

## Suppression effect on acrylamide formation in french fries by soaking of potato in various solutions

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Hiromi Nabeshi<sup>a)</sup>, Rika Adachi<sup>a)</sup>, Hiroshi Akiyama<sup>a, b)</sup>, Tomoaki Tsutsumi<sup>a)</sup>

a) Division of Foods, National Institute of Health Sciences

b) Department of Analytical Chemistry, School of Pharmaceutical Sciences, Hoshi University

### Abstract

Herein, we examined the suppression effect of potato soaking in various solutions on acrylamide (AA) formation in french fries. Thin strips of potatoes soaked for 20-180 min in various solutions such as tap water, vinegar water, and salt water were used to cook french fries by using either a conventional deep fryer or air fryer. The AA concentrations in the french fries were determined by liquid chromatography-tandem mass spectrometry analysis. Compared to unsoaked controls, solution soaking suppressed AA formation when using both fryers. This suppression effect tended to increase with prolonged soaking times. Under the same soaking time, the use of vinegar water was tended to be more effectively suppressed AA formation in french fries compared to tap water (20°C) treatment. Changing the water was also tended to be effectively suppressed AA formation. On the other hand, the AA concentrations in the french fries cooked with an air fryer were higher than those observed when cooking by using a conventional deep fryer. This may be attributed to higher heating temperatures, longer heating times, and larger heating irregularities in the case of the air fryer compared to the conventional deep fryer. Furthermore, the AA concentrations in french fries cooked by an air fryer without oil were markedly higher than those determined when cooking in the presence of oil. Thus, it may be necessary to pay attention to the possibility of increased AA formation in french fries cooked by air fryers (particularly non-oil cooking).

**Keywords** : acrylamide, suppression effect, soaking, french fries, air fryer heating

## I Introduction

Acrylamide (AA) is formed in food as a by-product of the Maillard reaction between asparagine and reducing sugars (glucose, fructose, etc.) upon heating at high temperatures<sup>1-4)</sup>. This chemical compound can cause carcinogenicity, genotoxicity, and neurotoxicity, and it is thus classified in Group 2A (probably carcinogenic to humans) according to the International Agency for Research on Cancer (IARC) risk assessment for carcinogenicity. In 2002, it was reported for the first time in Sweden<sup>5-7)</sup>, and subsequently in other countries including Japan, that AA was present in high concentrations in various processed foods produced by heating at high temperatures, such as potato chips and biscuits<sup>8, 9)</sup>.

Furthermore, in Japan, the Food Safety Commission assessed in 2016 that “Regarding the risk of carcinogenic

effects, epidemiological studies have not shown a consistent trend in the relationship between AA exposure and cancer incidence, including in populations with high exposures such as occupational exposure. Therefore, the health effects in humans are not clear. However, the exposure margin calculated from the Benchmark Dose Lower Confidence Limit (BMDL<sub>10</sub>), which is an indicator of safety derived from the benchmark dose method using dose-response curves in animal experiments, and the estimated intake of AA from food in Japanese is not sufficient, so it cannot be said that there is no concern from a public health standpoint<sup>10)</sup>”, making it one of the chemical substances of concern for health.

As AA is formed unintentionally in the food production process, it is recommended to consider the risk management based on the ALARA (As Low As Reasonably Achievable) principle, which relies on the results of an actual survey. In