A project work report on

Comparative study of starch content extracted from different sources

Supervised by:

Dr. Sheikh Mahatabuddin

Associate professor

Department of Nutrition and Food Engineering

Daffodil International University

Co-Supervisor:

Professor Dr. Md. Bellal Hossain

Head of the Department of Nutrition and Food Engineering

Daffodil International University

Submitted By:

Hanif Mahmud

ID: 162-34-533

Department of Nutrition and Food Engineering

Daffodil International University

Submission Date: June 2019

Letter of Transmittal

Dr. Md. Bellal Hossain
Professor and Head
Department of Nutrition of Food Engineering
Faculty of Allied Health Sciences
Daffodil International University

Date:

Subject: Application for submission of project report

Dear Sir,

I am Hanif Mahmud, ID: 162-34-533 worked on the project entitled "Comparative study of starch content extracted from different sources". I am happy to inform you that, I completed the targeted work and write up a report on my project within the allocated time period, though it could be more attractive if I could manage enough time to prepare the report. I would like to take this opportunity to thank you for the guidance and support you have provided me during the course of this report. Without your help, this report would have been impossible to accomplish. In addition, Daffodil International University has a group of respective persons who helped me during the course of my undergraduate studies including this project work. I gathered the most relevant information through systematic literature review to write up this report and explain my experimental findings. I have concentrated my best effort to follow your directions to achieve the objectives of this project work. I strongly believe your exceptional supervision provide me the expertise I need to learn through this undergraduate project work. The practical knowledge and experience gathered during report preparation will immeasurably help me in near future to flourish my professional life. Notably, I would like to request you to excuse me for any unwanted mistakes that may occur in the report.

I will be happy to deliver any information required at any stages of the consecutive researches related to current project. Finally, my humble request to you to accept this report and oblige thereby.

Thank you again your support and Patience.

Sincerely yours,

Hanif Mahmud (ID: 162-34-533)
Daffodil International University

Letter of Authorization

Dr. Md. Bellal Hossain Date:
Professor and Head
Department of Nutrition of Food Engineering
Faculty of Allied Health Sciences
Daffodil International University

Subject: Declaration regarding the validity of the project report

Dear Sir,

This is my truthful declaration that the "Comparative study of starch content extracted from different sources". I have prepared is not a copy thesis report previously made any other students. The plagiarism test result was 26% by using Turnitin Originality Report. I also express my honestly confirmation in support to the fact that the said thesis report has neither been used before to fulfill my other course related not it will be submitted to any other person a authority in future.

Sincerely yours,

Hanif Mahmud
ID: 162-34-533
Department of nutrition and Food Engineering
Daffodil international University

Certification of Approval

I am pleased to certify that the report on the study on ‘’Comparative study of starch content in different sources’’. Conducted by Hanif Mahmud bearing (ID No: 162-34-533) of the department of Nutrition and food Engineering has been approved for presentation and Defense/viva-voice. I am happy to certify that, the data and finding presented in the report are the authentic work of Hanif Mahmud. I recommended the report presented by Hanif Mahmud consists new varieties of potatoes which is not a copy of any other projects submitted anywhere. I need to train up him from very basic level, which evokes me to request the Head of the NFE Department to arrange or allot a 3 credit course to their students to teach basic research methodologies that could help the students to generate more efficient and productive project reports. However, his keen interest and devotion to research mark him as one of the top scorers compared to average students in DIU. It was my pleasure working with him. I wish him all success in life.

……

Dr. Md. Bellal Hossain
Professor and Head
Department of Nutrition of Food Engineering
Faculty of Allied Health Sciences
Daffodil International University

Dr. Sheikh Mahatabuddin
Associate Professor
Faculty of Allied Health Sciences
Department of Nutrition and Food Engineering Daffodil International University

Acknowledgements

I would like to acknowledge the encouragement and assistance give to me by a number of people. At first, I would like to express my gratitude to my creator the almighty Allah for enabling me the strength and opportunity to complete the report in time successfully. I am grateful to each and every people who are involved with me in every phase of my life.

I am grateful to my parents without whom I cannot be here. Without the support of my parents, I could not be able to achieve my objectives and goals.

My Deep gratitude and sincere thanks to the honorable Dean, Faculty of Allied Health Science, **Professor Dr. Ahmed Ismail Mostafa** for his kind cooperation and accept this degree.

I am deeply indebted to my supervisor Dr. Sheikh Mahatabuddin Associate professor- Daffodil International University. For this whole hearted supervision during my project work and organizational attachment period.

I am grateful to Managing Director and other employees of Kalinga Institute of Social Science for their kind cooperation and direction wish to express immense gratitude & humbly convey my heart-felt respect to managing Director.

Most importantly, I am grateful to our honorable head of the department, **Professor Dr. Bellal Hossain**, for his cordial and definitive direction throughout my study period in Daffodil International University.

Finally, I would like to express my gratitude to all of the NFE Faculty members for their great help during my undergraduate studies in DIU. I also thankful to Ms. Syeeda Shiraj Um-Monira, Ms. Najia Kamrul and Md. Abir Hossain to help me during my project work and organizational attachment period.

THE PROJECT
WORK IS
DEDICATED TO
MY BELOVED PARENTS

Comparative study of starch content extracted from different sources

Table content

Abstract

The transformed tubers are consumed widely as a popular vegetable. Potatoes, cassava, butternut, sweet potatoes etc. could be the standard example of root vegetables. Containing high amount of starch have been designated as one of the common features of these vegetables. For example, Cassava, *(Manihotesculenta*) a nutty-flavored starchy roots vegetable, potatoes and sweet potatoes, (*Solanum brevicaule*). Former one was local to South America while latter two are local to the area of cutting edge southern Peru and outrageous northwestern Bolivia somewhere in the range of 8000 and 5000 BC. Wild potato species can be found all over the America from the US to southern Chile. In the territory of southern Peru and outrageous northwestern Boliva from an animal types in the Solanum brevicaule complex where potatoes were trained around 7,000–10,000 years before. In the ecoregion of South America the indigenous species of the potatoes have been developed. At present, there are more than 1,000 unique types of potatoes have been cultivated. Over 99% of presently cultivated potatoes worldwide descended from varieties that originated in the lowlands of south-central Chile, which have displaced formerly popular varieties from the Andes. The importance of the potato as a food source and culinary ingredient varies by region that plays an important role in our food habit and changing continually. It has been considered as an essential crop in Europe, especially eastern and central Europe, where per capita production is still the highest in the world. Though, the most rapid expansion in production over the past few decades has occurred in southern and eastern Asia, with China and India leading the world in overall production as of 2014. Above all, it becoming more popular vegetable in the sustenance propensity for south Asian nations, for example Bangladesh, India, Pakistan. Therefore, to explore their quality and amount of starch, starches from potatoes and cassava was extracted using hand crafted technique. The percent of yield of starch acquired from every one of the sources was analyzed. The quickly absorbable starch (RDS), gradually edible starch (SDS) and RS substance in the starch tests will be investigated and related with their physiochemical and other useful properties. The findings demonstrated that the starch from various sources differed essentially in their compound, physical and practical properties. The highest starch content was seen in cassava starch (13.94%) and least in potato starch (3.84). This high starch content might responsible for lowest shelf life of the Cassava Roots, by making it vulnerable to microorganisms. Further biological and analytical research on this topic could open the prospect to utilize these starches for myriad applicable directions.

Chapter one

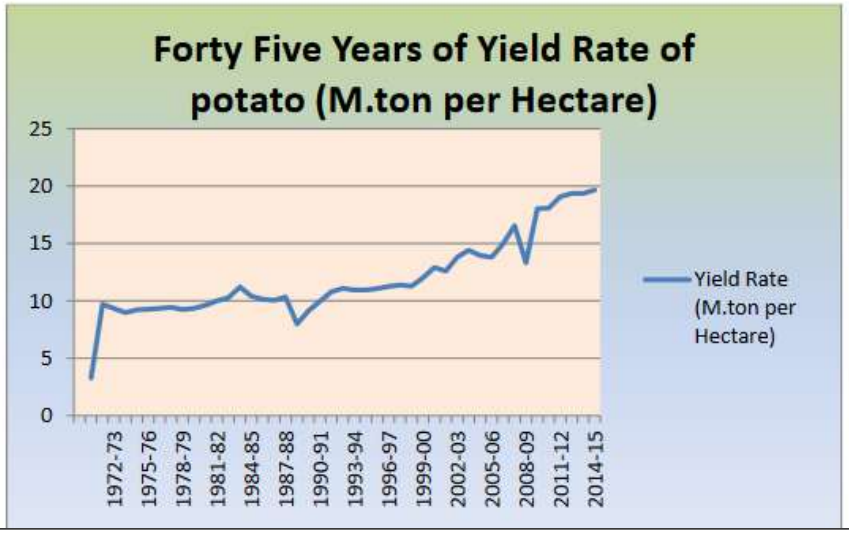
Introduction

Introduction

Bangladesh, a nation, has noteworthy recognition for its agricultural lands and products. Here farmers produce a lot of vegetables and grains for example, beans (kidney, naval force, pinto, dark, cannellini), Butternut, Squash, Chickpeas, corn, Lentils, parsnips, peas potatoes, sweet potatoes yam rice wheat maize rice, wheat, maize and so on. These food grains provides majority nutrients in our diet including starch, vitamins and minerals. Among these potato has wide range of use in our daily food habits as different forms of food items starting from mesh to French fries. In spite of table top use starches also used in myriad purposes in different industries for example in pharmaceutical industries starches used as excipient, a disintegrant, a glidant, or as binding agents. Hence Bangladesh importing tons of starch especially potato starches. Therefore extraction of high quality starches has the prospect to cover the internal demands. To do so, we need to introduce new varieties of vegetables with higher starch content like cassava or potatoes. This could offer the prospect to utilize these high quality starches in pharmaceutical companies or any other sophisticated industrial purposes.[4]

About 5,000 Potato varieties have been cultivated worldwide. Bangladesh is also a potential potato producing countries and cultivate approximately 6 varieties of potatoes and sweet potatoes???? . Farmers from all the districts has the contribution in this process and total gross product of potatoes have been reported as 19.647 M ton per hectare in 2015-16 fiscal year [20]. Another starch rich vegetable is cassava and cultivated in Madhupur region of Bangladesh. To date, more than 80 countries throughout the globe consumed cassava as source of starch by more than 800 million people because of its resistance to drought and though it is vulnerable to microbial attack due to its high content of starches. Its high content of starch also offer it to use in various purposes other than other cereals. People directly consumed cassava along with prepare different food items using homemade boiling methods to remove cyano compounds. Because of its high level of cyanide contents it is essential to peel cassava and never eat

Line Graph of Potato average yield reat from fiscal year 1970-01 to 2014-15



http://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/16d38ef2_2163_4252_a28b_e65f60dab8a9/45%20years%20Major%20Crops.pdf

it raw. Hence we can conclude that, Bangladesh has all these sources in a sufficient amount for the extraction of commercial grade starch which may successively reduce the requirements of the imported starches and save the foreign currency. [20]

Dishes can be readied utilizing cassava include:

Name of the dishes	Use the part of cassava
Bread, which can contain cassava flour just, both cassava wheat flour.	Cassava flour
French fries	Cutting cassava pieces
Mashed cassava	Cassava pest
Cassava chips	Cutting cassava pieces
Cassava bread absorbed coconut milk	Cassava flour
Cassava in cake	Cassava flour
Cassava in coconut sauce	Cassava juice
Yucca con major, a Cuban dish that joins cassava with a sauces and involving citrus juices, garlic, onion, cilantro, cumin, and oregano	Raw cassava juice

Cassava has been used to prepare following dishes:

- making custard which is a typical treats sustenance
- making starch and flour item. Which individuals can use to make gluten free-bread?
- Feeding creatures
- making meds. Textures, paper, and building materials, for example, compressed wood.

Scientists may eventually be able to replace high-fructose corn syrup with a cassava starch. Analysts are additionally trusting that cassava could be wellsprings of liquor that makes used to make polystyrene, PVC and other mechanical items. Importantly, the inactivity of Cassava starches towards molds could open the prospect to plan high yielding juices for microscopic organisms or yeasts.

Cassava is a high rich calorie vegetable that contains a lot of starch and key nutrients and minerals. Cassava is great source of vitamin C, thiamine, riboflavin, and niacin. The leaves, which are likewise palatable if an individual cooks them or dries them in the sun, can contain up to 25 percent protein. Be that as it may, the cassava root does not convey a similar dietary benefit as other tuber vegetables. Custard starch is picking up consideration as a wellspring of gluten free flour to make and other prepared items that are reasonable individuals with narrow mindedness to gluten. Cassava is wellsprings of safe starch, which researchers recommend can supports individual gut wellbeing by helping sustain advantageous gut microorganisms. Safe starches remain moderately unaltered as they go through the stomach related tract.[3] Cassava contains just little measure of proteins and fats. Subsequently, individuals who use cassava as an essential dietary staple may need to eat additional protein or take protein enhancements to abstain from getting to be malnourished. Since cassava leaves are a wellspring of protein, individuals in certain pieces of the world underscore consolidating the roots and leaves of the plant to address this worry. Some wellbeing nourishment stores and grocery store in U.S stock cassava and individuals can likewise discover wide assortment of cassava items on the web.

The dietary profile of 1cup of crude cassava is as per the following:

Nutrients	**Amount of nutrient in 1 cup of crude cassava**
Calories	330gm
Protein	2.8g
Carbohydrate	78.4g
Fiber	3.7g
Calcium	33.0mg
Magnesium	43.0mg
Potassium	558.0mg
Vitamin	42.4g
Thiamine, riboflavin, and niacin	-

The potato is a dull tuberous yield from the enduring nightshade Solanum tuberosum. In numerous specific circumstances, potato alludes to the consumable tuber, yet it can likewise allude to the plant itself. Normal or slang terms incorporate potato, tattie and spud. Potatoes were acquainted with Europe in the second 50% of the sixteenth century by the Spanish. Today they are a staple sustenance in numerous pieces of the world and a fundamental piece of a great part of the world's nourishment supply. Starting at 2014, potatoes were the world's fourth-biggest nourishment crop after maize (corn). It has since spread far and wide and become a main crop in numerous nations. Both of these vegetables are utilized as a noteworthy wellspring of calories and taxis for individuals, from any pay gathering, in creating nations. Cassavas have little filaments, nutrients and minerals. Most regularly, it has a lot of high safe starch that administers its key job in forestalling certain metabolic conditions and guaranteeing a solid gut. [9]

Potato plants are herbaceous perennials that develop about 60 cm (24 in) high, contingents upon assortment, with the leaves biting the dust back in the wake of blossoming, fruiting and tuber arrangement. They have white, pink, red, blue, or purple blossoms with yellow stamens. Potatoes are for the most part cross-pollinated by creepy insects, for example, honey bee, which convey dust from other potato plants. Tuber structure in light of diminished day length, despite the fact that this propend city has been limited in business assortments. In the wake of blossoming, potato plants produce little green natural products that take after green cherry tomatoes, each containing around 300 seeds. Like all pieces of the plant aside from the tubers the tubers, the organic product contain the lethal alkaloid solanine and are thusly inadmissible for utilization. All potato assortments are developed from seeds, likewise called 'genuine potato seed", "TPS "or" herbal seed" to recognize it from seed tubers. New assortments developed from seed can be spread vegetative by planting tubers, bits of tubers slice to incorporate at any rate a couple of eyes, or cutting, a training utilized in nurseries for the creation of solid seed tubers. Plants proliferated from tubers are clones of the parent, while those engendered from seed produce a scope of various assortments. [10]

A crude potato is 79% water, 17% sugars (of which 88% is starch), and contains insignificant fat (see table). In a sum estimating 100 grams (3.5 Oz), crude potato gives 322 kilojoules (77 kilocalories) of vitality and is a rich wellspring of nutrient B6 and nutrient C (23% and 24% of the everyday esteem, individually), with no different nutrients or minerals in huge sum .the potato is infrequently eaten crude strikingly, while there is minimal critical change in the measure of other [3]Ongoing examination demonstrated that potato has enemies of diabetics properties which can

balance out glucose level and brought down the insulin obstruction. At the point when cell don't demonstrate any reaction to the insulin hormone is known as insulin opposition. Potato processes gradually as a result of its low glycemic file. In light of glycemic record buyer feels fulfilled yearning

Potato is a decent wellspring of nutrient b6 is important to change over homocysteine. Abnormal state of homocysteine is related with heart assault and stroke. So potato can battle against cardiovascular ailment. Potato is incredible wellspring of protein. Protein vitality ailing health (PEM) is a significant issue in creating nations youngsters. So potato can be a defender against protein vitality ailing health Potato is a decent wellspring of nutrient C, protein, fat, sugar and minerals and carotenoids. It can diminish nutrient an inadequacy among human. Potato can secure against interminable illness on the grounds that past research about potato demonstrated that it has high cancer prevention agents' properties. Juice extricated from potato had an ameliorative impact carbon tetrachloride prompted liver damage in rodents. β-Carotene and anthocyanin are relies upon tissue shading. From past obviously potato has both large scale supplements and micronutrient. Macronutrient is essential in an enormous sum for our body .however micronutrient is important in a little sum [4].

Potatoes have been cultivated in all districts of Bangladesh. One of the significant sectors is use of local and altered starch is in the pharmaceutical business. A portion of the agro-based businesses of our nations are producing starch however this cannot cover the huge domestic demand of starch. Therefore, the introduction of new varieties with various nutrients or ingredients become the demand of the society. In that retrospect Professor Dr. M A Rahim introduce 28 new potato and colored potatoes from the indigenous varieties from Andes Mountain, Peru.[20] He kindly provide the sample of these new varieties to the Department of Nutrition and Food Engineering of the Daffodil International University for analysis of physico chemical properties of these newly introduced varieties in Bangladesh. I have extracted the starches from 14 out of these 28 samples and Cassava. The Cassava was collected from Madhupur, Tangail, Banglladeh. The extracted starches were odorless and white in color. Further characterization of these starches will be carried out soon afterwards. This report describe the processes and quantities of extracted starches in a comparative manner.

Starch

Starch is a sort of complex sugar that experiences a few distinct strides amid absorption. In the end starch is separated into glucose, which is the primary wellspring of fuel for all phones. Since sugars, similar to starch, assume such a major job in giving energy, the majority of your caloric admission should originate from this macronutrient. Starch is a sort of complex sugar that experiences a few distinct strides amid assimilation. Inevitably starch is separated into glucose, which is the fundamental source of fuel for all phones. Since sugars, similar to starch, assume such a major job in giving vitality, the greater part of your caloric admission should originate from this macronutrient [1].

Function of Starch

The principal use of starch in the dishes as a source of glucose. Starch starts separating in your mouth, where salivation encompasses complex starch particles. As you bite, salivation separates starch into more straightforward sugars called maltose. When maltose hits your small digestive tract, it is deconstructed further into a significantly easier structure, which is glucose. Starting here, glucose assimilates legitimately into your circulation system through intestinal dividers, offering vitality to cells, including synapse [14].

Storing Starch

Your body uses the starch sugars it needs immediately and afterward stores the rest as glycogen in your liver and muscles. Glycogen can be pulled for vitality for later use when your framework needs it. For instance, your body may consume glycogen amid an exercise on the off chance that you don't eat before a supper. Straightforward crabs, which incorporate different kinds of sugar, are likewise changed over into glucose, despite the fact that they digest in one basic advance in your small digestive tract [14].

Role of starchy Foods

There are a few kinds of high-starch nourishments you can add to your eating regimen. Boring vegetables, for example, potatoes, corn, peas and squash, have a lot higher starch content than non-dull vegetables, similar to lettuce and tomatoes. Entire wheat bread, quinoa, dark colored rice and pasta are different kinds of nourishments with high starch content. These common diets give roughly 15 grams of absolute sugar per serving, as per the American Dietetic Affiliation. A large portion of the starches in this sustenance's originated from starch, in spite of the fact that they may likewise contain some sort of sugar [12].

Recommended starch Intake

Around 45 to 65 percent of your complete calories need to originate from starches, report the Communities for Infection Control and Aversion. You ought to incorporate a blend of both basic and complex sorts of starches, which each give 4 calories for every gram. In the event that you for the most part devour 1,500 calories for every day, you need 168 to 243 complete grams of sugars every day. Following a normal 2,000-calorie diet requires 225 to 325 day by day grams of starches.
So as to get enough starch in your eating routine to change over into glucose, around 33% of your nourishment admission should originate from boring crabs. Your particular necessities may shift in the event that you have certain wellbeing conditions, for example, diabetes, so meet with an enrolled dietitian to decide your accurate needs [13].

Sources of starch

Starch is the significant sugar saves in plant tubers and seed endosperm where it is found as granules, each commonly containing a few million amylopectin atoms joined by an a lot bigger number of littler amylose particles. By a long shot the biggest wellspring of starch is corn (maize) with other normally utilized sources being wheat, potatoes, Cassava, custard and rice. Amylopectin (without amylose) can be separated from 'waxy' maize starch though amylose (without amylopectin) is best confined after explicitly hydrolyzing the amylopectin with pullulanase. Hereditary change of starch harvests has as of late prompted the advancement of starches with improved and focused on usefulness [17].

Characteristics of starch

Starch is a white, unscented, boring, and sugar powder. It assumes an indispensable job in the natural chemistry of the two plants and creatures and has significant business employments. In green plants starch is created by photosynthesis; it is one of the main structures in which plants store nourishment. It is put away most richly in tubers (e.g., the white potato), roots (e.g., Cassava potatoes &sweet potato), seeds, and organic products; it shows up as grains that vary in size, shape, and markings in different plants. The plant source can generally be recognized by tiny examination of the starch grains. Starch gotten by creatures from plants is put away in the creature body as glycogen. Stomach related procedures in the two plants and creatures convert starch to glucose, a wellspring of vitality. Starch is one of the significant supplements in the human eating routine. Its quality in sustenance's and different substances can be recognized by the blue-dark shading delivered when iodine arrangement is added to an example of the material to be tried. By treatment with high temp

water, starch granules have been appeared to comprise of at any rate two parts, known as amylopectin and amylose. Amylopectin is an expanded glucose polymer; amylose is a direct glucose polymer. Industrially starch is arranged mostly from corn and potatoes. Starch is generally utilized for estimating paper and materials, for hardening washed textures, in the assembling of nourishment items, and in making dextrin. Notwithstanding its different uses, cornstarch is a wellspring of corn syrup, of which enormous amounts are utilized in making table syrup, jelly, frozen yogurt, and different sugary treats. Corn sugar (glucose) is additionally gotten from cornstarch [16].

Significance of starch

Starch is significant on the grounds that we eat it! Starch is found in potatoes, cassava and in grains, for example, corn and wheat. Starch is comprised of glucose rehash units. In your body, unique proteins called catalysts (which are additionally polymers, incidentally) separate starch into glucose, so your body can consume it for vitality. In case you're eating a solid eating routine, you get a large portion of your vitality from starch along these lines. Since it is made of sugar particles it is known as a polysaccharide. It is fundamentally the same as cellulose. Starch has a couple of different uses other than nourishment. It's utilized in squeezing garments to shield them from wrinkling. It's likewise used to make a froth pressing. Starch is biodegradable, so starch froth pressing is an earth agreeable option in contrast to Styrofoam pressing [16].

Utilization of starch

Starch is adaptable and shoddy, and has numerous utilizations as thickener, water folio, emulsion stabilizer and gelling specialist. Starch is regularly utilized as an intrinsic normal fixing however it is additionally included for its usefulness. It is normally found firmly and fundamentally pressed into dried out granules (around one water for each glucose) with starting point explicit shape and size (maize, 2-30 µm; wheat, 1-45 µm; potato, 5-100 µm). The size conveyance decides its swelling usefulness with granules being commonly either bigger or lenticular (focal point like, A-starch) or littler and round (B-starch) with less swelling force. Granules contain 'obstruct how about we of amylopectin containing both crystalline (~30%) and formless zones. As they ingest water, they swell, lose crystalline and drain amylose.[1] The higher the amylose content, the lower is the swelling power and the littler is the gel quality for a similar starch focus. Partially, be that as it may, a littler swelling power because of high amylose substance can be neutralized by a bigger granule estimate. In spite of the fact that the properties of starch are normally conflicting, being reliant on the caprices of horticulture, there are a few providers of reliably uniform starches as useful fixings [16].

Studies showed that the significance of the all-out starch substance and its applications in our everyday life to research facility tests. Consequently, we removed starches from 13 assortments of potatoes and sweet potatoes, and one assortment of Cassava. We detailed their relative qualities in this venture report to open the possibilities of utilizing these new wellsprings of starches notwithstanding the local sources.

Chapter Two

Materials and methods

Materials and methods:

Collection of samples: potatoes was (solanum tubersum) collected from Bangladesh agricultural research institute. The root of the cassava (Manihotesculenta) plant was collected from Modhupur, Tangail, Bangladesh.

Starch extraction:

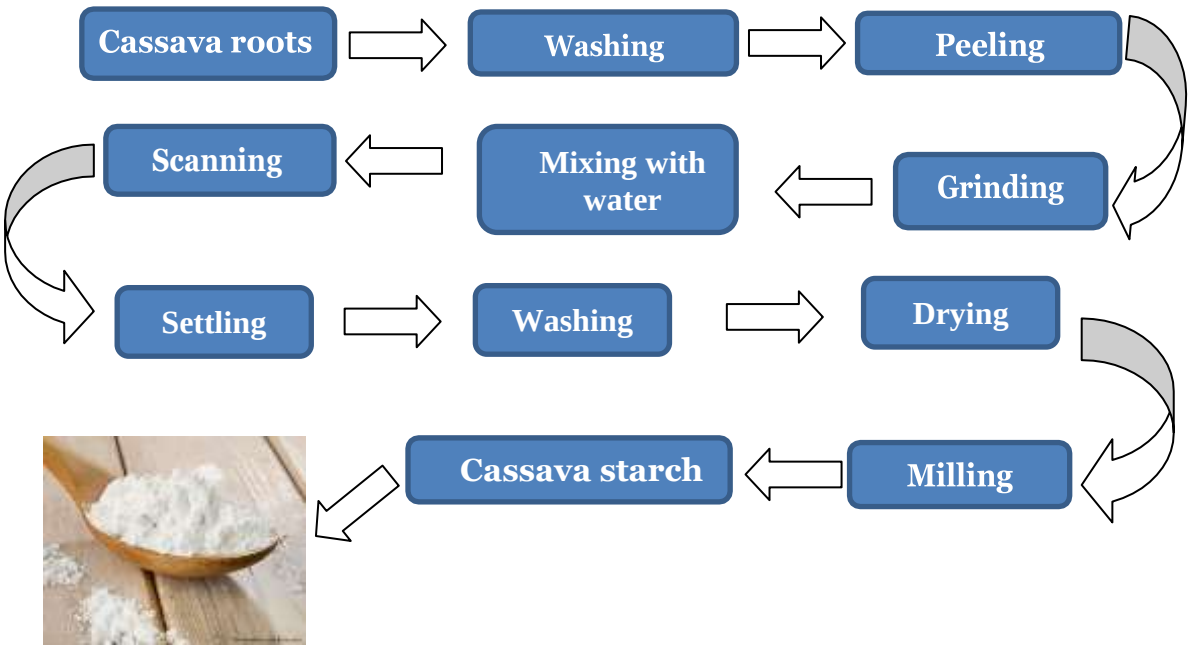
Starch was extracted utilizing the wet process introduced by Benesi *et. al.* (2004). New tubers were washed, washed, stripped, cut into roughly 1 cm slices and meshed in a blender (Model Ruler, Osaka, Japan) for 5 min. The mash was suspended in multiple times its volume of water, mixed for 5 minutes and transferred to a siever to sieve that made of two fold cotton. The filtrate was allowed permitted to represent 2 h for the starch to settle and the top fluid was emptied and disposed of (Stream outline 1). Water was added to the residue and the blend was mixed again for 5 minutes. Filtration was reused as in the former and the starch from the filtrate was permitted to settle. After removing all the top fluid the resulting sediment were oven dried at 70 degree C for 18 hours. The starch of strip was additionally removed by a similar strategy following is stream chart of starch extraction [12].

The entire procedure of how to concentrate starch from cassava and potatoes incorporates potatoes washing and cleaning, potato cutting and granulating make the bug starch slurry screening then sedimentation, starch dewatering, dry, processing, and bundling.

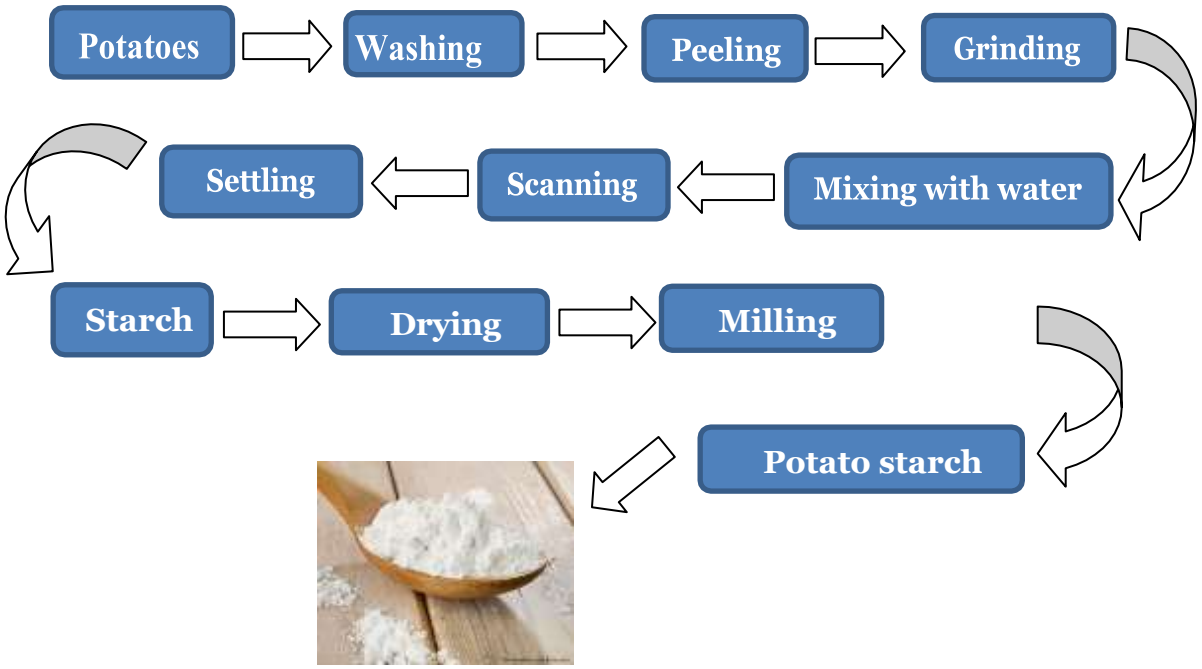
Source: https://www.thehealthyhomeeconomist.com/best-resistant-starch-for-gut-health/

Figure 1: Examples of Cassava and potatoes starch

Flow chart 1: Flow chart for cassava starch extraction



Flow chart 2: Flow chart for potato starch extraction



V7 **V2** **V3** **V8**

Figure 2: Different colored potatoes after chopping

Potatoes Cassava

Figure 3: Extracted starches after drying

Limitation of the study

Vital limitation was the insufficient time which bound us to conclude the research within a very short period of time. The time frame was not sufficient to conduct some other related experiments for example moisture tests or test for amylose or amylopectin content. Insufficient instruments and scarcity of other necessary chemicals for the present research could be addressed as second limitation.

Chapter three

Result discussion

Results and discussion

The content of the dry matters in the tubers have been regulated by various factors including the cultivation methodology and harvest date [19]. In this study we ignored those effects to determine the amount of starch content in tubers irrespective of their cultivation technology or harvesting time. The resulting starch after drying were weighted and the content of starches were determined as percent starch present in per 100 gm flesh of potato or the cassava (Table: 1). Some of the verities of potatoes were colored because of the preexisting anthocyanins, polyphenolic compounds and other colored antioxidants, while we were able to remove those coloring agents completely to isolate white starch through repetitive filtration and sedimentation. Note: we were able to remove all the fragrant molecules from the extracted starches except for a very minor smell or Cassava from Cassava starches.

Table 1 Starches extraction from Cassava and potatoes.

Serial no	Sample	Amount used for Extraction (gm.)	Starch extracted(gm.)	Percentage Of starch content (%)
01	Cassava	1800	251.85	±13.94
02	V1	1130	84.65	±7.49
03	V2	130	4.99	±3.84
04	V3	75gm	5.76	±7.68
05	V4	150	8.12	±5.41
06	V5	300	15.27	±5.09
07	V6	75	4.00	±5.33
08	V7	295	15.29	±5.18
09	V8	400	29.88	±7.47
10	V9	350	25.35	±7.24
11	V10	200	15.39	±7.69
12	V1T15	200	10.00	±5.00
13	10123	60	3.00	±5.00
14	10190	130	8.00	±6.15

These colorless starches (fig. 4a and b) could be used in myriad directions by addition of customize coloring and flavoring agents. This independence of utilization of starches makes it an important ingredient from our dining table to pharmaceutical industries.

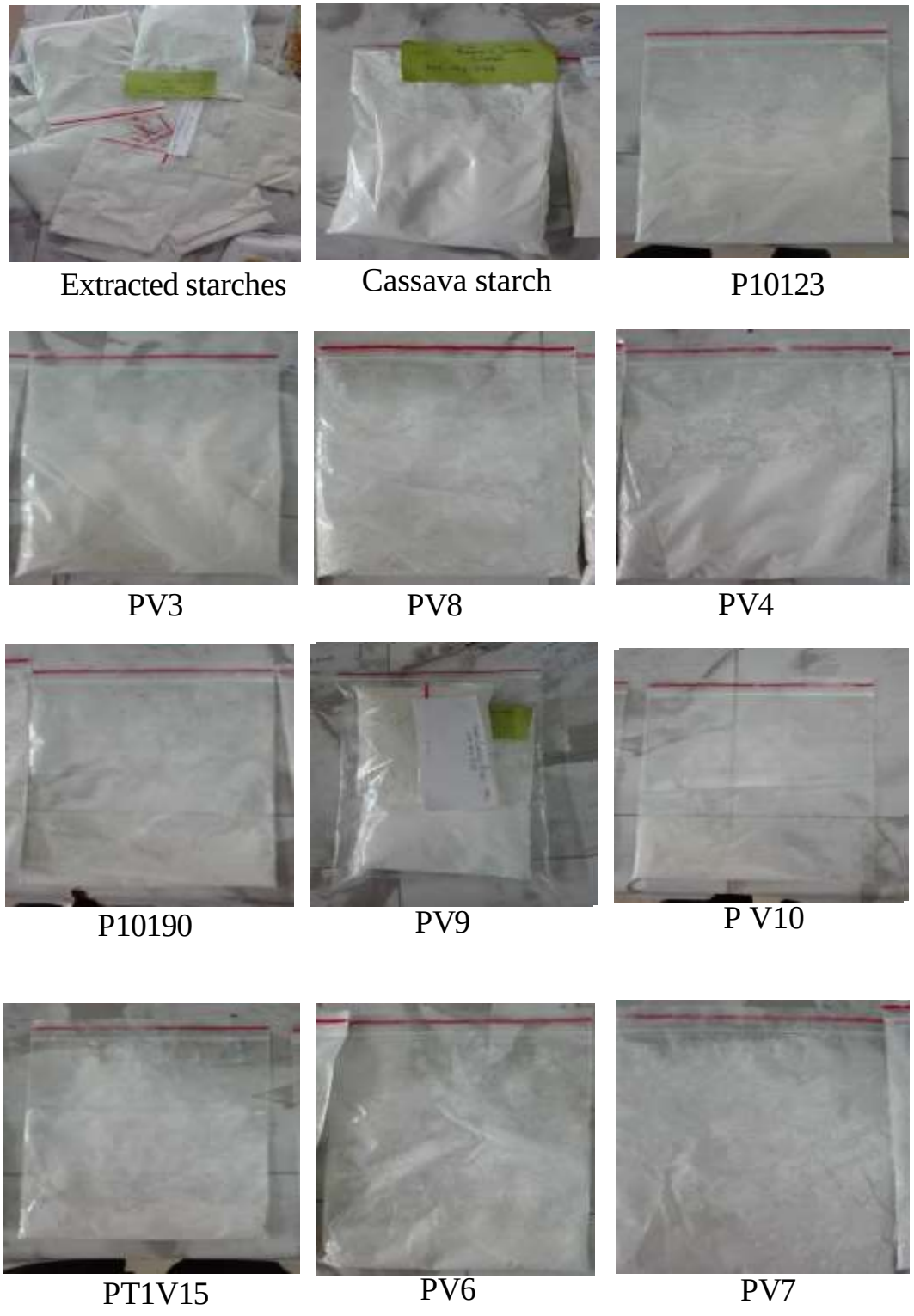


Figure 4 (a): Extracted starches from respective samples after oven drying. P stands for potatoes.

P V1

P V2

P V5

Cassava fiber

Figure 4 (b): Extracted starches from respective samples after oven drying P stands for potatoes.

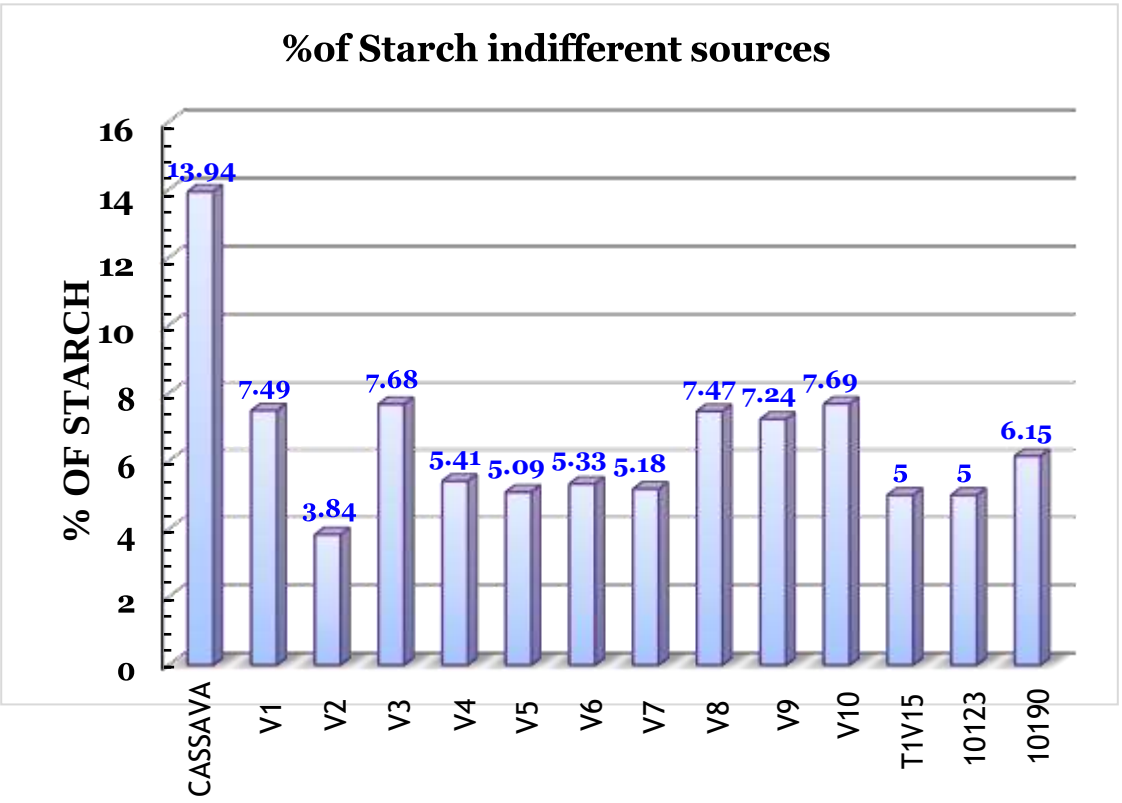


Figure 5: Graphical representation of percentage of starch content in different sources.

The percent yields of the extracted starches have been shown in the Table 1and Figure 5. The highest starch containing vegetable was Cassava and it gave 13.94% of Starch though the starch content in cassava has been reported 12-30 % in literature [19]. On the other hand the content of starches in potatoes has been reported as 20-30% [19]. While in present study the highest starch was around 8% and found in V1, V3, V8, V9 and V10. The rest were below or near to 6%. Note: the characterization of starches, content of amylose and amylopectin, could not be performed because of time constrain. The results are comparable to the standard values. The extracted starches were not significantly different in color, flavor, aroma and solubility. The fragrances were natural. Most importantly the method used in current study was able to remove all the pigments even from new varieties of colored flesh potatoes.

Finally, starches have various benefits for metabolic health. It can improve insulin sensitivity-the responsiveness of our body's resistant starch is also very effective at lowering blood sugar levels after meals. Secondly, if one intake processed starch with breakfast, it also lower his/her blood sugar spike at lunch. In addition, the effects on glucose and insulin metabolism have very impressive effects [15]. Recent research studies showed that a 33-50% improvement in insulin sensitivity after four weeks of consuming 15-30 grams per day [15], while the importance of insulin sensitivity cannot be stressed enough. Having low insulin sensitivity, insulin resistant, has been believed to be a major risk factor for several severe diseases, including metabolic syndrome, type II diabetes, obesity, heart disease and Alzheimer's [14]. Therefore, by improving insulin sensitivity and lowering blood sugar, resistant starch may help one to avoid chronic disease and improve his/her quality of life. However, not all studies agree that resistant starch has these beneficial effects [16]. It depends on the individual, the dose and the type of resistant starch. The raw materials used in current studies have excellent amount of high resistance starches. Moreover, they will be a good source of vitamin, minerals, antioxidants, phenolic compounds and so on. Most importantly, these vegetables are very cheap hence widely consumed by the peoples irrespective of their buying capacities.

.

Conclusion

The results obtained from current studies open the prospect of further investigation of the types of starches present in 15 vegetables, their applicability in biological laboratories, pharmaceutical industries and food industries and other related sectors. Whereas, the time constraints could not allow us to perform all the experiments related to complete characterization of extracted starches and their applicability. Therefore, author would like to request the DIU authorities to extend this research period in near future which could offer us the opportunity to complete a set of experiments to prepare more effective project reports.

Chapter four

References

References:

1. Wang, L. and Y.-J. Wang, 2004. Application of high intensity ultrasound andsurfactants in rice starch isolation. Cereal Chem., 81(1), 140-144.

2. Ji, Y., K. Seetharaman and P. J. White, 2004. Optimizing small scale corn starch extraction method for use in the laboratory.Cereal Chem., 81(1), 55–58.

3. British Pharmacopoeia, 2005, British Pharmacopoeia Commission, 1, 3.

4. Sørensen, M.; Grüneberg, W.J. and Ørting, B. (1997) AhipaPachyrhizusAhipa(Wedd.) Parodi. In: Hermann, M. and Heller, J., Eds., Andean Roots and Tubers: Ahipa, Arracacha, Macaand Yacon. Promoting the Conservation and Use of Underutilized and Neglected Crops 21, Institute of Plant Genetics and Crop Plant Research, Gatersleben/Internationa l Plant Genetic Resources Institute, Rome, 13-73.

5. Bergthaller, W.; Kjersting, H.J.; Velasco, L. and Grüneberg, W.J. (2001) Andean Yam Bean (Pachyrhizusahipa) Tubers as a New Source of a Legume Starch. Proceedings of the 4th European Conference on Grain Legumes, Cracow, 8-12 July 2001, European Association for Grain Legume Research (AEP), Paris,392-393

6. Physico-chemical properties of potatostarches. Food Chemistry, Saint Paul, v. 125, n. 3, p. 958-965, 20 físico-químicados rizomase do amidodo líTropical, ed. Arlington: AOAC International. 1990. 140p.

7. ALVANI, K.; QI, X.; TESTER, R. F.; SNAPE, C. E. Physico-chemicalproperties of potato starches. Food Chemistry, Saint Paul, v. 125, n. 3, p. 958-965, 2011.

8. ASCHERI, D. P. R.; MOURA, W. S.; ASCHERI, J. L. R.; CARVALHO, C. W. P. Caracterizaçãofísicae físico-químicados rizomase do amidodo lírio-dobrejo(Hedychiumcoronarium). PesquisaAgropecuária Tropical, Goiânia, v. 4, n. 2, p. 159-166, 2010.

9. ASSOCIATION OF OFFICIAL ANALYTICAL CHEMISTS – AOAC. Official methods of analysis. 15. ed. Arlington: AOAC International. 1990.140

10. P. BAHNASSEY, Y. A.; BREENE, W. M. Rapid ViscoAnalyzer(RVA) pasting properties of wheat, corn, waxy corn, tapioca and amaranth starches (A. hypochondriac us and A. cruentus) in the presence of konjacflour, gellan, guar, xanthenes and locust bean gums. Starch /Stärke, Weinheim, v. 4, n. 4, p. 134-141, 1994.

11. KARIM, A. A.; TOON, L. C.; LEE, V. P.; ONG, W. Y.; FAZILAH, A.; NODA,T. Effects of phosphorus contents on the gelatinization and retrogradationof potato starch. Journal of Food Science, Chicago, v. 72, n. 2, p. C132-8, 2007

13. Centers for Disease Control and Prevention: Carbohydrates(https://www.cdc.gov/diabetes/diabetesatwork/about/kits/healthy-eating.html)

14. National Digestive Diseases Information Clearinghouse: Your Digestive System andHow It Works(https://www.niddk.nih.gov/health-information/digestive-diseases)

15. Choose Your Foods: Exchange Lists for Diabetes; American Dietetic Association (https://diabetesed.net/page/_files/THE-DIABETIC-EXCHANGE-LIST.pdf)

16. NHS Choices: Starchy Foods (https://www.nhs.uk/live-well/eat-well/starchy- foods-and-carbohydrates/)

17. Alfa Laval Starch production brochure (https://www.alfalaval.com/industries/food - dairy-beverage/agriculture-processing/starch-and-sweetener-production/)

18. International Starch Institute Aarhus Denmark Potato starch effluents(http://www.starch.dk/isi/energy/bio.asp)

19. Barbara S. and PoitrP. Dry matter and carbohydrates content in the tubers of very early potato varieties cultivated under coverage, ActaSci. Pol. HortorumCutus4 (2) 2005, 111- 122.

20. http://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/16d38ef2_2163 _4252_a28b_e65f60dab8a9/45%20years%20Major%20Crops.pdf