



Isolation, characterization and physicochemical properties of starch from Ginger (*Zingiber officinale*)

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Abstract

Ginger (*Zingiber officinale*) contains constituent like starch, fat, gingerol, volatile oil, the crushed ginger root and starch extracted based on properties of physicochemical that isolates using 1 % w/v sodium metabisulphite solution of achieving starch was initiate to be crystalline, non-hygroscopic powder with 1.3 swelling powder capacity, 37% of solubility capacity and gelatinization temperature at 80°C. The character study of starch was extracted and showed physicochemical properties elevate using extraction, purification, concentration, physical or biological process expressed for identification of sinking and non-reducing carbohydrates.

Keywords: *Zingiber officinale*, physicochemical, reducing substance, antioxidant

Introduction

Ginger (*Zingiber officinale*) is a herbaceous persistent plant of the family Zingiberaceae, which is used worldwide in cooking and traditional medicine with exceptional acidity and typical aroma. The increased consumption of food supplements is recognized as a non-pharmacological treatment. It is commonly used for the treatment of stomachache, arthritis, and nausea. Starch is solitary prolific organic chemicals that synthesize amyloplasts of seeds, grains, roots, and leaves of green plants in the plasmids that serve as an elementary storage form of energy from the sun. Starch recognized as biodegradable and biopolymer of the digestible polysaccharide of renowned nutritional superior to a low molecular weight of carbohydrate or sugar^[1].

The World Health Organization (WHO), traditional plants are used as a complementary medicine used in pharmaceutical products coupled with desire traditional medicine used for quality and traceability of botanical element in food enhancement^[2, 3]. Ginger has antibacterial resistance used for traditional medicine of Zingiberaceae family that strengthen gastrointestinal (GI) disorder such as dyspepsia, to cure upper intestine ulcers include gastritis and peptic ulcer disease (PUD) caused due to bacterial infection (BI)^[4, 5].

The carbohydrates consist of large glucose units of polysaccharides which can produce using green plants as an energy store. The purest form of starch viewed as white, unsavory and unscented powders which are inexplicable in cold water or alcohol. Ginger component act as tough antioxidants and valuable antimicrobial agents used primary sources gastritis and peptic ulcer in the gram-negative bacterium^[6, 7]. Ginger inhibits numerous pro-inflammatory cytokines includes Interleukine-1 (IL-1), Tumor necrosis factor alpha (TNF- α) and Interleukine-8 (IL-8) with hamper prostaglandin (PG) and leukotriene (LT) synthesis enzymes, they expressed with gene encoding cytokines. They are conventional non-steroidal anti-inflammatory drugs (NSAIDs)^[8].

The present study observed physicochemical and functional properties of ginger form extracted starch that can elevate using extraction, purification, concentration, physical or

biological process expressed for identification of reducing and non reducing carbohydrates.

Materials and Methods

Materials

The fresh sample of Ginger root was collected from the local area of Mysuru district, Karnataka. The samples were cleaned and packed in a sealed container at room temperature until needed.

Purification and Isolation of Starch from Ginger (*Zingiber officinale*)

The fresh 2 kg of ginger roots were brought peeled and washed, the sample before chopped into tiny pieces and soaked in 1% of sodium metabisulphite solution in 1 liters of distilled water at room temperature at 25°C. Thereafter, a scrap of root were impassive and drench pulverized an into slurry using a grater. The paste was discrete through a huge amount of 1% sodium metabisulphite is filtered in muslin cloth. The deferment was centrifuged at 3500rpm for 10 minutes to assist for the exclusion of dirty, the supernatant was carefully decanted and the mucilage scraped off, repeat four times with the mucilage on the starch tattered constantly in anticipation of a pure starch was obtained. The starch was auxiliary dried at 60°C in a hot air oven, minced, evaluate and stored in a sample bottle for analysis^[9].

Determination of Swelling Power

Starch sample (0.1 gm) was evaluated in a test tube and 10 ml of distilled water was added. The mixture was heated in water bath at a room temperature of 50°C for 30 minutes with uninterrupted shaking. The test tube was centrifuged at 1500 rpm for 20 minutes in order to facilitate the removal of the supernatant which was carefully decanted and the weight of the starch paste taken. The swelling power was calculated as follows:

$$\text{Swelling Power} = \frac{\text{Weight of Starch Paste}}{\text{Weight of Dry Starch Sample}}$$

This was carried out over a temperature range of 50°C.

Determination of Solubility Power

Solubility index was determined over a temperature range of 50°C as follow: starch sample (0.5gm) was added to 10 ml distilled water in a test tube. This was subjected to heating in a water bath with a starting temperature of 50°C for 30 min. Thereafter, it was centrifuged at 1500 rpm for 30 minute. 5ml of the supernatant was decanted and dried to constant weight. The solubility was expressed as the percentage (%) by weight of dissolved starch from heated solution.

$$\% \text{ Solubility} = \frac{\text{Weight of the Starch Paste}}{\text{Weight of sample of Dry basis}} \times 100$$

pH

A 20 % w/v dispersion of the sample was shaken in water for 5 minutes and the pH was determined using pH meter.

Gelatinization Temperature

This was evaluated using the starch sample (0.5 gm) was put in a 20 ml beaker and 5 ml of distilled water added. The dispersion was heated on a hot plate. The gelatinization temperature was then read with a thermometer suspended in starch slurry ^[10].

Foam Capacity

Sample (1 gm) was homogenized in 50 ml distilled water using vortex mixer for 5 minutes. The homogenate was poured into a 100 ml measuring cylinder and the volume recorded after 30 seconds. The foam capacity was expressed as the percent increase in volume.

$$\text{Foam Calculation} = \frac{\text{Average change in Volume}}{\text{Initial Volume}} \times 100$$

Test for Carbohydrates

Molish's Test

Take 2 ml of ginger extract solution was treated with few drops of Molish's reagent in a test tube and 2 ml of conc.H₂SO₄ was added carefully along the side of tubes the formation of reddish violet ring at the junction of two layers indicates the presence of carbohydrates.

Test for Reducing Sugar

Benedict's test

Take 2 ml of benedict's reagent in a clean test tube add 1 ml of extract was added, warmed and allowed to stand for 2 min, that gets red precipitate indicates the presence of sugar.

Fehling's Test

Mix the equal volume of (5 ml) extract solution and same volume of fehling's solution (equal mixture of fehling's solution A and B) and boil it. After few minute the appearance of brick red precipitate, it indicates the presence of reducing sugar.

Test for Monosaccharides

Barfoed's Test

In a clean test add equal volume of extract and barfoeds reagent test solution. Allow it to heat for 1-2 minutes in a water bath and cool. The existence of red precipitate indicates the presence of monosaccharide.

Test for Hexose Sugar

Selwinoff's Test

Take a clean test tube add 3 ml Selwinoff's reagent gently

heat it later add 1 ml test solution in bearing water bath for 1-2 minutes. Observe red color formation.

Test for Non-Reducing Sugars

Benedicts Test

Take 2 ml of Benedict's reagent and 1 ml of extract was added, allow for warming for few minutes in stand; formation of red precipitate indicates the presence of sugar.

Test for Non-Reducing Polysaccharides

Iodine Test

Mix 3 ml test solution and add few drops of dilute iodine solution. Blue color appears; it disappears on boiling and reappears on cooling ^[11].

Results

From the above identification of preliminary screening tests shows the presence of carbohydrates are extracted from the starch of zinger.

Table 1

Physicochemical Properties of Ginger Starch	
Parameters	Ginger
pH	6.2 ± 0.2
Gelatinization Temperature (°C)	80 ± 0.02
Foam Capacity (%)	4 ± 0.1
Swelling Capacity	1.3
Solubility Capacity	37%

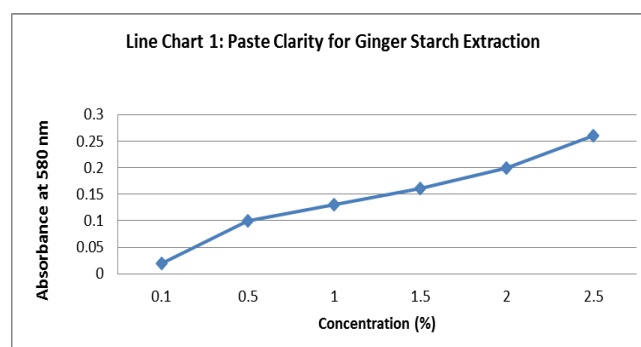


Fig 1

Table 2: Screening of extract Rhizome of Ginger using Photochemical Methods

S. No.	Chemical Test	Remark
01.	Test for Carbohydrates	
	a) Molish's Test	Positive
	b) Fehling Test	Negative
02.	Test for Monosaccharide	
	a) Barfoed's Test	Negative
	Test for Hexose Sugar	
03.	a) Selwinoff's Sugar	Positive
	Test for Non-Reducing Sugar	
04.	a) Benedicts Test	Negative
	Test for Non-Reducing Polysaccharides	
05.	a) Iodine Test	Positive

Conclusion

The present study the starch was extracted from *Zingiber officinale* by using centrifugation, physicochemical properties of ginger starch was found to be white, tasteless, the swelling and solubility profile, water holding capacity, paste clarity, foam capacity, pH, and gelatinization

temperature of ginger starch was found. There starch indicates the presence of carbohydrates.

Consent for publication

The authors declare that this article is original, has never been published, and has not been submitted to any other journal.

Ethics approval and consent to participate

Not applicable

Authors' contribution

PNM, MS and KBM wrote the manuscript, SKBY edited and finalized the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interest.

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References

1. Zhu J, Chen H, Song Z, Wang X, Sun Z. Effects of Ginger (*Zingiber officinale* Roscoe) on Type 2 Diabetes Mellitus and Components of the Metabolic Syndrome: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Evidence-Based Complementary and Alternative Medicine, 2018.
2. Stanisiere J, Mousset PY, Lafay S. How Safe Is Ginger Rhizome for Decreasing Nausea and Vomiting in Women during Early Pregnancy?. Foods. 2018; 7(4):50.
3. Mahady GB, Pendland SL, Yun GS, Lu ZZ, Stoia A. Ginger (*Zingiber officinale* Roscoe) and the gingerols inhibit the growth of Cag A+ strains of Helicobacter pylori. Anticancer research. 2003; 23:3699.
4. Wagesho Y, Chandravanshi BS. Levels of essential and non-essential metals in ginger (*Zingiber officinale*) cultivated in Ethiopia. SpringerPlus. 2015; 4(1):107.
5. Akinyemi AJ, Adedara IA, Thome GR, Morsch VM, Rovani MT. Dietary supplementation of ginger and turmeric improves reproductive function in hypertensive male rats. Toxicology reports. 2015; 2:1357-1366.
6. Poeloengan M. The effect of red ginger (*Zingiber officinale* Roscoe) extract on the growth of mastitis causing bacterial isolates. African Journal of Microbiology Research. 2011; 5(4):382-388.
7. Moussa A, Nouredine D, Hammoudi SM, Saad A, Bourabeh A. Additive potential of ginger starch on antifungal potency of honey against *Candida albicans*. Asian Pacific journal of tropical biomedicine. 2012; 2(4):253.
8. Mahluji S, Ostadrahimi A, Mobasseri M, Attari VE, Payahoo L. Anti-inflammatory effects of *Zingiber officinale* in type 2 diabetic patients. Advanced pharmaceutical bulletin. 2013; 3(2):273.
9. Zhu LJ, Liu QQ, Sang Y, Gu MH, Shi YC. Underlying reasons for waxy rice flours having different pasting properties. Food Chemistry. 2010; 120(1):94-100.

10. Chanapamokkhot H, Thongngam M. The chemical and physico-chemical properties of sorghum starch and flour. Kasetsart J Nat Sci. 2007; 41:343-349.
11. Zobel HF. Starch crystal transformations and their industrial importance. Starch-Stärke. 1988; 40(1):1-7.