Isolation of Potato Peel Starch & Its Food Application

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Abstract
In Pakistan, 95% of potato is cultivated in Punjab of which 75% of the potato crop is cultivated in Kasur, Okara, Depalpur, Sahiwal and Pakpattan. Potato peel accounts for 10% of potato residue during its processing. Potato peel constitutes important chemical compounds of which starch is of significance among others (Alka Joshi, 2020). This study was focused on the isolation of starch from potato peel, its conversion to modified starch and food application. Potato peel is susceptible to spoilage by microbes especially if its wet. Thus there is a load of their proper disposal on waste management sector (Rowland,2020). As the amylose increases in starch it starts to depict a prebiotic potential. Starch was extracted by alkali steeping method. Extracted starch was subjected to three rounds of autoclaving at 130°C for 30 minutes.

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Keywords: Potato peel starch, Starch isolation, Modified starch, Resistant starch, Food application

1. Introduction

Potatoes *Solanum tuberosum* is one of the largest grown crops not only in Pakistan but in the entire world. At present China is the largest potato producer in the world that has an output of 72,000,000 tons followed by India. India produces about 26,280,000 tons. (Debdatta, 2020).In Pakistan potato was grown on 0.184 million hectares with a production of 4.142 million tonnes (FAOSTAT, 2019). Potato peel constitute about 11.2 % moisture, ash 7.5 %,sugars 3.4%,carbohydrates 64.47 %,& protein 13.2 % by dry weight.

China is the largest potato producer in the world that has an output of 72,000,000 tons followed by India. India produces about 26,280,000 tons. (Debdatta, 2020). In Pakistan potato was grown on 0.184 million hectares with a production of 4.142 million tonnes (FAOSTAT, 2019).

This study is aimed at isolation of starch from potato peel. When a person eats a starchy item of food the gut does not necessarily digest all of it. At time the starch passes through human's gut without being broken. Such a starch that resists digestion is labeled as resistant or active starch.

Resistant starch has a high amylose content in it. It does not get digested in small intestine rather it gets fermented in large intestine. Resistant starch gives a feeling of fullness which means it adds to the satiety value of food. Furthermore it does not spike up the blood glucose levels. The good bacteria in the gut start to proliferate due to resistant and active starch. (Gunar, 2018).A starch which is high in amylose content improves insulin sensitivity (World Health Organisation, 2015).

The aim of this study is to isolate potato peel starch, modify by autoclaving and its supplementation in oatmeal cookies. Starch is extracted through alkali steeping & resistant starch is produced via autoclaving. A cookie may add up to 160 calories in a diet with protein 1g, carbohydrates 25 g & fiber 1.2 grams. (M Scott, 2010).

2. Methods

2.1. Isolation of potato peel starch

Potato peel starch was isolated through the help of alkali steeping method Madson's method (Deepa, 2013).It was used with a slight modification. This method was proposed in 2010. Percentage yield of starch was calculated by making use of the formula as mentioned below

Percentage yield = (dry weight of starch x 100) / dry weight of ground potato peel powder

2.1.1. Optimization of isolation process

The method of isolation of starch was optimized by changing amplitude & time durations of ultrasonication through the assistance of sonicator. Absorbance of the solution was taken by spectrophotometer at 620nm.

2.1.2. Modification of starch

The starch was modified using the method of Nasrin (Taslima Ayesha, 2014).Potato peel starch was at first dissolved in distilled water (1:10 w/w) with a pH of 7.5. The starch was autoclaved at 130°C & cooled down at 4° for a day. This was done three times.

2.2. FTIR (Fourier Transform Infrared)

FTIR analysis was done by using Cary 630, Agilent Technologies. Wavenumber range of the measurements taken was 500 to 4000 cm-1.

2.3. Water solubility index & Water absorption index

Based on the method of gerçekaslan (2020) the water absorption index of the samples of starch was determined.

- The formula used to calculate water solubility index (WSI) is mentioned below:
  Water solubility index = Weight afterwards drying method / weight of actual starch sample
- The formula used to calculate water absorption index is mentioned below:
  Water absorption index = Weight of wet sediment / Dry weight of actual starch sample

2.4. Swelling Power

Calculation of swelling power was done through the method proposed by (Moses, 2018).The swollen paste from the clear supernatant was also weighed through with the help of weighing balance.

The swelling power was calculated using the formula mentioned below:

Swelling Power =Weight of the (swollen) paste / Weight of dry starch

2.5. The determination of amylose content

For the determination of amylose content iodine calorimetric method was used (Khoomton & Noomhorn, 2015). Standard curve was formulated to determine the exact amylose content.

2.6. Oatmeal Cookies Preparation

0, 1% & 5 % modified starch was added in oatmeal cookie dough with jaggery & gram flour. Dough was kneaded was only 5 minutes & then cooled at 4° for 2 hours.(AllRecipe.com)

2.6.1. Proximate Analysis

Protein,Fat,NFE content of oatmeal cookies alongwith moisture & ash content of oatmeal cookies was determined.

2.6.2. Texture Analysis

Texture of cookies was analysed through a texture analyzer.

2.6.3. Sensory Evaluation

A 9 point hedonic scale was used for sensory evaluation by a panel consisting of 25 respondents.

2.7. Assessment of modified starch prebiotic effect

The strains of Pediococcus bacterium and Bifidobacterium were propagated at 37°C using Man Ragos Broth (MRS) broth for 24 hours. After sub culturing, these were grown in various concentrations of modified starch (0%,1% and 2%).

2.8. Enzyme Hydrolysis

Through amylase enzyme hydrlysis of modified starch was done.(Babatunde, 2023).

2.9. Acid Hydrolysis

Through Hydrochloric acid hydrolysis of modified starch was done by making use of DNS Reagent. (Shujun Wang, 2015).

3. Results

3.1. Starch Yield

Starch extracted from potato peel with total yield of 49.35 % (w/w) was termed as unmodified starch (UMS).Modified starch was prepared by autoclaving. Total modified starch yield was 29.95% (w/w).Treated modified starch was termed as (M.S).

UMS **MS**

Fig 1: Unmodified starch & modified starch

3.2. Optimisation of Starch Yield

To detect maximum yield of starch sonication time & amplitude was continously altered with variations in sample to solvent ratio.

Table 1: Optimisation of starch yield

Sample (gm)	Sonication Time 10 Sec ON 20 Sec OFF	Amplitude %	Volume of Solution (ml)	Concentration Of Starch (gm)
1	15 min	50%	2	0.87±0.014
1	30min	20%	2	0.84±0.014
1	30min	40%	2	0.80±0.007
1	30min	60%	2	0.86±0.007
1	45min	50%	2	0.87±0.007
5	30min	40%	2	0.80±0.007
10	30min	50%	2	0.82±0.007
10	40min	50%	2	0.85±0.021
15	40min	50%	2	0.84±0.007
20	40min	50%	2	0.88 ±0.007

3.3. Fourier Transform Infrared Spectra of Unmodified & modified starch

FTIR of modified starch depicts the presence of O-H bonds C=C & C-F bonds.while FTIR Spectra of unmodified starch shows presence of C-Oand C-H bonds.

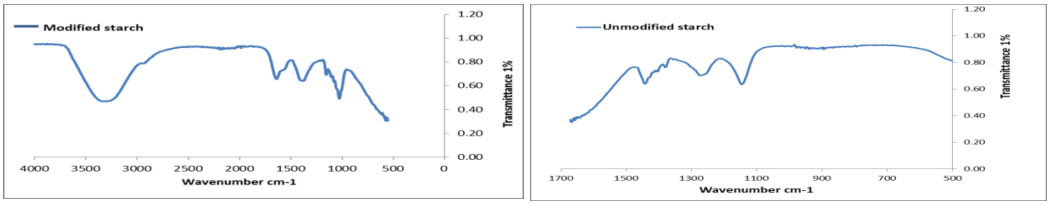

Fig 2: FTIR modified starch & FTIR unmodified starch

3.4. Water solubility index & water absorption index

Water solubility index of unmodified starch was 8.64 g/ml & 7.52g/ml for modified starch.Water absorption index of unmodified starch was 3.16g/ml & that of modified starch was 4.05 g/ml.

Table 2: WSI & WAI of unmodified and modified starch

Sample	Water absorption index (g/ml)	Water solubility index (g/ml)
UMS	8.64±0.014	3.16±0.028
MS	7.52±0.042	4.05±0.014

3.5. Swelling power

Swelling power of modified starch was 21.65 g/ml as compared to swelling power of unmodified starch 0.53g/ml.

Table 3: Swelling power of unmodified & modified starch

Sample	Swelling power (g/ml)
UMS	0.53±0.007
MS	21.65±0.671

3.6. Enzyme Hydrolysis

Modified starches were resistant to enzyme hydrolysis.

Table 4: Enzyme hydrolysis of unmodified &modified starch

Time	Absorbance (540nm) UMS	Glucose Concentration UMS	Absorbance 540nm MS	Glucose Concentration MS
5 min	0.92±0.02	1.01±0.02	0.10±0.01	0.09±0.01
15min	1.07±0.07	1.05±0.00	0.17±0.08	0.15±0.02
30min	1.08±0.04	1.03±0.01	0.14±0.06	0.15±0.02
45min	1.25±0.62	1.19±0.04	0.21±0.03	0.22±0.05
60min	1.33±0.43	1.31±0.01	0.15±0.02	0.25±0.06
90min	1.55±0.65	1.55±0.09	0.23±0.02	0.28±0.53

3.7. Acid Hydrolysis

Modified starch was resistant to acid hydrolysis

Table 5: Acid hydrolysis of unmodified starch & modified starch

Time (min)	Absorbance UMS	Absorbance MS
Control group 1	0.041±0.02	0.050±0.01
Control group 2	0.333±0.01	0.333±0.04
0	0.072±0.1	0.039±0.05
15	0.104±0.03	0.058±0.07
30	0.129±0.07	0.038±0.01
45	0.164±0.01	0.035±0.01
60	0.184±0.07	0.061±0.007
90	0.196±0.01	0.053±0.02

3.8. Prebiotic potential of modified starch

Colonies of pediococcus & bifido bacterium increased in number on increasing modified starch concentration.

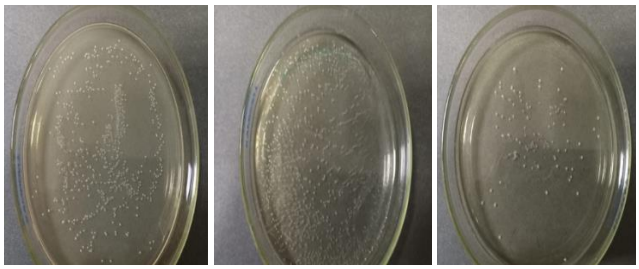

Fig 3: *Pediococcus* & *Bifidobacteria* strains with 1% & 5 % modified starch cultures

3.9. Proximate Analysis of oatmeal cookies

Nutrient content of all the oatmeal cookies was same with slight variation after the addition of modified starch.

Table 6: Proximate analysis of oatmeal cookies

Sample	Protein	Ash	Moisture	Fat	NFE (Non fibrous carbohydrates)	Fiber
Control	14.30±0.007	1.70±0.070	0.40±0.070	17.66±0.0777	62.14±0.141	4.20±0.070
A1	14.52±0.056	2.52±0.127	0.02±0.014	22.65±0.007	55.75±0.106	4.55±0.0777
A5	16.50±0.070	3.30±0.141	0.36±0.021	17.95±0.176	57.65±0.212	4.60±0.120

3.9.1. Energy Composition

All oatmeal cookies had somewhat similar energy composition with a slight variation because of the addition of 1 % & 5 % modified starch.

Table 7: Energy composition of oatmeal cookies

Sample	Control	A1	A5
Calories	463±0.155	484±5.88	457±1.414

3.9.2. Texture Analysis

All cookies showed somewhat similar textural properties with slight variations.

Table 8: Texture Analysis of oatmeal cookies

Property	Control group	Sample with 1% MS	Sample with 5% MS
Hardness	46.33±28.20	52.23±48.38	69.61±22.89
Cohesiveness	0.63±0.04	0.66±0.07	0.73±0.02
Springiness	0.73±0.05	0.66±0.82	0.69±0.11
Gumminess	46.33±23.62	38.3±36.66	51.33±16.25
Chewiness	37.0±20.42	28.3±28.72	37.33±12.50
Resilience	0.42±0.12	0.3±0.11	0.46±0.02

3.9.3 Sensory evaluation

All cookies were accepted by respondents & showed similar sensory evaluation results with slight variations.

Table 9: Sensory evaluation of oatmeal cookies

Sample	Appearance	Aroma	Flavor	Mouthfeel	Overall acceptability
Control	7.48±1.22	7.45±0.99	7.36±1.32	6.8±1.43	7.38±1.80
MS 1%	7.08±1.45	7.28±1.77	7.44±1.45	7.28±1.56	7.36±1.54
MS 5 %	7.36±1.89	7.12±1.87	7.08±1.67	7.1±1.44	7.46±1.34

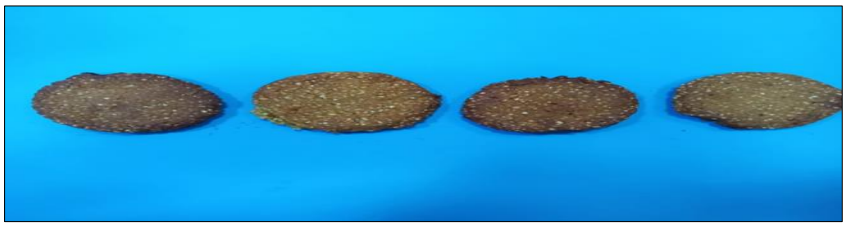

Fig 4: Oatmeal cookies

4.1. Discussion

Across the globe, potato is considered the foremost horticultural crop to provide bulk to human diet**.**Alkali steeping is a method of starch extraction which is relatively simpler.The unmodified starch yield through alkali steeping after ultra sonication method was 49.35 % (w/w).The modified starch or resistant starch yield was 29.95% (w/w).According to a method of Paul Chen starch yield percentage from potato peel was 49%.Water absorption index of unmodified starch was 8.64 g/ml & water absorption index of modified starch was 7.52 g/ml. The water solubility index of unmodified starch was 3.16 g/ml & that of modified starch was 4.05 g/ml. Swelling power of modified starch was 21.6 g/ml as compared to swelling power of 0.53 g/ml corresponding to unmodified starch. Proximate analysis of cookies with the addition of modified starch was also done that depicted a result with slight variations in each sample of oatmeal cookies.Sensory evaluation of oatmeal cookies was done on a 9 point hedonic scale which showed all cookies were generally acceptable with a slight variation.Modified starch was resistant to enzyme & acid hydrolysis & depicted a prebiotic potential in it through *Bifidobacterium* & *Pediococcus* bacteria strains.

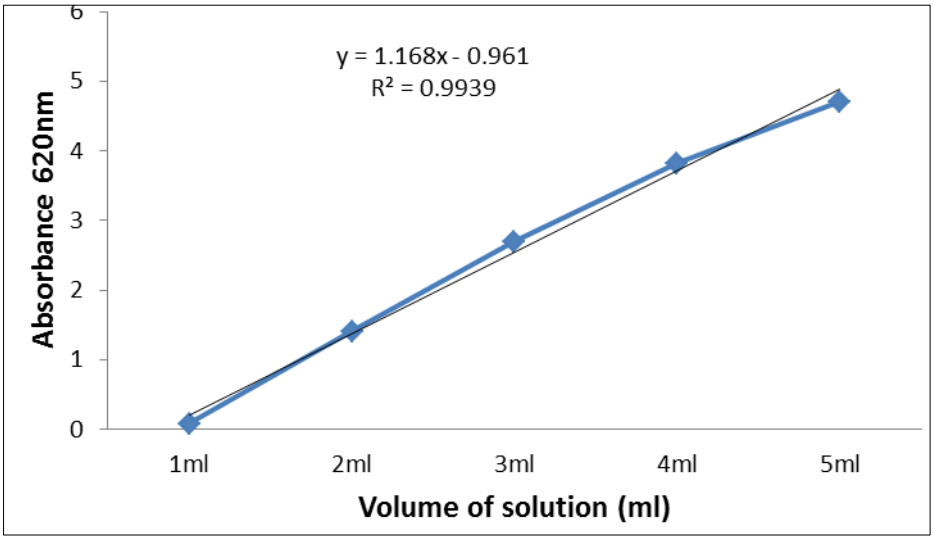

Fig 5: Standard curve unmodified starch concentration

Conclusion

In conclusion starch can be extracted from potato peel and can be modified to use in a biological application because modified starch isolated from potato peel has a prebiotic effect that induces a variety of benefits for human health. The findings of the study fully support the notion that modified starches extracted from potato peel contain in them prebiotic potential as the Pediococcus and Bifidobacteria colonies multiplied in tenfold within 24 hours of incubation.

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References

1. Abdel-Magied MM. Effect of dietary fiber of potato peel on the rheological and organoleptic characteristics of biscuits. Egypt J Food Sci. 1991;19:293-300.
2. Adzahan NM. Modification on wheat, sago and tapioca starches by irradiation and its effect on the physical properties of fish cracker (keropok) [Master's thesis]. Selangor: Universiti Putra Malaysia; 2002.
3. Akyol H, Riciputi Y, Capanoglu E, *et al*. Phenolic compounds in the potato and its byproducts: an overview. Int J Mol Sci. 2016;17:835-837.
4. Al-Weshahy A, Rao AV. Isolation and characterization of functional components from peel samples of six potato varieties growing in Ontario. Food Res Int. 2009;42:1062-1066.
5. Benkeblia N. Potato glycoalkaloids: Occurrence, biological activities and extraction for biovalorisation—a review. Int J Food Sci Technol. 2020;55:2305-2313.
6. Bezkorovainy A. Probiotics: determinants of survival and growth in the gut. Am J Clin Nutr. 2001;73(Suppl):399S.
7. Bird AR, Brown IL, Topping DL. Starches, resistant starches, the gut microflora and human health. Curr Issues Intest Microbiol. 2000;1(1):25-37.
8. Brunner G. Near critical and supercritical water. Part I. Hydrolytic and hydrothermal processes. J Supercrit Fluids. 2009;47(3):373-381.
9. Chemat F, Vian MA, Cravotto G. Green extraction of natural products: Concept and principles. Int J Mol Sci. 2012;13:8615-8627.
10. Chung SY, Han SH, Lee SW, Rhee C. Effect of Maillard reaction products prepared from glucose-glycine model systems on starch digestibility. Starch. 2012;64:657-664.
11. Cicco N, Lanorte MT, Paraggio M, Viggiano M, Lattanzio V. A reproducible, rapid and inexpensive Folin-Ciocalteu micro-method in determining phenolics of plant methanol extracts. Microchem J. 2009;91:107-110.
12. Cummings JH, Macfarlane GT. The control and consequences of bacterial fermentation in the human colon. J Appl Bacteriol. 1991;70:443-459.
13. Nase L, Hatakka K, Savilahti E, Saxelin M, Ponka A, Poussa T, *et al*. Effect of long-term consumption of a probiotic bacterium, Lactobacillus rhamnosus GG, in milk on dental caries and caries risk in children. Caries Res. 2001;35:412-420.

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