Original Article

Isolation And Charaterization Of Starch From Pearl Millet Flour And Used It In Formulation Of Paracetamol Tablet

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Abstract

Objectives: This study aims to evaluate a novel tablet excipient obtained from local sources, Pearl millet Pannistumamericanum starch of family Poaceae which is used locally as food because of its high carbohydrate content. It was thought that the starch of Pearl millet Pannistumamericanum may serve as a tablet disintegrant.
Methods: The excipient properties of Pearl millet starch as well as the pregelatinized form were studied in paracetamol tablets produced by wet and dry granulation methods of massing and screening and compared with maize starch BP.
Results: Wet method showed superiority in all properties of both granules and tablets. Using wet method granulations Pearl millet Pannistumamericanum starch and maize starch BP have similar angle of repose, Carr's index, tapped density, bulk density, and Hausner's ratio, however, Pearl millet Pannistumamericanum starch has shown advantageous in some properties such as moisture content and swelling index. Tablet produced with Pearl millet Pannistumamericanum starch disintegrated almost the same of those produced with maize starch BP at all concentrations employed. It was also found that when used as a disintegrant, the pre-gelatinized form provide tablets with better hardness and friability values than maize starch BP.
Conclusion: This study confirmed the suitability of Pearl millet Pannistumamericanum starch as an alternative to maize starch BP as a tablet disintegrant, particularly, in paracetamol tablet formulation.

Keywords: Disintegrant; Pearl millet, Pannistumamericanum; Paracetamol tablet; Starch, Friability, Maize, Angle of repose.

INTRODUCTION

Excipients are defined as "Any substance other than active drug or pro-drug that is included in the manufacturing process or is contained in finished pharmaceutical dosage forms" by the international pharmaceutical excipient council. Excipients are divided into a number of categories by the US Pharmacopoeia-National Formulary (USPNF) based on the tasks they carry out in formulations, such as binders and disintegrants [1]. The selection of the proper excipients might be quite beneficial for the efficient production of powerful tablets. Pharmaceutical formulators are exploring ways to use functional excipients to improve the manufacturing process and the quality of the finished product. But choosing the right excipients is a balancing act that calls for a consideration of both expected product performance and time and cost savings.

In the pharmaceutical business, excipients are the inactive ingredients required to make a medicine. In addition to many others, they can be categorized as colors, flavors, binders, emollients, fillers, lubricants, and preservatives. Common fillers include the excipients lactose, dibasic calcium phosphate dehydrate, and maize starch [1-2].Starch is one of the most widely distributed naturally occurring carbohydrates in plants. It was a source of energy and was found in a variety of plant organs, such as seeds, fruits, tubers, and roots. Although starch is extensively used, affordable, biodegradable, pollution-free, and renewable, it has a number of disadvantages that restrict its commercial application, including being insoluble in cold water, readily dehydrating, having low emulsifying power, and being unstable in acid [3]. A study of the literature demonstrates the value of starches from various plant sources as pharmacological excipients. Starches are particularly advantageous since they are readily available, inexpensive, and used in the production of tablets as fillers, binders, disintegrants, and glidants[4].

According to their chemical composition, starches are polysaccharides made up of a variety of monosaccharides or sugar (glucose) molecules connected by -d-(1-4) and/or -d-(1-6) linkages. The two main structural elements of starch are amylopectin, a larger branched molecule with -d-(1-4) and -d-(1-6) linkages, and amylose, which is essentially a linear polymer in which glucose residues are -d-(1-4) linked and typically accounts for 15%–20% of starch.Amylose is a straight or slightly branched compound with a molecular mass of 105-106 g/mol and a degree of polymerization of up to 6000. Chains may easily be used to create single or double helices. Amylopectin, on the other hand, has a molecular mass of 107–109 g/mol.It is one of the largest molecules in nature and has a degree of polymerization of 2 million on

average. Amylopectin normally has a chain length between branch sites of 20–25 glucose units. A starch granule is considered to have 30% crystalline matter and 70% amorphous matter by mass. The amorphous regions include the bulk of the amylose and a sizable amount of the amylopectin. The vast bulk of the crystalline area is amylopectin [5-6].

Starch is a substance that occurs often in nature and is derived from grains or root vegetables. Despite being mostly used as food, it is easily converted through chemical, physical, and biological processes into a range of useful goods. Starch is used to make a wide range of products, including paper, textiles, adhesives, beverages, desserts, pharmaceuticals, and building supplies. Starch is the primary kind of carbohydrate found in plants. It is a vital raw material for industry and a substantial source of nourishment for both humans and animals. Commercial starches are made from a variety of botanical sources. Despite having distinct functional features, most starches used by different industries are changed before use, leading to a large range of usable products [7].

The functional properties of starch lead to its utilization. A key functional component of pasting is the development of high viscosity during heating of the starch-water solution. This quality is utilized in many foods as well as non-food products like adhesives. Another essential practical trait is the ability to create gels. One use for these traits in the food and non-food sectors is thermoplastics. Starch is the primary nutrient for human populations. Increased frequent consumption of polymeric plant carbohydrates, such as starch, in the diet is encouraged by recent guidelines for healthy eating habits [8].

The odorless, white, amorphous powder that makes up pure starch is insoluble in water and other typical organic solvents. In its natural condition, it has a somewhat bland flavor. It is one of the most widely distributed chemical compounds in nature because it serves as the energy-storing form of plant components.
The starch's origin dictates the size and shape of the colorless, highly reflective particles that make up starch under a microscope, making it the most important of these components. The crystalline component of a starch granule is made up of ring-shaped crystal-line lamellae that alternate with amorphous regions. Amylose and amylopectin, two related carbohydrates, make form the starch molecule in terms of chemistry. Amylose is a straight chain with -1,4-glycosidic links, but amylopectin is a branching polymer made up of -1,4-glycosodic with branched chain linked by -1,6-glycosidic bonds.

This conformational shift gives each of these polymers distinctive properties. For instance, the short branching of amylopectin at the 1,6-glycosidic connections results in the crystalline region of the granules [9–11]. Amylose makes up around 20–30% of starch in its native condition, whereas amylopectin makes up 70–80%.

Chemical Properties of Starch

Amylose is insoluble in water but soluble in hot water without forming a gel because of the packing that is formed by the straight chain that gives it its rigidity. On the other hand, amylopectin is nonrigid, soluble in water, and gels when heated. There are traces of lipids and phosphate groups in starch, which is mostly synthesized in the amyloplast of plant storage organs and/or the chloroplast of plant leaves.

Pharmaceutical applications of starch

Because it is one of the few naturally occurring substances that can be processed to meet the majority of excipient specifications, starch is one of the most frequently used excipients in pharmaceutical products. It is non-toxic, simple to locate, odorless, and biocompatible. A variety of dosage forms, each of which rely on starch for its unique properties, are made from it in its natural state. The most typical uses of starches as excipients are covered in this section.

1. Binder

Starch is widely used as a binder in the wet granulation process of massing and screening, an important step in the production of tablets, capsules, and other solid dosage forms. The flow of APIs, which typically have a fairly cohesive architecture, is improved by granulation. To ensure dosage form weight consistency in high-speed manufacturing equipment and avoid dose variation brought on by uneven flow and powder segregation. In this process, starch is used as a liquid binder to create agglomerates with good flow properties.

The paste is produced by heating a starch solution, which causes the particles in the formulation to "stick together" and form larger-sized agglomerates that will reduce cohesion and encourage flow. To do this, powder bed particles are joined, and when they dry, they solidify into bridges. Up to a certain point, the paste was more viscous the stronger the bridges and larger the particles formed were [12]. Therefore, any substances that alter the viscosity of the starch paste will alter the starch's capacity to function as a binder. Studies have shown that the source of a starch, and therefore its chemical composition and character, affect the starch's viscosity [13].

2. Disintegrant

Pharmaceutical formulations employ an excipient called a disintegrant to break down solid dosage forms like tablets or granules into easier-to-handle, discrete bits. Disintegration is a critical step in the process of drug release and absorption because it creates a larger surface area for the medication to more easily and quickly

dissolve in solution. The process of medication degradation, release, and absorption is accelerated in order to provide the medicine's desired therapeutic effect.

The solid bridges and other binding forces in the dosage form are thought to disintegrate as a result of starch's affordable and practical disintegrant's swelling properties when water is present. How much swelling takes place depends on the origin or type of the starch, which is a sign of the relative proportion and conformation of the amylose and amylopectin in the particular starch [14–15]. Weak associative forces may serve as an indicator of a starch's potential as a disintegrant [9]. The development of channels that permit liquids to flow through the solid dosage form and dissolve the drug may also have a disintegrant effect.

3. Diluent

Some drugs are supplied at extremely low quantities, thus they must be processed very slowly before being compacted into tablets or other required dosage forms. In these cases, the formulation may be bulked up with inert ingredients that don't alter the drug's pharmacology in order to facilitate conventional formulation techniques. Due to its bland flavor, lack of smell, and ease of digestion, starch is used for this.

4. Absorbents

Starch is hygroscopic and may absorb moisture up to 10-17% when it is equilibrated in ordinary air conditions [16]. In order to keep powders dry and maintain the stability of drugs that are sensitive to deterioration by hydrolysis and other associated chemical reactions, it is utilized as an absorbent in the formulation of pharmaceuticals.

5. Glidant/lubricant

Starches have been researched for usage as lubricants and glidants due to their ability to adhere to surfaces and slickness [17].

6. Modified starches.

Starch's uses are limited in their natural form due to its inability to withstand specific processing conditions, such as high temperatures, variable pH levels, freeze-thaw cycles, its propensity for retrogradation and disintegration, and its brittleness. To make starch even more beneficial for medical uses, it can be modified. For example, acetylation increases paste flow, clarity, and swelling capacity [18–19], whereas carboxylmethylation raises water solubility, decreases the temperature at which gelatinization takes place, and raises paste stability [20].

PEARL MILLET

The investigation of alternative starch sources with superior functional qualities has been prompted by the reduction of traditional sources of starch needed to meet the daily needs of an expanding population. The market demand for starch has increased as a result of the many food uses it has, particularly as a thickening, emulsifying, and surfactant. Millets are a starch source that is underused and may be employed in a variety of industrial food and non-food applications. Pearl millet, commonly known as bajra, is a recently produced millet that belongs to the Poaceae family and can contain up to 70% starch, depending on the cultivar. It is another possible source of starch. It is native to Africa, where it is also farmed, as well as semiarid areas of Asia and Africa. In addition to being used to make traditional dishes, pearl millet was largely employed as a source of nutrition for animals and birds [21].Pearl millet is a more affordable and commercially feasible source of starch isolate since it has less industrial applications. Its capacity to thrive in places afflicted by salt and drought as well as its lower growing cost further increase its attractiveness as an industrial crop. Its extraction and usage as native and modified starch can open up new opportunities for starch-based businesses. The physiological characteristics of pearl millet also make it a more advantageous crop when compared to other grains. It is more resilient to extreme heat, drought, and barren soils with little water-holding ability where other crops commonly fail. (WHC). As a grain, pearl millet is categorized as C4. Since these cereals use water more effectively and take in more CO2 from the air to produce oxygen with less inputs, they are regarded as being ecologically friendly. As a result, pearl millet helps to manage climatic uncertainties, cut CO2 emissions, and slow down climate change [22].

In the semi-arid tropical regions, it is virtually solely farmed by subsistence and small-scale commercial growers. The pearl millet, which accounts for over half of all millet produced globally, is one of the most important millet species. It is mostly produced in Africa and India and has a unique tolerance for hot, dry conditions [23]. Pearl millet usually has a higher fat content than the majority of other cereal grains, which results in more calories, a higher protein content, and a higher quality protein content. In addition to being high in calcium, iron, and zinc, as well as potassium, phosphorus, magnesium, zinc, copper, and manganese, it is a cereal with "high energy" that contains carbohydrates, protein, and fat [24]. It has high levels of vitamins B and A. It was almost exclusively farmed in the past for subsistence, but it is now widely used to make small-scale, commercially manufactured meals. Many traditional foods and beverages, including as couscous and flatbreads, doughs, porridges, gruels, nonalcoholic beverages, and beers, are made from pearl millet. For improved nutrition, pearl millet has recently been produced with biofortified iron and zinc [25].

Starch Isolation

The pearl millet seeds were selected and thoroughly cleaned. The separated seeds (0.95 kg) were washed before spending the entire night soaking in a sodium metabisulphite (1/V) in water solution. (27 OC). The soaked seeds were then removed and processed in a lab blender to create a slurry. The paste was filtered many times through muslin fabric after being mixed with a sizable amount of 1% sodium metabisulphite solution. To help with the debris removal, the suspension was centrifuged at 3500 rpm for 10 minutes. The mucilage was eliminated, and the supernatant was carefully decanted. The process was carried out three times, with the mucilage on the starch continuously scraped off, until a pure starch was obtained. When analysis was necessary, the resultant starch was crushed, weighed, and kept in sample vials. It was crushed, sun-dried, and roasted at 60 oC in a hot air oven [26].

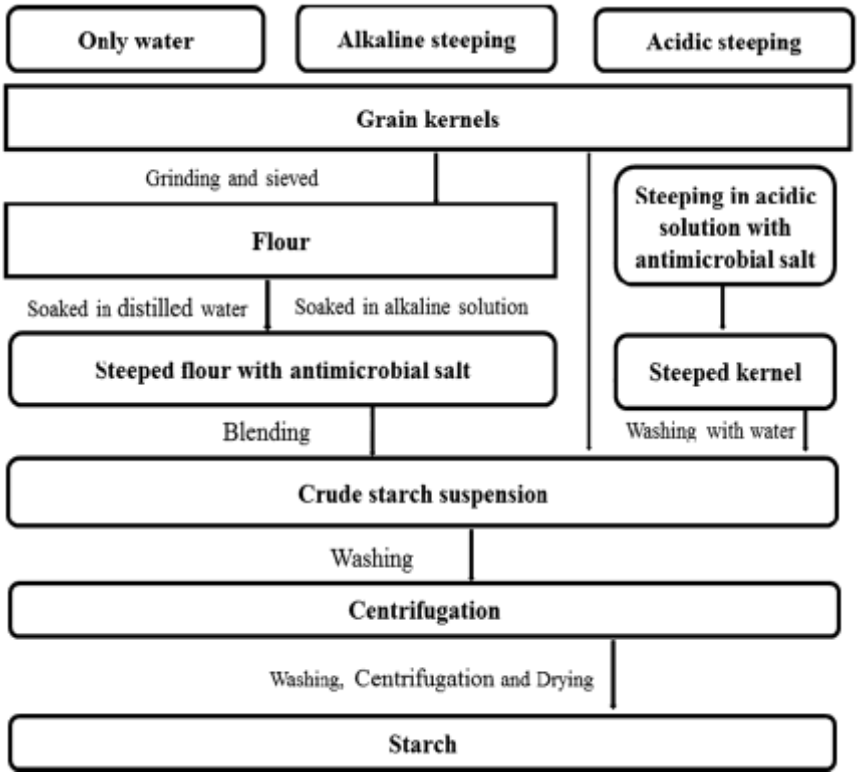

Fig. 1. General procedures of starch isolation.

Physicochemical Property Determination

1.1. Swelling Power

The method described by Afolayan et al (2014) [27] was significantly changed in order to determine the swelling power. The starch sample (0.1 g) was weighed and 10 ml of distilled water were added to a test tube. The mixture was heated in a water bath at 50 OC for 30 minutes while being constantly stirred. The test tube was subsequently centrifuged at 1500 rpm for 20 min to get rid of the supernatant. After carefully decanting the supernatant, the weight of the starch paste was calculated. The swelling power was calculated as follows:

$$\text{Swelling power} = \frac{\text{Weight of starch paste}}{\text{Weight of dry starch sample}}$$

This was done in the 50 OC to 95 OC temperature range.

1.2. Solubility Index

The method described by Afolayan et al. (2014) [27] was slightly adjusted to determine the solubility index. 10 ml of distilled water and 0.5 g of the starch sample were put to a test tube. At a starting temperature of 50 OC, this was heated in a water bath for 30 minutes. Following that, it was centrifuged for an additional 30 minutes at 1500 rpm. The supernatant was decanted into 5 ml, dried at a constant weight, and then reconstituted. The solubility was expressed as the percent (%) by weight of dissolved starch in the heated solution. This was carried out between 50 OC and 95 OC.

1.3. Gelatinization Temperature

The method developed by Attama et al. in 2003 [28] was used to assess this. One gram of starch was placed in a 20 ml beaker along with 10 ml of distilled water. The dispersion was heated on a hot plate. The gelatinization temperature was then determined using a thermometer suspended in the starch slurry.

1.4. Foam Capacity

The Omojola et al. (2010) approach received revisions [29]. Using a vortex mixer (vortex 2 Genie set at shake 8) and 50

ml of distilled water, a 1 g sample of starch was homogenized for 5 minutes. 30 seconds after the homogenate was poured into a 100 ml measuring cylinder, the volume was recorded. The foam capacity was represented by the volume increase as a percentage.

1.5. Emulsion Capacity

1 g of the substance and 5 ml of distilled water were mixed in a vortex for 30 seconds. Following thorough dispersion, 5 cc of vegetable oil (groundnut oil) was progressively added, and mixing was carried out for an additional 30 seconds. The suspension was centrifuged for five minutes at 1600 rpm. Directly from the tube, the amount of oil that was taken out of the sample was counted. Emulsion capacity is a unit of measurement for how much oil can be retained in suspension in one gram of a substance.

1.6. Browning and Charring Temperature

The Builders et al. (2001) method underwent changes [30]. The browning and charring temperatures of a section of the starch sample were determined using the melting point apparatus, model Electrothermal 9100.

1.7. Ph

After five minutes of shaking a 20% w/v dispersion in water, the pH of the sample was measured using a pH meter

1.8. Water Holding Capacity

To determine the water holding capacity, Omojola et al.'s (2010) [29] technique was utilized. In a pre-weighed centrifuge tube, the starch sample (5% w/v) was diluted. For two minutes, the tube was stirred in a vortex mixer. After discarding the supernatant, the tube and the hydrated sample's weights were measured. The amount of water that was bonded to 100 g of dry starch was determined and reported as the weight.

1.9. Bulk and Tapped Density

The procedure outlined by Narayana and Narasinga Rao (1984) was extensively altered to calculate the bulk density of the starch [31]. Using a short-stemmed glass funnel, starch powder (50g) was added to a 250 cm3 calibrated measuring cylinder. To determine the bulk density, the starch's volume was measured.

$$\text{Bulk density (g/cm}^3\text{)} = \frac{\text{Weight of sample}}{\text{Volume occupied}}$$

The cylinder was constantly tapped with a ruler to determine the tapped density until a consistent volume was attained.

1.10 Content of Amylose and Amylopectin

Weighing was done separately on test tubes holding the standard (0.1g) and the starch sample (0.1g). Carefully poured into these test tubes were 1 cm3 of 95% ethanol and 9 cm3 of 1 mol dm-3 NaOH. The test tubes were covered with foil paper and had been well mixed. After being cooked in a hot water bath for ten minutes to gelatinize the starch, the samples were completely chilled. The suspensions had undergone a 10-fold dilution. Before being subjected to analysis, an aliquot of 0.5 cm3 of the extract was combined with 0.1 cm3 of acetic acid solution and 0.2 cm3 of iodine solution. From 9.2 cm3 of distilled water, 10 cm3 of this was created. The solution was vortexed, read at 620 nm, and allowed for 20 minutes for color development [32].

$$\% \text{ Amylose content} = \frac{\% \text{ Amylose of standard X Absorbance of sample}}{\text{Absorbance of standard}}$$

2. Results And Discussion

With a yield of around 32%, the resultant starch was a dazzling white, crystalline, non-hygroscopic powder with no odor. When compared to other sources of starch like corn and cassava, the output is thought to be rather sizable. The findings of the physical-chemical characteristics and in-depth analysis of pearl millet starch are shown in Table 1.

PARAMETER	VALUE
Gelatinization temperature	79ºC
Foam capacity	4%
Browning temperature	224.5 – 265.0ºC
Charring temperature	270.3 – 290.0ºC
pH	6.88
Water holding capacity	28.345 ml
Bulk density	0.526 g/cm^3
Tapped density	0.667 g/cm^3
Emulsion capacity	20%
Amylose content	17.66%
Amylopectin content	82.34% 79°C

Table 1. Physicochemical Properties & Proximate Analysis of Pearl Millet Starch

INTERACTIVE STUDY PEARL MILLET AS A STRARCH IN PARACETAMOL TABLET

Drug-excipients compatibility studies

In order to identify any potential chemical interactions between a medicine and millet starch, the infrared spectrum spectra have to match. 1 g of starch was used to make 1 g of medication, and 5 mg of the resulting physical combination was combined with 95 mg of potassium bromide. The mixture (100 mg) was compressed into a transparent pellet using a hydraulic press. They were scanned from 4000 to 500 cm1. It was compared between the infrared spectra of the physical combination and those of the pure drug [33].

FORMULATION

FORMULLATION	F1	F2	F3
Paracetamol (mg)	500	500	500
Millet Starch (mg)	30	45	60
PVP (mg)	18	18	18
Talc (mg)	12	12	12
Magnesium Sterate (mg)	6	6	6
Lactose Mono hydrate (mg)	34	19	4

Table 2. Basic formula for prepared paracetamol tablets.

Preparation of Tablets

Wet granulation was used to make the paracetamol powder (particle size about 74 m), polyvinylpyrrolidone (PVP K30) (3%) as binder, talc (2%) as glidant, magnesium stearate (1%), and millet starch (5, 7.5, 10%) as disintegrant. After moistening with PVP solution and rubbing for 10 minutes, combine the needed amount of paracetamol with half the starch in a dry mixture. Before being packaged, the mixture was dried for two hours at 60 C in a hot air oven after screening through a no. 12 mesh sieve (1400 m). The leftover starch was combined with the dry granules for 5 minutes after being manually filtered using an 850 m No. 18 mesh sieve.Following the addition of talc and magnesium stearate, the mixture was run for a further three minutes. The several batches of paracetamol granules were crushed into tablets using a single punch tableting machine with a punch diameter of 12 mm and a compression force of 4–8 KP. (600 mg). In order to alter the weight of the tablet, lactose monohydrate was employed as filler. To allow for elastic recovery and hardness before assessment, the tablets were kept in storage for 24 hours following compression.

EVALUATION PARAMETER

The pharmacopoeia-recommended evaluation parameters for tablets, as well as a few unique tests, must be carried out.

(a) Organoleptic parameter: [34-36]

A tablet's size and shape can be covered, described, and controlled in three dimensions. A crucial factor in both duplicating appearance and counting with a filling outfit is tablet thickness. Some filling companies count the tablets based on their even consistency. Ten tablets were eaten, and a micrometre was used to measure their thickness.

(b) Tablet hardness: [37-39]

The amount of force needed to break a tablet across its diameter is what is known as the tablet's hardness. The hardness of the tablet affects how resistant it is to breaking, chipping, or abrasion when handled before to use and during storage transition. Pfizer's tablet tester selects ten pills from each batch to gauge how hard each batch is.

(c) Uniformity of weight: [40-41]

20 tablets are randomly selected, weighed, and the average weight is then determined. Only two individual weights differ from the average weight by an amount more than that, and none by a percentage greater than twice that.

(d) Friability test: [42-43]

Friability tests are conducted using the Roche Friabilator. Prior to being put into the friabilator, 10 tablets are first weighed (W1) and spun at 100 rpm for 4 minutes. The weights of the pills will be changed, and (W2). A percentage is used to represent the weight difference.

Percentage friability= (initial weight-final weight/initial weight) ×100.

(e) Water absorption ratio: [44-45]

6 cc of water and two tissue paper folds are placed in a micro petri plate. The tissue paper is covered with a tablet, which is then given time to completely soak through. After that, the wet tablet is weighed. The water absorption ratio is calculated using the following equation.

$$R= 100* Wa -Wb/ Wa$$

(f) In-Vitro Disintegration: [46]

The test, which makes use of tablet disintegration technology, uses six tablets. The disintegration medium is distilled water, and the duration in seconds needed for the tablet to fully dissolve with no observable mass remaining in the

instrument is counted.

(g) In-Vitro Dissolution: [47-48]
The dissolving test was conducted using phosphate buffer pH 5.8, in compliance with the USP standard for paracetamol. The gadget was agitated at 50 RPM. (USP36-NF31, 2008). At certain intervals, 5 ml samples of the media were removed and replaced with an equivalent volume of fresh buffer medium. Each jar containing 900 ml of fluid included a 500 mg tablet. After filtering, 100 ml of the 1 ml samples were diluted, and the UV absorbance at its maximum wavelength of 243 nm was found using a UV/Visible spectrophotometer.

Angle of repose
The angle of repose () of the starch/granule samples was measured by allowing 30 g of starch powder to run down a funnel and form a conical heap under the force of gravity [49].

$\tan\theta = h/r$
where h is the cone's height and r is the base of the cone's radius.

Carr's index and Hausner's ratio:
The difference between the tapped and bulk density of the granules, divided by the tapped density, was used to calculate the Carr's index. The ratio between the tapped density and the bulk density of the granules was calculated using Hausner's quotient [50].
Carr's index was determined using the formula in equation.
Carr's index = (Tapped density−Bulk density)/(Tapped density)×100%
Hausner ratio was calculated as shown in equation
Hausner ratio = (Tapped density)/(Bulk density)

RESULT AND DISSCUSION
The results of the micromeritic properties of paracetamol granules are shown in Table 2. The flow characteristics were examined using the angle of repose, and the compressibility was assessed using the Carr's index and Hausner's ratio. The results showed that all granules had good to fair flow, and the values were within the guidelines established for the creation of high-quality tablets. The results of Carr's index and Hausner's ratio showed that the granules had good consolidation properties.

The absorbance of various solutions was performed in a concentration range of (4—16 g/ml) using calibration plots for standard paracetamol solutions analyzed by the UV method at h max 243 in accordance with USP. All formulations passed the dissolution test for immediate release tablets (release > 80% in 30 min).

Table 2 Micromeritics properties of the prepared paracetamol granules.

Type ofstarch	Conc.% starch	of Bulk density	Tapped density	Carr's index	Hausner ratio	Angle of repose
Millet	5	0.465 ± 0.049	0.54 ± 071	13.75 ± 0.82	1.15 ± 0.071	33.77 ± 0.44
	7.5	0.47 ± 0.015	0.56 ± 0.017	16.1 ± 1.08	1.2 ± 0.02	32.43 ± 0.75
	10	0.465 ± 0.021	0.56 ± 0.042	16.85 ± 0.82	1.2 ± 0.02	31.3 ± 0.93

Table 3 Physical test of prepared tablets.

Starch	Conc.%	Cv%	Hardness	Friability%	Disintegration time (min)
Millet	5	1.71	7.30 ± 1.204	0.84 ± 0.028	7.167 ± 0.764
	7.5	1.85	6.50 ± 0.500	0.94 ± 0.042	4.167 ± 0.764
	10	1.24	6.00 ± 0.500	1.2 ± 0.141	1.290 ± 0.175

CV%: coefficient of variance%.

CONCLUSION
Pearl Millet is a nutritious and gluten-free grain that has been used in traditional diets for centuries. When used as a starch in tablet formulation, it can offer several benefits, including: Good binding properties: Pearl Millet starch has good binding properties which make it a suitable excipient for tablet formulation. It can help hold the tablet ingredients together, ensuring that the tablet doesn't fall apart or crumble easily. Good disintegration properties: Pearl Millet starch has good disintegration properties, which means that it can help the tablet to break down quickly and release its active ingredients. Cost-effective: Pearl millet is a grain that is relatively cheap, making it an economical excipient for tablet manufacturing. Healthful: Pearl millet is a wonderful source of a number of vital nutrients, including fiber, protein, vitamins, and minerals. This makes it a desirable choice for creating tablets with added nutritional advantages. Gluten-free: Pearl millet is naturally devoid of gluten, making it a great choice for those who suffer from celiac disease or gluten sensitivity.Overall, Pearl Millet starch has strong binding and disintegration capabilities, is cost-effective, and has nutritional value. These are only a few advantages of employing Pearl Millet starch as an excipient in tablet manufacturing.

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