The Impact of Germination Time on The Protein Concentration In (*Triticum aestivum)* Wheat Seeds.

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Abstract: The nutritional content of food material can make someone healthier. For maintaining overall health, it is important to understand the nutrition content of it. It helps in avoidingthe disease and confirms the optimal energy levels. Dietary needs can be fulfilled by consuming the right product at the right time, such as sprouts. Sprouts are the new part of seed that grown from it during its germination. Germinating seed acts as a rich source of protein and fibers. However, protein concentration does vary with germination time.Wheat is a staple food in many cultures and is included in the diet for several reasons.Wheat in the diet can contribute to a balanced and nutritious eating pattern, providing essential nutrients and energy for optimal health. Results showed that there is a significant increase ($P< 0.01$) in protein content from 24 hrs 0.712 ± 0.038 mg protein to 96 hrs 0.875 ± 0.058 mg per gram of germination of wheat seeds.Understanding the optimal use of natural resources is often overlooked by most of people. Our objective is to elucidate methods for enhancing the effectiveness of utilizing common items. By maximizing the potential of these resources, we can improve our health in various ways.

Keywords: germination, health, nutrition, nutrient deficiencies, protein concentration, wheat seeds

1. Introduction:

Nutrients are like the building blocks that keep our bodies healthy and functioning properly. They're important because they provide us with the energy we need to do things like move, think, and grow. Without enough nutrients, our bodies can't work as well, which can lead to problems with our health and growth. So, making sure we get the right nutrients from the food we eat is super important for staying strong and healthy [1].

In the context of our research, the protein is one of the key nutrients being studied.Protein is important because it helps our bodies build and repair tissues, such as muscles, skin, and organs. By understanding how the timing of germination affects the protein content in wheat seeds, we can learn how to grow wheat that provides more of this vital nutrient. This

knowledge can then help ensure that people who rely on wheat as a food source receive the necessary protein for their health and well-being.

The seed is the smallest firm part of a plant from which a new plant of the similar kind can produce. For persuading the growth of that particular plant, the seed must be germinated [2]. The sprouting of a seed or other reproductive body, generally after a phase of dormancy called as germination [3]. Dormancy is the main factor responsible for poor or irregular germination of seed. It is a condition in which seed cannot germinate, even under optimum growing conditions [4]. For germination of a seed, it is necessary to break its dormancy.

The process of seed germination contains three main steps: imbibition, respiration, and cell division. The absorption of water by dry seed is called imbibition. As seeds absorb water, the enzymes and stored food present in the seed become hydrated. The change in the variations of these contents can affect germination process. Protein and oil bodies are the primary reserves in oilseed crops that transport energy to seedlings during their development.

Germinating seeds undergo cellular respiration for getting energy during their maturation. This is the regulated phase of the germination process. It is characterized by the activation of ATP synthesis in glycolysis, Krebs cycle, and respiratory chain.

It is claimed that the protein content increases in germinated seeds when compared to non-germinated ones, suggesting that proteins were either hydrolysed or separated from antinutritional factors. The digestibility of protein is reliant on the nature of antinutritional factors. These antinutritional factors are trypsin inhibitors and phytate, which are in the food matrix. Germination blocks the activity of trypsin inhibitors and eliminates the phytate-related inhibition over hydrolysis [5].

Wheat (*Triticum aestivum*) is a vital cereal grain in the *Poaceae* family. It is one of the world's most important main crops and a primary source of dietary carbohydrates. *Triticum aestivum* are the predominant cultivated species. The raw wheat contains 13% water, 12% dietary fiber 71% carbohydrates and 2% fat. It also contains 13% protein from which 75–80% of the protein content is as gluten [7]. It is mentioned that protein content rises in germinated seeds when compared to non-germinated ones [8]. In our research, we aim to investigate the impact of germination time on the protein concentration in (*Triticum aestivum)* wheat seeds.

2. Materials and Methods:

All the chemicals, and reagents used in experimentation were AR grade and the instrument was of standard make. The seeds germinated for 24, 48, 72, and 96 hrs. The seed germination was done by using a traditional method where 15 gm of wheat seeds (Triticum aestivum) were soaked in water and kept for 24 hrs so that they got suitable water and air. The wrapped hydrated seeds in wet cloth were kept in a warm place for proper germination. For the protein estimation, the required sample durations were planned viz. 24, 48, 72, and 96 hrs. After completion of the specified germination period, 20% homogenate was prepared in freshly prepared distilled water. Further Furthermore, the mixture was centrifuged at 10,000 rpm for 20 minutes. The supernatant was used as a sample for protein estimation. The protein estimation was done by using Lowery method [9] at 100 ug/ml standard concentration.

3. Results:

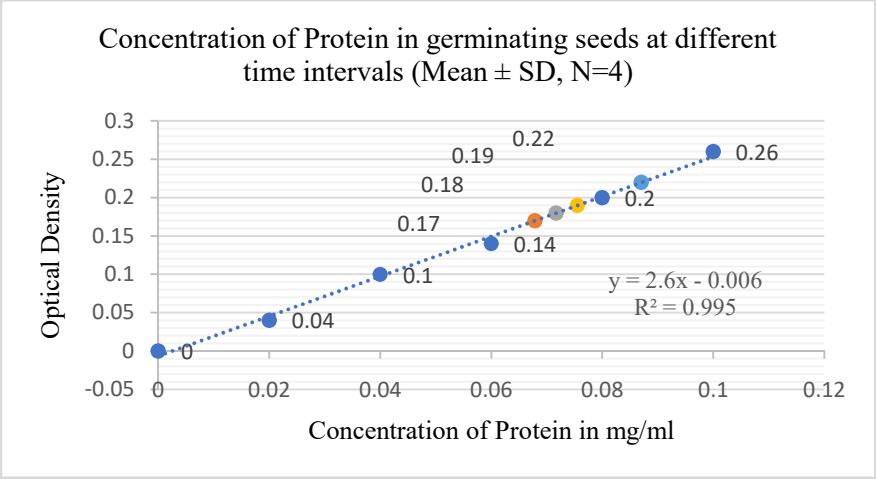
Amount of Protein obtained at different time of incubation of Germinating Seeds

Mean ± SD (N=4)

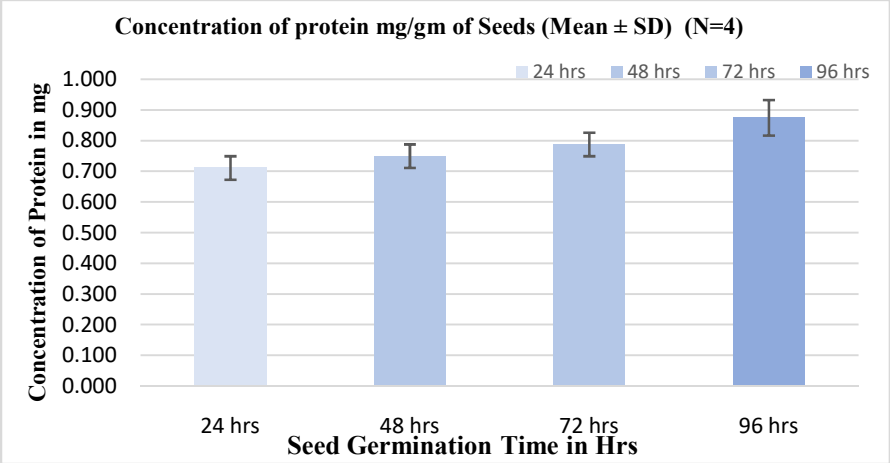
Sr. No.	Group No.	Seed Germination period	Concentration of protein mg / gram of seeds
1	1	24 hrs	0.712 ± 0.038
2	2	42 hrs	0.750 ± 0.038^{NS}
3	3	72 hrs	$0.788 \pm 0.038^{*}$
4	4	96 hrs	$0.875 \pm 0.058^{**}$

Statistical analysis was done using Students t-test where group 1 was compared with group 2, group 3, and group 4 separately where NS= Not significant, *=P<0.05, **=P<0.001

Table 3.1: Concentration of protein per gram of germinating seeds at different time interval.



Graph 3.1: Graph showing standard protein curve of seed homogenate



Graph 3.2: Concentration of protein mg/gm of Germinating Seeds at different time interval

4. Discussion:

Various factors are responsible for breaking the dormancy of the seed, such as moisture and temperature. Water, air and appropriate temperature are essential for seed germination. Water is essential for germination because the developing embryo is unable to utilize stored food as it is in a dry form. However, it can be utilized in fluid form only if dissolved oxygen is absorbed by the seed. Additionally, water halts the germination because once all the dissolved oxygen is utilized by the seed, as the life supporting oxygen is now missing. When seeds absorb water, hydrolytic enzymes are activated that break down the stored food resources, approving the cells of the embryo to divide and grow. Seed coat eruption occurs, so the seedling can arise from the seed [10].

We have observed an increased pattern of protein content with respect to germination time. Table no.1 showed 0.712 ± 0.038 mg protein per gram of germinating seeds, after 24 hrs,

which significantly increased to 0.875 ± 0.058 ($P<0.001$) mg protein per gram of germinating seeds. This change in concentration of protein adhered to the theory of germination where initial imbibition activates primary enzymes and gradually promotes germination and so, the increase in protein concentration.

Hydration of seeds causes the release of free Radical. These radicals are involved in various expansion stages of seed biology. Oxidative stress may increase at higher levels, leading to cellular damage and weakening of seed. Plant cells have systems, detoxifying enzymes and antioxidant compounds that scavenge ROS, participating in seed survival. This antioxidant system has various roles in desiccation and germination of developing seeds. Free radicals are also proved to act as a positive signal in seed dormancy release. Once the seed dormancy breaks, it will lead to the formation of radicles. Radicles are capable of fascinating water from the soil, which is required for the development of the embryonic plant. Radicle engrosses water and nutrients and supplies it to the leaves for initiating photosynthesis [11].

Seeds germination and raise into a plant, which is an enduring change. It shows that the germination of seed is a chemical change. This alteration can be defined as any change which results in the formation of a new chemical substance [12].

According to the study results, for those looking to obtain maximum nutritional benefits from sprouts as a protein source, it is advisable to consume them after a germination period of 72 hours instead of 24 hours.

5. **Conclusion**:

The seed germination process leads to the gradual rise in the concentration of protein in germinating seed. The performed experimental work support the idea that germination is a vital stage which influences the nutritional composition of seeds, particularly in enhancing protein content. Increase in theconcentration of protein in germinating seeds increase nutritional value of the seeds and hence it is very much beneficial to humans. Protein is one of the most essential macronutrients which plays a central role in various biological processes such as tissue repair, immune system and muscle development.By consuming sprouted grains (sprouted seeds), one can get a rich source of protein and make them a valuable addition to their diet. This natural increase in protein content through germination contributes to the overall development of human health. The germination time and protein concentration in wheat seeds aligns with the goals of sustainable development by enhancing agricultural

productivity, improving food security, reducing environmental impact, and fostering economic prosperity for farmers [13].

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