCLUSION

Exposure of DMHF, which is an odor component generated from the Maillard reaction in cooked meats, affected the autonomic nervous system and increased dietary intake of rats. From these results along with the previous study, DMHF controls blood pressure and appetite via the autonomic nervous system.

## REFERENCES

1. Arihara, K., Zhou, L., Ohata, M. (2017). Bioactive properties of Maillard reaction products generated from food protein-derived peptides. Advances in Food and Nutrition Research 81:161-185.
2. Shen, J., Niijima, A., Tanida, M., Horii, Y., Maeda, K., Nagai, K. (2005). Olfactory stimulation with scent of lavender oil affects autonomic nerves, lipolysis and appetite in rats. Neuroscience Letters 383: 188-193.
3. Shen, J., Niijima, A., Tanida, M., Horii, Y., Maeda, K., Nagai, K. (2005). Olfactory stimulation with scent of grapefruit oil affects autonomic nerves, lipolysis and appetite in rats. Neuroscience Letters 380: 289-294.
4. Watanabe, A., Kamada, G., Imanari, M., Shiba, N., Yonai, M., Muramoto, T. (2015). Effect of aging on volatile compounds in cooked beef. Meat Science 107: 12-9.
5. Ohata, M., Zhou, L., Owashi, C., Arihara, K. (2014). The effect of odor generated from protein digests and reducing sugars by the Maillard reaction on blood pressure. IMARS News Letter 9: 21-25.
6. Schwartz, G. J., Zeltser, L. M. (2013). Functional organization of neuronal and humoral signals regulating feeding behavior. Annual Review of Nutrition 33: 1-21.