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VITAMIN B CONTENTS IN WHEAT GRAIN

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ABSTRACT The water-soluble vitamins comprise vitamin C and various constituents of the vitamin B group, namely thiamin (vitamin B1), riboflavin (vitamin B2), niacin, vitamin B6, pantothenic acid, biotin, folate, and vitamin B12. These vitamins play a wide range of biochemical and physiological roles and are widely present in natural food sources. Their diverse functions distinguish them from fats, carbohydrates, and proteins in terms of nutritional variety and importance in human health. Wheat contains various B vitamins, such as thiamine, riboflavin, pyridoxine, niacin, pantothenic acid, biotin, and folates. Reduction in the daily intake of B vitamins like thiamine, riboflavin, and pyridoxine could potentially be linked to a decrease in the consumption of whole wheat bread and an increase in the intake of refined products. Wheat germ and wheat bran stand out as significant sources of dietary fiber, contributing to the prevention and management of specific digestive disorders. This review explores the extensive Vitamin B profile within wheat grain, emphasizing its nutritional richness and multifaceted health benefits. Acknowledging the diverse range of Vitamin B content in wheat underscores its essential contribution to health promotion, underscoring its importance in dietary choices for overall well-being.

Keywords: *Vitamins; Wheat; Cereals; Nutrients; Multivitamins*

INTRODUCTION

Vitamins constitute a category of organic compounds that are indispensable in minute quantities for the normal physiological functioning of the human body. In human nutrition, thirteen vitamins are acknowledged and classified into two groups based on their solubility characteristics. The fat-soluble vitamins encompass vitamins A, D, E, and K, inclusive of approximately 50 carotenoids exhibiting varying degrees of vitamin A activity. In contrast, the water-soluble vitamins consist of vitamin C and the constituents of the vitamin B group, specifically thiamin (vitamin B1), riboflavin (vitamin B2), niacin, vitamin B6, pantothenic acid, biotin, folate, and vitamin B12. These vitamins exhibit diverse biochemical and physiological functions and are ubiquitously distributed across natural food sources. (Ball, 2008). Vitamins are compounds that humans cannot synthesize and, therefore, must be obtained through the diet. With intricate biochemistry, they play a vital role in human nutrition and health. Deficiencies in vitamins can lead to diseases, some of which can be severe and even lethal (Asensi-Fabado and Munné-Bosch, 2010).

Vitamins exhibit diversity compared to fats, carbohydrates, and proteins. Their distinction from other groups arises from their organic nature, and their classification is determined by both chemical composition and function. Minimal quantities of vitamins are essential for growth, development, health, and reproduction. Some vitamins deviate from the typical definition and are not always required to be included in foodstuffs; examples include ascorbic acid, vitamin D and niacin (Maqbool et al., 2017).

B-complex vitamins, consisting of eight water-soluble variants, are integral to various physiological processes. These include thiamin (vitamin B1), riboflavin (vitamin B2), niacin (vitamin B3), vitamin B6 (pyridoxine), folate (folic acid), vitamin B12, biotin, and pantothenic acid. Found abundantly in a variety of foods, these vitamins play a crucial role throughout the body, functioning as coenzymes that aid in energy extraction from food. Additionally, B vitamins contribute significantly to normal appetite, optimal vision, and the maintenance of a healthy skin, nervous system, and the formation of red blood cells (Bellows et al., 2012).

Nutritional Composition of Wheat Grain: Wheat is commonly viewed primarily as an energy (carbohydrate) source, and it unquestionably holds importance in this aspect. Nevertheless, it encompasses substantial quantities of other crucial nutrients such as proteins, fiber, along with minor elements like lipids, vitamins, minerals, and phytochemicals. These components can potentially contribute to a nutritious diet (Shewry et al., 2015). Wheat grains contain 55% carbohydrates and contribute to 20% of the overall food calories. Within wheat, the composition comprises 78% carbohydrates, 14% protein, 2% fat, 2.5% minerals, and vitamins like thiamine and vitamin B, alongside minerals such as zinc, iron, selenium, and magnesium, which collectively represent a minor portion of the overall dietary intake (Iqbal et al., 2022). Wheat (Triticum) holds the distinction of being one of the earliest cereals cultivated by humanity. Within the wheat genus, several species exist, with three notable ones – common (*Triticum aestivum* L.), durum (*Triticum durum* Desf.), and spelta (*Triticum spelta* L.) – having a global presence (Biel et al., 2020).

Cereals play a vital role in human nutrition, serving both as a primary ingredient for cooking and as raw material for producing flour used in baking. Botanically classified under the grass family (Gramineae), cereals encompass a variety of grains, including wheat, maize, rice, oats, barley, millets, sorghum, and rye. Wheat, among these, stands out as a major cereal and a globally significant food ingredient, primarily due to its adaptability for milling into flour. The flour extraction rate varies between 73% and 77%, influenced by factors such as the wheat variety, cultivation conditions, and the milling process (Mahmoud et al., 2015). In wheat, a range of B vitamins exists, including thiamine, riboflavin, pyridoxine, niacin, pantothenic acid, biotin, and folates. These compounds are water-soluble and hold significant importance in metabolism, specifically in the breakdown of carbohydrates (thiamine), proteins, and fats (riboflavin and pyridoxine) (Batifoulier et al., 2006).

Vitamin B Complex found in Wheat: The B vitamins found in wheat, including thiamine, riboflavin, pyridoxine, niacin, pantothenic acid, biotin, and folates, are water-soluble compounds that play a crucial role in metabolism, particularly in the processing of carbohydrates (thiamine), proteins, and fats (riboflavin and pyridoxine). Whole wheat bread serves as a significant source of dietary fiber, minerals, and vitamins. A reduction in daily intake of B vitamins such as thiamine, riboflavin, and pyridoxine might be associated with decreased bread consumption and an increased intake of refined products (Batifoulier et al., 2006).

Vitamin B1: Vitamin B1, also recognized as thiamin (or thiamine), is one among the eight B vitamins. Because thiamin can only be stored in the body for a brief period before being readily excreted, maintaining proper blood levels requires a consistent dietary intake of thiamin. The recommended daily intake (RDI) for adults above the age of eighteen is 1.2 mg/day for men and 1.1 mg/day for women. Adequate intake levels for children are lower. Pregnant women of any age should elevate their daily thiamin intake to 1.4 mg/day (Martel et al., 2018).

Vitamin B2: Riboflavin (also known as vitamin B2) is a water-soluble vitamin found in all plants and the majority of microorganisms. It plays a vital role in the growth and reproduction of both humans and animals. Riboflavin operates as a precursor for coenzymes called flavin adenine dinucleotide (FAD) and flavin mononucleotide (FMN), which are predominantly engaged in the redox reactions occurring in all living organisms (Averianova et al., 2020). Riboflavin (commonly known as vitamin B2) is not produced by vertebrates and therefore needs to be obtained through the diet. It is present in most foods, with the richest sources being dairy products, meat, and dark green vegetables. Deficiency in riboflavin rarely happens independently in regions where sufficient food is accessible; it typically manifests as part of a multi-nutrient deficiency (Buehler and Medicine, 2011).

Vitamin B3: Niacin, also recognized as nicotinic acid, and niacinamide, known as nicotinamide, represent different forms of vitamin B3. Both niacin and niacinamide exhibit comparable vitamin activity within the B-vitamin group. They serve as precursors for the synthesis of pyridine coenzymes like NAD (nicotinamide adenine dinucleotide) and NADP (nicotinamide adenine dinucleotide phosphate), crucial in numerous cellular metabolic reactions. In nature, free nicotinic acid and nicotinamide exist in limited quantities. Nicotinic acid predominantly binds to plant macromolecules, while nicotinamide commonly constitutes a part of NADP in the animal kingdom. Primary sources of preformed niacin include beef, pork, wheat flour, corn flour, eggs, and cow's milk. Human milk contains a higher concentration of niacin compared to cow's milk (Chand et al., 2016).

Vitamin B5: Pantothenic acid plays a crucial role in the synthesis and upkeep of coenzyme A (CoA), functioning as a cofactor and carrier for acyl groups involved in numerous enzymatic processes (Food and Intakes, 2000). It is also a component of the fatty acid synthase complex as acyl carrier protein. The Dietary Reference Intake (DRI) recommends a daily intake of 5 mg of pantothenic acid for males and females aged 14 and older, 6 mg during pregnancy, and 7 mg during lactation (Kelly, 2011).

Vitamin B6: Pyridoxine, known as vitamin B6, serves as a co-factor in multiple enzymatic pathways crucial for amino acid metabolism, with the main biologically active form being pyridoxal 5-phosphate. Vitamin B6 holds pivotal roles in various metabolic processes within the human body, particularly in the development and functioning of the nervous system. Foods such as meat, poultry, fish, vegetables, and bananas contain B6. There's speculation regarding B6 potentially playing a role in preventing pre-eclampsia and preterm birth, yet evidence supporting this is lacking. However, B6 might aid in reducing pregnancy-related nausea. Excessive intake of B6 has been associated with symptoms like numbness and difficulties in walking (Thaver et al., 2006).

Health Benefits of Vitamin B Complex from Wheat Grain:

Cereals serve as significant dietary sources of various B vitamins, notably including thiamine (B1), riboflavin (B2),

niacin (B3), pyridoxine (B6), and folates (B9) (Shewry et al., 2015). Wheat is widely acknowledged as a valuable source of protein, minerals, B-group vitamins, and dietary fiber. Although the nutritional composition of wheat grains, inclusive of its essential coating of bran, vitamins, and minerals, can be influenced by environmental conditions, it remains an exceptional food for building health. Wheat flour is a versatile ingredient utilized in the creation of bread, biscuits, confectionery items, noodles, and crucial wheat gluten or seitan. Moreover, wheat serves various purposes such as animal feed, ethanol production, the brewing of wheat beer, acting as a raw material for cosmetics, providing wheat protein for meat substitutes, and contributing to the creation of wheat straw composites. Wheat germ and wheat bran are particularly noteworthy as sources of dietary fiber, aiding in the prevention and treatment of certain digestive disorders (Kumar et al., 2011).

CONCLUSION

In conclusion, this review elucidates the pivotal role of wheat grain as a prominent source of various Vitamin B compounds. The presence of thiamine (B1), riboflavin (B2), niacin (B3), pyridoxine (B6), and folates (B9) in wheat underscores the nutritional density of this fundamental dietary component. The comprehensive examination of these Vitamin B variants within wheat grain highlights their significant involvement in metabolic pathways, neurological functions, and cellular maintenance.

The substantial abundance of B vitamins in the nutritional profile of wheat grain accentuates its importance in human diets, serving as a natural reservoir of these indispensable micronutrients. Recognizing the diverse array of health advantages associated with Vitamin B intake from wheat, including its role in energy metabolism, neural health, and genetic material synthesis, further underscores the necessity of integrating wheat-based products into a well-rounded diet.

This review presents compelling evidence regarding the nutritional importance of wheat grain, not solely as a staple food source but also as a substantial repository of the Vitamin B complex. Acknowledging and leveraging the wealth of Vitamin B content inherent in wheat grain enables individuals to optimize their dietary selections, thereby fostering comprehensive health and well-being.

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