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Effect Of Drying Methods On The Chemical Composition Of Ginger (Zingiber Officinale) Rhizome

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Abstract
This article presents the results of scientific studies carried out between 2022 and 2024 on the "Sengang" variety of ginger (Zingiber officinale) cultivated under the soil and climatic conditions of the Namangan region. The study investigated the chemical composition of ginger rhizomes dried using three different methods — sun drying, shade drying, and artificial (convective) drying. The effects of these drying methods on moisture, ash content, fiber, and mineral elements (calcium, phosphorus, iron) were analyzed. The results provide an important scientific basis for the effective processing of ginger in the pharmaceutical and food industries, improving product quality, extending shelf life, and preserving its bioactivity.
Key words: Ginger, Sengang, Zingiber officinale, medicinal properties, agroclimate, FAO, antioxidant, amino acid, gingerol, zinc, iron, manganese, potassium, calcium, magnesium, vitamins (C, B3, B6, E, K), sun drying, shade drying, drying equipment, moisture, ash, fiber, pharmaceuticals, food industry.

INTRODUCTION

Ginger (*Zingiber officinale*) belongs to the Zingiberaceae family and originates from East and South Asia. There are 53 genera and more than 1,300 species of ginger worldwide [3]. Ginger cultivation began approximately 3,000 years ago and has become an indispensable part of many culinary dishes [4]. Ginger is produced under various agro-climatic conditions around the world. According to 2016 statistics from the Food and Agriculture Organization (FAO) of the United Nations, India, China, Nepal, Indonesia, and Thailand are among the top five ginger-producing countries. Agro-climatic conditions can influence the nutrient composition of ginger [5,9]. Ginger possesses anti-inflammatory, antioxidant, immune-supporting, and antimicrobial properties, along with other beneficial effects, all of which have been scientifically confirmed [6,7,8].

Numerous decrees and resolutions have been adopted by the President of the Republic of Uzbekistan to promote the cultivation and processing of medicinal plants within the country. Among them are Presidential Decree No. DP-139 dated May 20, 2022, "On measures for creation of value added chain by means of effective use of source of raw materials and support of conversion of herbs"[1], and Presidential Decree No. PQ-251, "On measures to organize the cultural cultivation and processing of medicinal plants and their widespread use in treatment‖ and other regulatory legal acts in this area" [2]. These decrees and resolutions set out a number of tasks, including the protection of medicinal plants, the rational use of natural resources, the cultivation and establishment of plantations of medicinal plants, further deepening of reforms in the sector, and the application of innovative technologies in agriculture, processing, and the food industry.

Ginger differs from other plants due to its unique composition. Its rhizomes contain essential amino acids required by the human body, such as valine, leucine, isoleucine, phenylalanine, and threonine. In addition, ginger is rich in powerful bioactive compounds such as gingerols and shogaols. These compounds not only help to improve health but also support the immune system. Ginger also contains important minerals such as zinc, iron, manganese, potassium, calcium, and magnesium, as well as vitamins C, B_3, B_6, E, and K. This composition makes ginger not only beneficial but also an effective aid for improving human health. Ginger is known for its strong antioxidant properties, which help neutralize free radicals in the body and serve as an effective means of combating inflammation. Therefore, ginger is widely used in pharmaceuticals, medicine, and the food industry.

Methodology.

For the research, the “Sengang” variety of ginger, cultivated under the soil and climatic conditions of our republic, was selected. This variety is known for its specific characteristics and valuable compounds. In the study, ginger was dried using different methods, and its chemical composition was analyzed. The chemical composition of the “Sengang” ginger was examined for each drying method.

Results**.** For the research, the “Sengang” variety of ginger, which grows well and produces good yields under the soil and climatic conditions of our republic, was selected. This variety stands out from others due to its high medicinal properties and adaptability to local conditions. The “Sengang” variety was studied as the research object using various drying methods (sun drying, shade drying, and drying equipment). The compositional indicators of the dried products — including moisture content, ash content, fiber content, and mineral composition — were analyzed, with the results presented in Table 1. This research has practical significance for improving drying technologies and enhancing product quality.

Table 1. Analysis of the compositional indicators of ginger under different drying methods.

Composition	Fresh Ginger	Sun Drying	Convective Drying	Shade Drying
Moisture (%)	79,2	5,66	5,3	6,96
Ash (%)	1,02	3,96	3,96	3,98
Fiber (%)	2,37	1,54	1,326	1,57
Calcium (Ca) %	0,0018	0,087	0,06	0,067
Phosphorus (P) %	0,031	0,046	0,0316	0,0396
Iron (Fe) %	0,0128	0,0247	0,0178	0,0227

According to Table 1, the compositional indicators of ginger under different drying methods were analyzed. Below is an explanation for each indicator:

Moisture content: The moisture content of fresh ginger is 79.2%, indicating that ginger retains high moisture in its natural state. Through drying processes, the moisture content is significantly reduced. In sun-dried ginger, the moisture drops to 5.66%; in convective drying, it reaches 5.3%; and in shade drying, it is 6.96%. Shade drying results in a slightly higher moisture level compared to the other methods.

Ash content: The ash content of fresh ginger is 1.02%. During the drying processes, the ash content increases significantly: 3.96% in sun drying, 3.96% in convective drying, and 3.98% in shade drying. This mainly indicates a concentration of solid substances (such as minerals) during drying.

Fiber content: The fiber content of fresh ginger is 2.37%. This indicator decreases under drying conditions. In sun drying, it is 1.54%; in convective drying, 1.326%; and in shade drying, 1.57%. This decrease in fiber content makes the ginger product structurally softer and easier to classify.

Mineral content:

Calcium (Ca): In fresh ginger, calcium is 0.0018%. During drying, this figure increases significantly to 0.087% in sun drying, 0.06% in convective drying, and 0.067% in shade drying, indicating variations depending on the drying method.
Phosphorus (P): In fresh ginger, phosphorus is 0.031%, rising to 0.046% with sun drying, 0.0316% with convective drying, and 0.0396% with shade drying, reflecting changes in mineral content during drying.
Iron (Fe): In fresh ginger, iron is 0.0128%, increasing to 0.0247% with sun drying, 0.0178% with convective drying, and 0.0227% with shade drying. The higher iron content can positively influence the bioactive properties of ginger.
In general, the drying process has a significant impact on the compositional indicators of ginger. Variations by drying method lead to a greater concentration of beneficial compounds, enhancing the useful properties of ginger.

Discussion

The results of the conducted research indicate that processing ginger rhizomes using different drying methods has a significant impact on their chemical composition. First of all, the sharp reduction in moisture content not only ensures longer shelf life of the product but also increases its microbiological stability. According to the study results, the lowest moisture content was observed in convective drying, confirming the efficiency of this method.
The increase in ash content can be explained mainly by the concentration of mineral substances during the drying process. In this regard, the increase in calcium, phosphorus, and iron elements in ginger helps to enhance its bioactive properties.
The slight decrease in fiber content positively affects the physical appearance and processing characteristics of the product, since lower fiber content facilitates grinding and standardization processes.
In addition, it can be observed that the different drying conditions (sun, shade, convective) also significantly affected the distribution of mineral elements. For example, the amounts of calcium and iron increased in many methods, further enhancing their beneficial value for health.
Based on this discussion, it can be concluded that convective drying, which is technologically controlled, can be considered the most optimal method to preserve the beneficial properties of ginger and to increase its bioactivity. At the same time, it will be important for future research to deeply study indicators such as the preservation of aromatic compounds, phenolic compounds, and the degradation of vitamins.

Conclusion.

The results of the study show that the drying process has a significant impact on the chemical composition of ginger. Different drying methods (sun drying, shade drying, and mechanical drying) alter the moisture content, ash content, fiber content, and mineral composition of ginger. During drying, the moisture content is significantly reduced, which extends the shelf life of the product. The ash and fiber contents increase during drying, improving the quality and appearance of ginger. The amounts of minerals (calcium, phosphorus, iron) also change during the drying process, enhancing the bioactive properties of the product. These changes strengthen the beneficial properties of ginger and expand its potential for effective use in the pharmaceutical and food industries. Moreover, this research has practical significance for improving ginger drying technologies, enhancing product quality, and preserving its valuable properties. In the future, these findings may serve as a basis for improving medicinal plant processing and introducing new technologies.

References

Presidential Decree No. PF-139 (May 20, 2022): "On measures for creation of value added chain by means of effective use of source of raw materials and support of conversion of herbs"

Presidential Decree No. PF-251 (May 20, 2022) "On measures to organize the cultural cultivation and processing of medicinal plants and their widespread use in treatment‖ and other regulatory legal acts in this area"

Shahrajabian, M. H.; Sun, W.; Cheng, Q. Clinical Aspects and Health Benefits of Ginger (Zingiber officinale) in Both Traditional Chinese Medicine and Modern Industry. Acta Agric Scand - B. Soil Plant Sci. 2019, 69(6), 546–556. DOI: 10.1080/09064710.2019.1606930.

Shidfar, F.; Rajab, A.; Rahideh, T.; Khandouzi, N.; Hosseini, S.; Shidfar, S. The Effect of Ginger (Zingiber Officinale) on Glycemic Markers in Patients with Type 2 Diabetes. J. Complement Integr. Med. 2015, 12(2), 165–170. DOI: 10.1515/jcim-2014-0021.

Bhatta, D. R.; Gokhale, S.; Sharma, A. L.; Gupta, U.; Gaur, A.; Gowda, S.; Raut, S.; Thapa, S.; Khadka, R. Carrier State of Haemophilus Influenzae Type B (Hib), Streptococcus Pneumoniae, Streptococcus Pyogenes, Neisseria Meningitidis and Corynebacterium Diphtheriae Among School Children in Pokhara, Nepal. Asian Pac. J. Trop. Dis. 2014, 4(1), 45–49. DOI: 10.1016/S2222-1808(14)60312-1.

Rani, K.; Tyagi, M.; Singh, A.; Shanmugam, V.; Shanmugam, A.; Pillai, M.; Srinivasan, A. Identification of Annotated Metabolites in the Extract of Centella Asiatica. J. Med. Plant Res. 2019, 13(5), 112–128. DOI: 10.5897/ JMPR2018.6711.

Asatov I., Merganov A., Abdullaev Z. Technology of caper (Capparis spinosa) seed preparation for cultivation and cultural growth //E3S Web of Conferences. – EDP Sciences, 2021. – T. 244. – C. 02022.

kromjonovich, Abdullayev Zokir, and Merganov Avazkhon Turgunovich. "Factors affecting quality in the production of organic products from buds and fruits of capers (Capparis spinosa)." Int. J. Sci. Res 3 (2022): 311-319.

Abdullayev Z. I., Karimov I. R., Mamadjonova N. A. Environmentally friendly technology for the production of powder for the food industry by drying the technically ripe fruits of the caper plant //E3S Web of Conferences. – EDP Sciences, 2023. – T. 390. – C. 07025.