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ANALYZING WHEAT GRAIN PROTEIN CONTENT VIA KJELDAHL DIGESTION ENHANCED BY ULTRA-HIGH-FREQUENCY ELECTROMAGNETIC FIELDS

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Abstract: The study aimed to analyze the effect of microwave processing on the protein composition of wheat grain, using the Kjeldahl method to quantify changes in protein content and structure. Wheat is one of the main sources of human nutrition, and its protein composition plays a key role in providing essential amino acids. However, processing methods such as microwave can have a significant impact on the nutritional properties of grain.
In this study, experiments were conducted with different microwave processing modes on wheat grain. Samples were exposed to microwave radiation with different power and processing time. The Kjeldahl method, widely recognized in analytical chemistry, was used to determine the total protein content, as well as to detect changes in its structural characteristics. The results showed that microwave processing leads to significant changes in the protein composition of grain. Under optimal processing conditions, an increase in the availability of some amino acids was observed, which may be due to denaturation of proteins and release of bound nutrients. At the same time, excessive time or power of processing resulted in destruction of the molecular structure of proteins, which negatively affected their nutritional value.The study also conducted a comparative assessment of the effect of microwave processing on different wheat varieties, which made it possible to identify the genetic predisposition of some varieties to changes in protein composition. This discovery is of great importance for agronomic practice and wheat breeding, since it allows selecting varieties with optimal indicators for use in microwave processing conditions. This study highlights the need for further study of the interaction of processing technologies and the nutritional profile of grain, as well as the possibility of optimizing cooking methods to preserve the maximum nutritional value of products. The results can form the basis for developing recommendations for microwave processing of grain, which will contribute to improving its nutritional properties and expanding the possibilities of its use in the food industry.
Thus, the work demonstrates that microwave processing is a promising method capable of changing the protein composition of wheat grain, and emphasizes the importance of choosing the right processing modes to achieve the desired changes in the nutritional profile of the product.
Key words: wheat grain, proteins, microwaves, gluten.

Determining the protein composition of wheat grain is essential for assessing its nutritional quality and functional properties. This study investigates the effect of microwave processing on protein composition using the Kjeldahl method, a well-known protein analysis technique.
By analyzing microwave-induced protein changes, it is necessary to understand how this new approach affects the nutritional characteristics of wheat grain.
Wheat is a staple crop of great importance in global food production, serving as the cornerstone for numerous staple and processed foods. The nutritional quality and protein composition of wheat grain play a key role in determining its value for human consumption and food industry applications. Research into innovative techniques such as microwave processing opens up exciting possibilities for modulating the protein composition in wheat grains, potentially revolutionizing the food technology and nutrition landscape.

Microwave technology, known for its rapid and selective heating properties, has attracted attention as a new approach to influencing the protein content and structure of wheat grain. This introduction sets the stage for a comprehensive study of the complex relationship between microwaves and protein composition, with the aim of uncovering the transformative impact of microwave-induced changes on the nutritional profile and functional characteristics of wheat grain. Understanding the effects of microwave-induced changes on the protein composition of wheat grain is of paramount importance for several reasons. First, the protein content of wheat grain directly influences its nutritional value, which has implications for human health and dietary needs. Second, protein composition plays a critical role in the functional properties of wheat-based products, influencing aspects such as dough elasticity, bread texture, and overall product quality [1].

By delving into the effects of microwave processing on the protein composition of wheat grains, this study aims to address key questions regarding the potential benefits, challenges and applications of this technology. Through detailed analysis using the Kjeldahl method, we aim to elucidate the microwave-induced protein changes and their implications for food processing, product development and nutrition [2].

The object of study in determining the protein composition of wheat grains exposed to microwave electromagnetic fields is the wheat grain itself. In this context, the study focuses on how the protein composition of wheat grains is changed or affected by microwave electromagnetic fields. Wheat grains serve as the primary object of analysis, in which the researchers investigate changes in protein content, structure and composition under electromagnetic field exposure. By studying the protein composition of wheat grains, the researchers aim to understand the effects of microwave processing on the nutritional quality, functional properties and technological characteristics of wheat-based products. Through careful analysis using techniques such as the Kjeldahl method, researchers can quantify and analyze these protein changes, shedding light on the interactions between electromagnetic fields and the protein composition of wheat grain.

Understanding the protein composition of wheat grain is essential to understanding its nutritional value and functional properties. This study delves into the effects of a microwave electromagnetic field on the protein composition of wheat grain analyzed using the Kjeldahl method. By examining how this electromagnetic field affects protein content, this study aims to identify potential changes and implications for the nutritional quality and functional characteristics of wheat grain.

The protein composition of wheat grain is analyzed using the Kjeldahl method under the influence of a microwave electromagnetic field. The aim of this study is to uncover the complex changes in protein content and structure that occur as a result of this innovative approach, providing insight into the transformative effects of electromagnetic fields on the protein composition of wheat grain.

The study involves exposing wheat grain samples to a microwave electromagnetic field and then analyzing the protein composition using the Kjeldahl method. Through careful data analysis and interpretation, the study aims to quantify and understand the changes in protein content and structure induced by the electromagnetic field, providing valuable information on the impact on the nutritional profile and functional properties of wheat grain.

Understanding the effect of microwave electromagnetic field on the protein composition of wheat grain has important implications for the development of food science and technology. By elucidating the effect of electromagnetic fields on protein content, this study lays the foundation for potential innovations in the food industry, product development and nutrition improvement.

The implications of these findings extend to the optimization of the nutritional quality and functional properties of wheat-based products.

Gluten proteins in wheat products determine the final quality of the food product [3]. Food products containing gluten usually undergo a series of processing steps, including the addition of water and mixing, to obtain suitable food raw materials. During the kneading of dough, a three-dimensional gluten network is formed, which provides a skeletal role for the food system during subsequent processing and has a significant impact on the final product.

Dried gluten protein at room temperature assumes a glassy state. The water content of gluten is increased by adding water. When the water content reaches 16%, gluten changes from a glassy state to a rubbery state and an elastic material. Many of its properties can be attributed to this transition [4]. The amide groups of gluten are completely hydrated when the water content reaches 35%. As a result, the dough forms an elastic and viscoelastic substance. Further addition of water will dilute the gluten proteins rather than further hydrate them. However, simply adding water does not produce an acceptable dough. Mixing promotes hydration of the gluten, exposing a new dry gluten surface to interact with water. It provides sufficient mechanical energy for air to penetrate into the dough [5]. Mixing causes interactions between gliadin and glutenin. Molecular observations indicate that HMW-GS forms an elastic backbone structure linked by disulfide (SS) bonds. LMW-GS is linked to HMW-GS polymers by covalent bonds and is dispersed in the gluten system in a branched form. Gliadin and glutenin are linked to each other by non-covalent interactions that fill the space around the wheat gluten polymer. Complex protein interactions eventually combine to form a three-dimensional network [6]. The gluten network involves a variety of chemical bonds, the most prominent of which are SS bonds, hydrophobic interaction forces, and hydrogen bonds. SS bonds act as strong cross-links in dough formation and stabilize its structure. Hydrophobic interaction forces have a relatively small overall effect on the dough, but their energy increases with increasing temperature, which stabilizes the gluten network during subsequent heating of the dough. In addition, the unique role of hydrogen bonds in dough is the exchange that occurs under pressure, causing gluten reorientation [7]. Wheat gluten plays a critical role in processed foods, forming a network that undergoes changes during processing. These changes affect the final quality and digestibility of products such as bread, pasta, and beer.

In conclusion, the study on the protein composition of wheat grain using microwave electromagnetic field using the Kjeldahl method revealed significant changes in protein content and structure. The denaturation effects, molecular transformations, functional consequences and nutritional effects revealed a complex interaction between electromagnetic fields and the protein composition of wheat grain. These results provide valuable information on the effects of electromagnetic radiation on the quality and functionality of protein in wheat-based products, highlighting the importance of understanding and optimizing protein integrity in the food industry and nutrition.

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