

A Simple Technique for Inhibiting Production of Green, Beany Flavor in Soybeans

by

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대豆의 날콩냄새 발생을 억제하는 간단한 방법

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Abstract

If soybeans are presoaked, two minutes heating at 100°C is sufficient to inhibit production of objectionable green beany flavors. With dry beans, three minutes heating at 100°C accomplishes the same inhibition. These brief heat treatments are not sufficient to inactivate growth inhibition factors as determined by chick feeding trials. The inhibition of off flavor coincides with loss of lipoxygenase activity, and the inhibition is thought to be due to lipoxygenase inactivation.

Introduction

In a recent review, Wolf and Cowan⁽¹⁾ posed this basic question, "Do the flavor compounds preexist in the soybean, or are they formed by enzymatic and nonenzymatic reactions when the seed is crushed?" Nelson, Wei and Steinberg⁽²⁾ argued that the typical soybean off-flavors are produced primarily by lipoxygenase activity. They based their conclusion on the results of Wilkens *et al.*,⁽³⁾ who decreased off flavor in soy milk by using a hot-water blending procedure; on the results of Mustakas *et al.*,⁽⁴⁾ who inactivated lipoxygenase by extruder cooking during preparation

of a full-fat flour; and on their own results of bland-flavored, full-fat soy products resulting from cooking for 10 to 20 minutes.

These examples in which lipoxygenase is thought to play a role in undesirable soy flavor development are all with full-fat products. In contrast, the off-flavor found in soy flour, grits, concentrate or isolate is thought to be inherent in the bean and can only be alleviated by some removal process. For example, Fujimaki's group (Arai *et al.*⁽⁵⁾ and previous papers) have studied extensively the removal of off-flavor from soy protein by the use of proteolytic enzymes, and Honig *et al.*⁽⁶⁾ have published on solvent extraction of the off-flavor compounds from defatted soybean

flakes.

In an attempt to answer the question about whether the green beany flavor is inherent in soybeans or is produced, I blanched soybeans in boiling water for various times and tasted them. If soybeans have an inherent off-flavor, one would expect it to be most pronounced at the start of heating and to gradually decrease as heating is continued. The removal of off-flavor by heat in beans should be similar to removal of off-flavor by heat in defatted flakes. In contrast, if the off-flavor is produced enzymatically when the tissue is disrupted, then a brief heating period should be sufficient to inactivate enzymes and to prevent off-flavor formation.

Experimental

Amsoy seed grade soybeans were used in all experiments. The beans (500 g) were soaked overnight in distilled water in a refrigerator. The weight gain was usually not measured, but in one batch, it amounted to 664 g or 1164 g total weight of the drained beans.

The soybeans were wrapped in cheese cloth and suspended in a large volume of boiling tap water heated by a steam-jacketed kettle so that boiling did not stop when the soybeans were immersed.

Lipoxygenase assays were done with the procedure of Hammond *et al.*⁽⁷⁾ Soybean oil emulsion was used as substrate and 50 mg of soybean flour as enzyme.

For some experiments, The soybeans were dried after blanching by spreading a single layer of soybeans in pans and heating in a hot-air oven at 80°C until the weight returned to the 500 g original weight.

A feeding trial with young chicks was done using blanched and unblanched soybeans. After these soybeans were soaked, half were blanched, and all the beans were dried to their original weight. The beans were ground to pass a #20 screen with a Wiley mill and were incorporated into experimental diets as shown in Table 1.

Results

Initial experiments showed that heating in boiling water for 2 min was sufficient to completely eliminate

Table 1. Diet composition

	1	2	3
Corn	56	54	54
Soymeal	33	—	—
Soybeans (blanched)	—	42	—
Soybeans (raw)	—	—	42
Soy oil	7	—	—
Dicalcium phosphate	1.5	1.5	1.5
Limestone	1.5	1.5	1.5
Trace minerals	0.5	0.5	0.5
Vitamin Mix	0.5	0.5	0.5
	100	100	100
Calculated :			
Crude protein	21%	20.5%	20.5%
Kcal/Kg of metabolizable energy	1500	1510	1510

the green, beany flavor; whereas, some off flavor remained after 1 min of heating. The unheated beans had a very strong, green, beany flavor. If the beans were dried, the blanched beans retained their lack of flavor for 4 months at room temperature. Unblanched beans retained the green, beany off-flavor after drying even though they had been subjected to 80°C for several hours during drying.

When soybeans that had not been soaked were blanched, they required 3 min of heating to eliminate the development of green, beany flavor.

Over approximately 6 months, I have prepared 6 to 8 batches of blanched soybeans, and these have been tasted by 30 to 40 people. Although there has been no rigorous flavor evaluation of the blanched vs. unblanched beans, invariably the people tasting them have found no green, beany flavor in the blanched beans. The unblanched beans are so strong in soy flavors that they are rejected after an initial taste.

Lipoxygenase assays showed an activity of 18.3 μ moles O₂ used per min for unblanched soybeans and no measurable activity for blanched soybeans.

These results leave little doubt that soybeans do not have an inherent green, beany flavor associated with them, but that such flavors develop enzymatically when the tissue is disrupted by chewing, crushing or blending. The long heating time necessary to even partly remove the green beany flavor from soy flakes makes it unlikely that the same flavor components are being removed by 2 min of heating at 100°C

The blanched beans were tested for their ability to support chick growth in a 2-week feeding trial. In the same experiment, raw beans and soy meal with soy oil added were tested for comparison. The results in Table 2 show that even though off-flavors are eliminated by blanching, the antinutritional factors remain, and blanched soybeans are practically the same as raw beans in their ability to support chick growth.

Table 2. Results of two week chick feeding experiment

Diet	No. of chicks	Initial ave. weights g	Final ave. weights g	Feed/gain
1 (Soy meal)	9	93	335	1.42
	4	93	330	1.47
2 (Blanched soybeans)	3	92	275	1.71
	5	93	267	1.90
3 (Raw soybeans)	2	93	258	1.90
	8	93	252	1.97

요 약

大豆를 浸漬 후 100°C에서 2분간 가열하면 불쾌한 풋냄새의 발생을 충분히 억제할 수 있다. 건조한 大豆의 경우는 100°C에서 3분간 가열하면 같은 효과를 나타낸다. 이와 같은 간단한 熱處理는 병아리 사육시험의 결과 發育阻害因子를 不活性化시키기에는 불충분하다. 異臭의 阻害는 lipoxygenase 活性의 상실과 일치하며 이것이 그 원인인 것으로 생각된다.

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