

Relationship between the inhibitory effect of ginger (*Zingiber officinale* Roscoe) on nitric oxide production and the drying conditions after harvest

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Abstract

In the course of our evaluation of the quality of crude drugs, we examined the conditions under which ginger is processed. In an examination of the relationship between the drying conditions after harvest and inhibitory activity toward nitric oxide (NO) production, we found that drying at a higher temperature gave greater inhibitory activity than drying at a lower temperature. In addition, five constituents were isolated from ginger extract, and their inhibitory activities toward NO production were investigated. Among them, shogaol analogues showed the strongest inhibitory activity.

Keywords : *Zingiber officinale* Roscoe, quality control, inhibition of nitric oxide production

I Introduction

Ginger, the rhizome of *Zingiber officinale*, is used as a spice worldwide. Moreover, ginger is important as a crude drug and is used in many Kampo preparations. Crude drugs are produced from natural resources and therefore significant differences in constituents are sometimes observed depending on differences in cultivation or processing conditions after harvest. We previously reported the changes in the constituents during drying after harvest for *Perilla* herb, *Achyranthes* root and *Leonurus* herb.¹⁻³⁾ Moreover, we discovered that [6]-gingerol contributed to the inhibitory effect of ginger on nitric oxide (NO) production using an LCMS metabolome analysis.⁴⁾

The crude drug ginger ("Shokyo" in Japanese) is the rhizome of *Zingiber officinale* Roscoe (*Zingiberaceae*), and is known to have anti-inflammatory, stomachic, orexigenic and sudorific effects. Therefore, ginger is used in several Kampo preparations, including "Kakkonnto", "Shosaikoto" and "Hangekobokuto". Gingerols, constituents of ginger, are known to be easily transformed to shogaols through dehydration by heating.⁵⁾ While several studies have

examined the anti-inflammatory effects of [6]-gingerol⁶⁾ and [6]-shogaol⁷⁻⁸⁾, there has been no previous confirmation that derivatives of shogaol and gingerol inhibit NO production.

In this paper, we examine the relationship between the inhibitory activity of ginger toward NO production, as a measure of an anti-inflammatory effect, and the conditions used for drying, which is a necessary step in processing of the crude drug.

II Materials and Methods

1. Materials

The ginger used in this study (Cultivar: Kintoki) was cultivated at the Tanegashima Experimental Station of the National Institute of Biomedical Resources (NIBIO), and harvested in November, 2011.

2. Chemicals

F-12 Ham medium, L-glutamine, and lipopolysaccharide (LPS) were purchased from Sigma-Aldrich Co. LLC. Mouse