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MEMBERSHIP

November 20, 2026

For Immediate Release

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[Niigata University of Health and Welfare, Niigata Agro-Food University, and Yukiguni Factory] Discovery of Novel Functions of Ergosterol Through a Highly Sensitive Analytical Method

The Department of Clinical Engineering at Niigata University of Health and Welfare, Niigata Agro-Food University, and YUKIGUNI FACTORY CO., LTD. conducted a joint study on ergosterol, a naturally occurring compound found in mushrooms, using highly sensitive GC-MS and LC-MS/MS analytical techniques. The study revealed that ergosterol suppresses cholesterol synthesis and also influences vitamin D-related metabolites. Furthermore, human studies have shown that blood ergosterol levels may serve as an intake biomarker for objectively assessing the consumption of mushrooms, including maitake.

These findings suggest that ergosterol should be regarded not merely as a precursor to vitamin D_2, but also as a biologically important compound associated with lipid metabolism, vitamin D metabolism, and the assessment of dietary intake.

These findings have been published as a review article in Volume 75, Issues 10-11 of the *Journal of Analytical Chemistry* (November 2026).

Research Overview

◆ The Multifaceted Functions of Ergosterol and Its Potential as a Dietary Intake Biomarker
Ergosterol is a sterol found primarily in fungi, including mushrooms, and is widely recognized as a precursor to vitamin D_2. In recent years, these compounds have attracted increasing attention not only as nutritional components but also as food-derived bioactive compounds that exert physiological effects on lipid metabolism, bone metabolism, and nervous system function.
Research on ergosterol is being conducted from multiple perspectives, including lipid metabolism, bone metabolism, cognitive function, and dietary intake assessment, to better understand its biological effects and potential health benefits.

1 Inhibition of Cholesterol Synthesis
Discovery of the Cholesterol Synthesis-Inhibitory Effects of Ergosterol
Studies using HepG2 human hepatocellular carcinoma cells confirmed that ergosterol is taken up by the

cells and that a portion of it is metabolized into brassicasterol.
Furthermore, detailed analysis of cholesterol biosynthesis intermediates revealed that ergosterol treatment increased the levels of 7-dehydrocholesterol and desmosterol while reducing cholesterol levels.
Moreover, analyses at both the gene and protein levels revealed reduced expression of DHCR7 and DHCR24, enzymes involved in cholesterol synthesis.
These findings suggest that ergosterol may exert its inhibitory effects on cholesterol synthesis at downstream steps of the biosynthetic pathway.

2 Cholesterol-Lowering Effects Confirmed in Obese Rat Models
The effects of ergosterol were subsequently investigated using obese rat models fed a high-fat, high-sucrose diet. The study confirmed that a high-fat, high-sucrose diet increases LDL cholesterol and total cholesterol levels and promotes cholesterol synthesis. Administration of ergosterol to these rats resulted in reductions in total cholesterol, free cholesterol, and LDL cholesterol levels. Consistent with the findings from the cell studies, ergosterol also affected the cholesterol biosynthesis pathway in vivo, as evidenced by an increase in 7-dehydrocholesterol levels.

3 Vitamin D-Related Effects of Ergosterol
In this study, highly sensitive LC-MS/MS analysis was used to measure not only cholesterol synthesis-related compounds but also vitamin D-related metabolites. As a result, ergosterol administration significantly increased vitamin D_2 levels and also increased levels of 25-hydroxyvitamin D_3, a metabolite of vitamin D_3.
These results suggest that ergosterol-induced increases in 7-dehydrocholesterol levels may, in turn, affect vitamin D_3 biosynthesis.

4 Cholesterol-Lowering Effects and Reduced Bone Resorption Confirmed in an Osteoporosis Model
Furthermore, the effects of ergosterol were evaluated in ovariectomized rats, an osteoporosis model that mimics postmenopausal conditions in women. In the ergosterol-treated group, the ovariectomy-induced increase in cholesterol levels was suppressed, and markers of bone resorption were reduced. In addition to increased vitamin D_2 levels, elevated levels of 1α,25-dihydroxyvitamin D_3, the biologically active form of vitamin D_3, were also observed. These findings suggest that ergosterol may play a role not only in lipid metabolism but also in vitamin D metabolism and bone metabolism.

5 Potential of Serum Ergosterol as a Biomarker of Mushroom Consumption
The findings were further evaluated in human studies. In an 18-week randomized, double-blind, placebo-controlled trial involving 50 healthy Japanese adults aged 40 to 84, serum ergosterol levels increased significantly in participants who consumed bread containing 50 g of maitake mushrooms compared with pre-intervention levels. In contrast, no significant changes in serum ergosterol levels were observed in the placebo group. These findings suggest that serum ergosterol levels may serve as an objective biomarker of mushroom intake, including the consumption of maitake.

Key Research Findings

In this study, highly sensitive GC-MS and LC-MS/MS analytical techniques enabled detailed analysis of ergosterol and cholesterol-related compounds, allowing the detection of previously undetectable changes in their levels. As a result, this study demonstrated that ergosterol may be involved in cholesterol synthesis, vitamin D metabolism, and bone metabolism. The findings also suggest that serum ergosterol levels may serve as an objective biomarker of mushroom intake in humans.

This research demonstrates that highly sensitive analytical techniques are valuable tools for elucidating previously unrecognized functions of ergosterol, a common food-derived compound, as well as its metabolic fate in the body.

Original Paper Information

Title: Discovery of New functions of ergosterol using highly selective and sensitive analytical methods
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Bunseki Kagaku (Analytical Chemistry), published on November 16, 2026
DOI: https://doi.org/10.2116/bunsekikagaku.75.573

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