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Review Article

# Nishasta-e-Gandum (*Triticum aestivum* L.) through the ages: An ethnopharmacological review

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Abstract

Wheat (*Triticum aestivum* L.) is one of the most consumed cereals around the world, apart from rice and maize. Wheat is cultivated globally, and it has various pharmacological benefits. Nishasta-e-gandum (wheat starch) is a powder obtained from the seeds of grain by certain procedures. It is used traditionally in various parts of India and other countries as a part of food preparations, and Unani medicine considers its medicinal properties along with its nutritive value. This review is to focus on the ethnobotanical description, history, pharmacological activities, and the literature summarization of the Nishasta-e-gandum mentioned in ancient Unani medicine texts. The classical unani texts, publications, pharmacological textbooks, and scientific databases are used for the material collections of the review. The Nishasta-e-gandum has utilized for various conditions in traditional uses and for activities in ancient unani scriptures such as *muqawwi-e-bah*(aphrodisiac), *mulayyin*(laxative),*Mughadhdhi*(nutritive),etc.,. modern research supports its effect on osteoporosis, hypolipidemic and hypocholesterolaemic activity, etc. The whole wheat constitutes numerous other activities like anticancer, antimicrobial, antidiabetic, and laxative. The review provides insight into the betterment in the usage of wheat and wheat starch as a functional food due to its medical properties tagging along nutritional benefits. The traditional wisdom has broad knowledge on the therapeutic and nutritive potential of Nishasta -e-gandum which plays role in prevention and cure of ailments. The review emphasis the further scientific research needed in the unani medicine which can provide new light in to modern nutraceuticals and pharmaceuticals.

**Keywords:** Wheat starch, Nishasta, Unani medicine, *Triticum aestivum*, gandum

## Introduction

Nishasta-e-Gandum (wheat starch) is an important part of the Unani medicine as a nutraceutical as well as a treatment agent. Prepared by *Triticum aestivum* L., wheat starch is not just food derivative but a substance that can be multi-appositely utilized in multiple prevention and treatment of diseases, in particular, the diseases linked to digestive debility, convalescence, and wasting disorders[1]. The more traditional unani scholars like Ibn Sena and Zakariya Razi also stressed on its abilities to moisten (*ratb*) and nourish (*Ghidha'*), and it was therefore recommended in diseases that are characterized by weakness, dryness, gastrointestinal irritation[2, 3].

Wheat starch is ethno pharmacologically congruent; that is, it represents food and medicine integrating, an idea of fundamental importance in most traditional medicine systems. Its traditional use cuts across a broad range of cultures who have employed it as a restorative, treatment of inflammatory bowel and improvement of tissue repair. Being easily demulcent, rich in complex carbohydrates, Nishasta-e-Gandum is thought to counterbalance the dryness and imbalances of heat within the body as adherents of Unani physiology view it in terms of temperament *(mizaj*). Moreover, it finds a use in such formulations as Mufarreh Shaikhur Rais and Halwa-e-Gandum that feature the refreshment and stamina building[2].

Current pharmacological review is going to prove numerous of these historical assertions right, showing that wheat starch has prebiotic, anti-inflammatory and mucosal protective effects. With the increased popularity of natural drug treatments and modern scientific certification of herbal medicines, an ethno pharmacologic review of Nishasta-e-Gandum is more than overdue.

This paper seeks to connect the classical Unani literature with the current pharmacological knowledge, to give an overall vision of the origin, historical background, therapeutic applications and scientific contributions were stated in the classical books on Nishasta-e-Gandum. It further examines its uses in classical Unani preparations and as medicine in the present day age of integrative medicine.

## Material and methods

A comprehensive literature review was conducted by gathering data from various online platforms, including Google Scholar, Sci-Hub, PubMed, and credible internet sources. The search was guided by specific keywords including *Triticum aestivum*, wheat starch, Unani medicine, traditional, etc. In addition to electronic sources, traditional literature in both Urdu and English that is commonly referenced in Unani medicine was also read along with the other pharmacology textbooks. The botanical identity of the plant is confirmed through the World Flora Online database. For consistency and authenticity in classical terminology, standard Unani medical terms published by the Central Council for Research in Unani Medicine (CCRUM) were utilized. This review explores the morphological features, pharmacological properties, ethno-medical significance, therapeutic applications, and nutritional potential of Nishasta-e-gandum, particularly through the lens of Unani medicine.

## History & geographical distribution

It is thought wheat (*Triticum* spp.) originated in South-Western Asia and several historical records have testified to this hypothesis. One of the renowned botanists, De Candolle suggested that wheat might have been cultivated in a very specific place, around Euphrates and Tigris rivers, the so-called cradle of early civilization. According to historical reports, the Aryans had brought wheat to the Indian sub-continent and the cultivation of wheat was also present during the prehistoric era including the Stone Age[5]. The ancient Chinese history also points out that wheat was already being grown as early as 2700 BCE. These assertions are further substantiated by the exhaustive research that was carried out by N.I. Vavilov as regards the geographical origin of crop plants. He postulated that durum wheat was probably developed in Abyssinia (now Ethiopia), and that bread wheat, or soft wheat, had perhaps developed in the region that stretched across Pakistan, the southwest of Afghanistan, and southern mountains of Bokhara[8]. Wheat is one of the earliest cultivated food crops and it has significantly contributed to the survival of the principal civilizations in Europe, West Asia and North Africa over 8000 years now. It is still one of the most commonly grown crops in the world today so highlighting its term of significance in human history[6, 7].

Wheat is among the most commons established crops in the world that covers a lot of land compared to any other commercial crop. It is considered as one of the most important foods in the world since food security of a large part of the human population depends on it. It is also grown in their large quantities in some areas of North and South America, North Africa, eastern and Southern Africa and some parts of Oceania although its production stands out in Asia and Europe, especially in India, China and Russia[6]. These major growers add up to give about 61 percent of the global wheat production with China, the United States, India, Russia, Canada and European Union, and Australia being the major growers. Wheat is mainly grown in Rabi season, especially along the northern, western and part of the southern plains in India. The wheat is produced largely in Punjab, Haryana, Uttar Pradesh, Madhya Pradesh, Bihar and West Bengal. But cultivation is fairly restricted to the northeastern states, and at some coastal portions of southern India as there are restrictions in its climatic seasons and soil conditions[9].

## Taxonomical classification

(The nomenclature and taxonomy is taken from ITIS (integrated taxonomic information system) [10]

**Kingdom**-Plantae

**Subkingdom**- Viridiplantae

**Infrakingdom**- Streptophyta

**Superdivision**- Embrophyta

**Division**- Tracheophyta

**Subdivision**- Spermatophyta

**Class**- Magnoliopsida

**Superorder**- Lilianae

**Order**- Poales

**Family**- Poaceae

**Genus**- *Triticum* L.

**Species**- *Triticum aestivum* L.

**Synonyms**- *Triticum hybernum* L., *Triticum sativum* Lam., *Triticum vulgare* Vill.

## Vernacular names

Wheat is called by various names in different places in India[4, 11, 12].

- Urdu-nishast e Gandum (Gehun)
- Arabic-lubabul Hantha
- Persian-Aab guwan
- English-Wheat starch
- Tamil-Godumai
- Malayalam-Gothamb
- Hindi-Gehu
- Sanskrit-Godhuma
- Telugu-Godumulu

## Botanical description

It grows in the largest number of varieties across the world as it is adaptable and versatile in its uses. Depending upon the environmental and varietal factors, the plant generally grows to the height of 60 to 150 cm. It has erect hollow stems (culms) that are solid at the nodes and leaves are alternate, linear, flat, and rough-textured with a base that sheaths. It has a compact, terminal spike-shaped inflorescence that reaches the length of 1015 cm and comprises a series of spikelets in two opposite rows on an axis (rachis). Every spikelet usually has two to five florets that are covered by glumes. Flowers are bisexual

and mostly self-pollinating, and the pollination process happens before the spikelets have opened[13].

It is oblong to oval in shape (or caryopsis (grain)), and has a thin seed coats enclosed. Endosperm that is full of starch and gluten is present inside it which makes *T. aestivum* very appropriate in bread and bakery. It has a fibrous root and, therefore, can absorb nutrients efficiently through the upper layers of the soil. This is a hexaploid (2n = 6x = 42) species, therefore complex and versatile. It does well in cool temperate areas especially during Rabi (winter) season in most countries like in India where Punjab, Haryana and Uttar Pradesh produce most because of favorable Agroclimatic conditions[13].

**Collection and cultivation**: wheat is cultivated in places with sun, mesic to dry mesic conditions, and soil having loam or clay-loam. It thrives in temperate zones and requires cool weather during its growing season, followed by dry and warm conditions during harvest. The crop is typically sown during the Rabi season in India (October to December) and harvested between March and April[13].

## Major species

The main species upon which wheat classification depends are the species, commercial use, and growth habit. It has sixteen known species, although only two are dominant in commercial growing: bread wheat (*Triticum aestivum*) and durum wheat (*Triticum durum*). More so, wheat selection is classified as per their growth habits; there is the winter wheat, spring wheat, and facultative wheat. An example of this group is winter wheat, which needs prolonged cold to induce flowering and generally goes dormant after entering the freezing phase[15, 16].

- The most popular cultivated species are the **Triticum aestivum**, or **bread wheat**, a hexaploid group that produces most of the world's wheat crop because it is hardy and adaptable.
- The second type, **durum wheat (T. durum)**, is a tetraploid one; it is mainly grown to manufacture pasta and semolina[16].
- **Einkorn wheat (T. monococcum)** is less common, a diploid species which has been an early domesticated type, which decreased in use over the course of time.
- ***T. dicoccum*** (another tetraploid) had historical significance, and today is only grown in rare cases, under the name **emmer wheat**.
- The hexaploid **spelt (T. spelta)** has been grown in small quantities and generally valued as providing a nutritional profile and appearing in traditional and health foods[16].

**Microscopic and macroscopic details**

- Gandum (wheat) consists of germ, endosperm, and bran (figure 4) starch part is mainly endosperm. Nishasta e gandum is a white, very fine powder with mucilaginous taste and odorless in character[11, 17].
- Microscopically, it is simple starch grains of two sizes; smaller circular or oval (up to 15µ) and large oval or sub-Reni form (up to 50µ) with central hilum having concentric striations[11, 17.]

## Identity, purity and strength

The identification of wheat starch is given below[11].

Foreign matter : not more than 2%

Total Ash : not more than 0.1%

Acid insoluble ash : nil

Alcohol soluble extractives : not less than 5%

Water soluble extractives : not less 1%

Loss in weight on drying at 105 ˚C : not more than 11%

## Natural composition of wheat starch

Wheat grains produce starch in the endosperm and appear comprising two main polymeric forms, amylose and amylopectin. Amylose is mostly linear together with 25-30 percent of the starch fraction, which contains a α-4-glucose unit's sequence that is characterized by chains linked together by α-1, 4-glucosidic bonds. On the other hand, amylopectin is a very much branched molecule comprising of 70-75 percent of the total starch content. There are two types of starch granules by size; A-type granules (5-40µm) and B-type granules (less than 10µm) (Figure 1) of different physical and functional properties. Although the levels of minerals occurring in wheat starch are small, phosphorus is the only exception that has significant functional importance. It is in the form of phosphate monoesters and inorganic phosphate and forms part of the physicochemical characteristics of the starch, especially when it is covalently bound into chains of amylopectin[18].

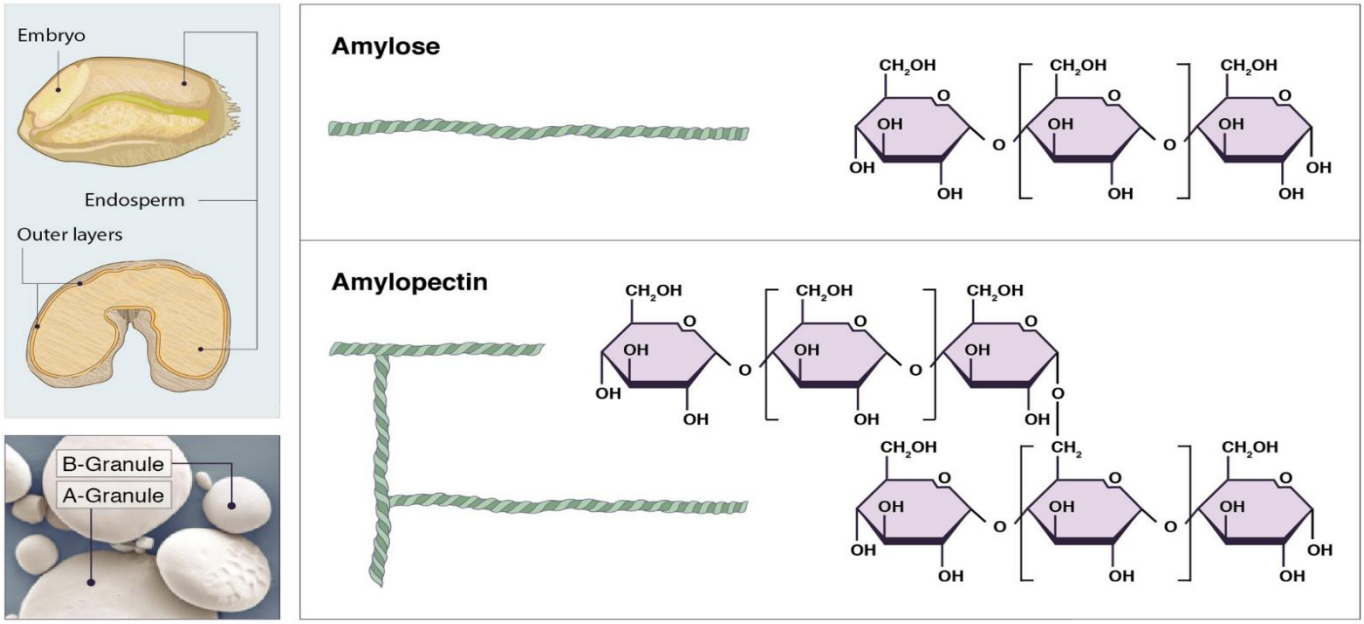


Figure 1: One of the major carbohydrates in wheat grain and flour is starch (amylose and amylopectin). Starch is located in the starchy endosperm cells. It consists of two populations of granules, large A-granules and disc-shaped and small B-granules. Source: This figure was cited and edited in Shewry et al.[37]

**Identification**

A translucent viscous jelly is produced when 1g of starch is boiled with 15ml of water and cooled[17].

The jelly will turn deep blue while adding iodine solution and the color will disappear on heating and appears on cooling.[17]

## Nishasta-e-gandum in unani medicine

Nishasta is a Persian word that is used for starch in Unani medicine. Nishasta mostly prepared from gandum (wheat) but also made from potato, maize, corn etc. The best season to prepare Nishasta is mosam-e-garm (summer) and best starch is made from durum wheat. It is white, soft, fresh and finely powdered without mold/fungus[11].

**Mizaj**: sard o khushk 1° [cold & dry 1](according to sheik-u-raees)[19,20]

Sard 2° tar 1° [cold 2 & wet 1] (other attiba) [21,22]

Haar & barid motadil [moderate in hot and wet] (sahib-e-minhaj) [21]

Sard [cold] (jalinoos) [21]

## Preparation of Nishasta-e-gandum

There are different methods mentioned for the preparation of the Nishasta-e-gandum.

- Nishasta is made by soaking wheat in water for a day by changing the water 5 times. After a day, the water is discarded and the wheat is rubbed together to remove the husk then the remaining portion is sieved and dried in sunlight and fine powder is obtained[19].
- The whole wheat flour (gandum ka Atta) kneaded into dough, placed on a bowl with small holes/sieve above a pot. Water is added to the dough and is kneaded simultaneously. Starch part will go down and gluten part of dough remains. Then pot kept idle, after the starch settle above water is decanted and starch part is sun dried[23].
- Wheat is soaked till it is fermented and then the husk is removed by pressing with hand. The solution is sieved and kept it for some time, later the water above is decanted and sediment is dried in sunlight and stored.[21]

**Wheat starch in various traditions:** *Nishasta* is a cultural heritage of Kashmir, India. People from Kashmir use it for preparing dishes by traditionally making it at home . Household preparation of a dense sweet, confection of Nishasta is considered as the best remedy for back pain and bone health and also gives as a diet in pregnancy[24]. It is used to improve immunity, skin health, etc. Another one is *Kurdi* prepared in Maharashtra, India. This is a cereal starch prepared from wheat grains that they consumed on special occasions. *Seera* is a type of food also called *Nishasta* made in Himachal Pradesh, India. Both *Kurdi* and *Seera* are prepared from the natural fermentation of starch extracted from wheat[25].

**Dosage:**4.5-66.5g/5-7g[20,21].

## Nutritional value of Nishasta-e-gandum (Wheat Starch)

Serving Size: 1 tbsp. (10 g) [26]

Amount per Serving-Calories 36 % Daily Value*

| | | |
|---|---|---|
| ○ | Total Fat | 0.1g 0%Daily Value |
| ○ | Saturated Fat | 0g 0%Daily Value |
| ○ | Polyunsaturated Fat | 0g |
| ○ | Monounsaturated Fat | 0g |
| ○ | Cholesterol | 0mg 0%Daily Value |
| ○ | Sodium | 0.2mg 0%Daily Value |

| | | |
|---|---|---|
| ○ Total Carbohydrates | 7.6g | 3%Daily Value |
| ○ Dietary Fiber | 0.3g | 1%Daily Value |
| ○ Sugars | 0g | |
| ○ Protein | 1g | |
| ○ Vitamin D | 0mcg | 0%Daily Value |
| ○ Calcium | 1.5mg | 0%Daily Value |
| ○ Iron | 0.5mg | 3%Daily Value |
| ○ Potassium | 10.7mg | 0%Daily Value |

*The % Daily Value (DV) is how much a nutrient in a serving of food contributes to a daily diet. 2000 calories/day is used for general nutrition advice.

## Actions (Afa'al)

The actions are[19, 20, 21],

- *Qabiz*(Astringent)
- *Habis-u-dam*(Haemostatic)
- *Mundij*(Concoctive)
- *Muqawwi-e-Bah* (Aphrodisiac)
- *Mulayyin* (Laxative)
- *Mughadhi* (Nutritive)
- *Radai* (Repellent)
- *Mudammil* (Healing agent)
- *Mubarrid* (Cooling)
- *Mujafif* (Desiccant)
- *Musakkin* (Sedative)

## Uses (istemal)

It is used for various ailments[19, 20, 21],

- *Kalaf* (melasma)
- *Qurooh-e-chashm* (ulcer of eye)
- *Mulayyin-e-sadr*
- *Surfa-e-har* (acute catarrhal cough)
- *Khushuna-e-halq and riya* (Irritation of throat &lungs)
- *Waja-e-sadr* (chest pain)
- *Nafth al dam* (hemoptysis)
- *Ishal-e-muzmin and safravi* (chronic & bilious diarrhea)
- *Nazla and Zukham* (coryza and catarrh)
- *Sahj- wa-Quruh-e-ama* (crohn's disease)

## Adverse effects (muzzirat)

It may have various adverse effects[19, 20, 21]

- Slight *Sudda* (obstruction) in *Kabid* (liver)
- Oligospermia
- Increased production of *Sawda*( black bile)
- Polyuria
- Difficulty in digestion

## Correctives (musleh)

To reduce the adverse effects, the correctives used are[19, 20, 21],

- *Shereen ashi'a* (sweet substances)
- Qaranfil (*Syzygium aromaticum* L.)
- Zanjabeel (*Zingiber officinale* L.)
- Karafs (*Apium graveolens* L.)

## Substitutes (badal)

There are different substitutes[19, 20, 21], which are,

- Brinj maghsool (*Embelia ribes* Burm.f.)
- Soaked rice (*Oryza sativa* Linn.)

## Adulterants

- Tapioca starch[17]
- Cassava[17]
- Brazilian arrowroot (*Manihot esculenta*)[17]

## Compound formulations

- *Halwa-e-gajar*[11]
- *Laooq-e-badam*
- *Laooq-e-shamoom*
- *Majoon-e-sohag*
- *Majoon-e-muqawwi-e-rahm*
- *Majoon-e-suparipak*

## Phytochemistry

Wheat grain consists of three major components which include the bran component, the germ component, and the endosperm component. The majority of a dry matter of a fully grown wheat grain is represented by starch, proteins, and cell wall polysaccharides. As a by-product, the bran becomes separated during the milling of grain into refined flour. Besides the major parts, wheat boasts of minor yet significant elements that include lipids, terpenoids, phenolic compounds, minerals, and essential vitamins.[27]

Lipid makes up different proportions in the various parts of the grain; i.e., it is most concentrated in the germ (approximately 8-15 %), approximately 6 in the bran, and scarcely 12% in the endosperm. The germ contains a lot of natural oils, commonly referred to as wheat germ oil, and it contains important antioxidants and minerals. However, on exposure to the air, the oil may oxidize and become rancid, lowering shelf life. This is why during the production of flour, the germ is removed to avoid the formation of unwanted flavors of stored flour.[28, 29]

Up to 85 percent of Germ lipids can be non-polar, whereas polar lipids constitute a substantially smaller percentage (approximately 17%). The endosperm lipid

profile is significantly different from that of the germ and bran. Interestingly, out of these, it is only the endosperm that contains high quantities of the galactolipids, including the monogalactosyl diglyceride and digalactosyl diglyceride as well as the phospholipids, including the phosphatidylcholine, lysophosphatidylcholine, and phosphatidylethanolamine.[30]

## Pharmacological studies

**Role in osteoporosis:** The traditional wheat preparation Nishasta is evaluated in retinoic acid-induced osteoporosis in an animal model for 14 days. The study revealed an increase in the bone volume, trabecular numbers, bone mineral density, and reduced trabecular thickness. It also ensures bone formation and prevents bone resorption, and also impacts gut calcium absorption and microbiota composition[31].

**Glycemic index modulation:** In vitro analysis shows that wheat starch mixed with high-molecular-weight β-glucans (from *Hericium erinaceus*) decreases the rapid digestibility of this starch and its capacity to inhibit the resulting expected glycemic index (pGI) as well as the proportion of resistant starch. These properties show that wheat starch is a possible management of postprandial glycemic spikes.[32]

**Anti-oxidant and prebiotic effect:** Wheat has a resistant starch that makes it fermented in the colon, leading to short-chain fatty acids such as butyrate that sustain colonocyte health, regulate oxidative stress, as well as improve insulin sensitivity. Wheat starch is a functional food ingredient because it promotes gut microbiome equilibrium due to the presence of these prebiotic effects as well.[33]

**Pharmaceutical excipient:** Wheat starch is also commonly applied in the pharmaceutical industries as excipient because of the binding, disintegrant, as well as filler characteristics as an excipient. New formulations, such as wheat starch aerogels, have demonstrated high encapsulation efficiency and thermal stability based on loading antioxidant compounds, which implies that they have positive potential in drug-controlled delivery systems.[34]

**Antimicrobial and antioxidant film applications:** Wheat starch-based films and particularly the presence of essential oils (e.g., turmeric or cinnamon) show anti-oxidative properties and antimicrobial effects. Such films have proved to be cross-disciplinary useful in food pharmaceutics in increasing shelf life and cutting spoilage of perishable foods[35].

**Safety in Celiac Disease Management:** Natural gluten-free diets showed similar outcomes as using wheat-starch-based gluten-free diets in newly diagnosed celiac patients; in both cases, the diets went hand in hand with symptom relief and positive mucosal healing. This aids the safety of purified wheat starch in allowing gluten-restricted diets through proper processing.[36]

## Conclusion

In conclusion, this review summarizes that Nishasta-e-gandum has both nutritional and therapeutic potential, as well as a cultural heritage, which need to be explored further. It has been traditionally used in Indian households for preparing various dishes. In Unani medicine, Nishasta is used as a binding agent for various compound formulations and also possesses different medicinal actions along with nutritive value. This enlightens our understanding of nutraceutical knowledge in Unani medicine.

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