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# Formulation and Evaluation of *Annona squamosa* Linn Seed Capsule for Antioxidant Activity

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**ABSTRACT:**

The present study aimed to formulate and evaluate Annona squamosa Linn seed capsules for antioxidant activity. The seeds of Annona squamosa Linn, commonly known as custard apple, have been traditionally used for their medicinal properties. Annona squamosa linn belongs to the family of Annonaceae and it is tropical and native species of Bahamas, bermuda, Brazil, central America, Ecuador, Egypt, India, Mexico, Peru, south America and west India. Different part Annona squamosa linn have been studied throughout the years for its benefits in health, medicinal and traditional uses related to the composition of various chemical compounds present in the custard apple. The antioxidant property of Annona squamosa linn have been researched in various research and studies for its effectiveness in treating ailments and illness through in vitro and in vivo assessment. The seeds also show the presence of tannins, vitamin E, vitamin C and higher content of amino acids. The squamosa seed contain the higher amount of Annonaceous acetogenins compounds, which are potent mitochondrial complex I inhibitors and have high cytotoxicity. It can be used for the discovery of novel products, including pharmaceutical drugs. The capsules were also evaluated for their physical parameters, such as weight variation, hardness, and disintegration time. The study suggests that Annona squamosa seed capsules may be a potential natural antioxidant supplement.

**Keywords:** Annona squamosa linn, antioxidants activity, capsule formulation, custard apple seeds.

## INTRODUCTION:

*Annona Squamosa* belongs to the family *Annonaceae*, it is a small tree or shrub that grows in subtropical and tropical regions. Custard apple seed are delicious fruit and are used when they are full ripe. Custard apple seed is a good source of vitamin C and vitamin A. *Annona Squamosa*, commonly known as custard apple. Its seed have been used in traditional medicine for various purposes including antioxidant, antibacterial, antifungal, antimicrobial and antidiabetics [1]. Oxidative stress is a major contributor to various chronic diseases, including cancer, diabetes, and neurodegenerative disorders. Antioxidants play a crucial role in mitigating oxidative stress and preventing disease progression. In recent years, there has been a growing interest in exploring natural antioxidants as alternatives to synthetic ones [2]. This study aimed to formulate and evaluate Annona squamosa Linn seed capsules for antioxidant activity. Annona Squamosa Linn is an edible fruit. The tree of Annona Squamosa L. grows from tiny sprouts as it springs 3 m up to 8 m. It has a large brownish to light brown bark with randomly spread branches and thin leaves [3]. Annona Squamosa L. has been used as a natural remedy and in numerous food industries. Annona Squamosa L. pulp contains 35 to 42 mg per 100 g of vitamin C. The dietary fiber, vitamin B1 which is thiamine, and potassium is high in Annona Squamosa L [3]. The plant sprout has high photosensitivity at $30^0$ C and vigorously shooting growth. The optimal soil pH for Annona Squamosa L. is between 6.0 - 6.5 PH. It can also grow in a variety type of soils from sandy soil to clay loams. The chemical constituents existing in the fruits of Annona Squamosa L. are noorcorydine, isocorydine, liriodenine, and norushinsunine. Annona Squamosa L. leaves are rich in alkaloid compounds such as aporphine, roemerine, rhamnoside, norisocoryline, and quercetin-3–o-glucoside [4]. Annona Squamosa seeds have confirmed that the major active chemical constituents are annonaceous, acetogenins and cyclopeptides, Annonaceous acetogenins, a class of polyketides, containing oxygenated functional groups including ketones, epoxides, hydroxyls, tetra hydropyrans and tetrahydrofurans, essentially found in the seed [5].

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**Figure 1** [7]: Morphology of Annona squamosa linn plant

**Table 1** [6]**:** Taxonomy of sugar apple (Annona squamosa linn) plant

| **Taxonomical Classification:** | |
|---|---|
| Kingdom | Plantae |
| Division | Magnoliophyta |
| Class | Magnoliopsida |
| Subclass | Magnoliidae |
| Order | Magnoliales |
| Family | Annonaceae |
| Subfamily | Maloideae |
| Tribe | Abrae |
| Genus | Annona L. |
| Species | Annona Squamosa L. |
| Synonyms: | |
| English | Sugar apple |
| | Custard apple |
| | Sweet sop |
| | Sweet apres |
| | Sitaphal |

**Methodology:**

The local market provided the materials needed for the experiment. Using a scoop, the fruit's seeds were extracted from the pulp and utilized to make a powder for more research. Laminated aluminium foil (LAF) (100 gauge), high density polyethylene (HDPE) (120 gauge), and low-density polyethylene (LDPE) (200 gauge) were utilized to store the seed powder for the storage research. As previously mentioned, the custard apple seed powder was stored for 60 days in two distinct packaging conditions—vacuum and regular packaging—using various packing materials. Using the techniques outlined by [8], the physical characteristics of custard apple seed powder, such as bulk density, water absorption capacity, water solubility index, pH, and titratable acidity, were assessed. Additionally, the custard apple seed powder's chemical characteristics, including its moisture content, protein, fat, fibre, and carbohydrate content, were assessed using the methodology described in [8]. During the 60-day storage period, a physical and chemical analysis of the custard apple seed powder packed in various packing materials was carried out every 15 days.

After 2.5 kg of dry seeds were ground, 1 kg of powder was produced Custard apple seed powder's average particle diameter was determined to be 0.250 mm.

**Material and methods:**

**Materials:**

Custard apple seed, microcrystalline cellulose, starch, magnesium stearate, vitamin E, silica, capsule shell.

**Collection of seed:** The seed of Annona squamosa were collected from local market of Udgir.

**Drying of seed:**

The seeds of Annona squamosa were dried in air for one day than to remove moisture form seed, the seeds were crushed in small pieces with the help of mortal and pestles. Again, these particles were dried in air for 3 days.

**Powdering of seeds:** The powder of seed was prepared with grinder.

**Method:**

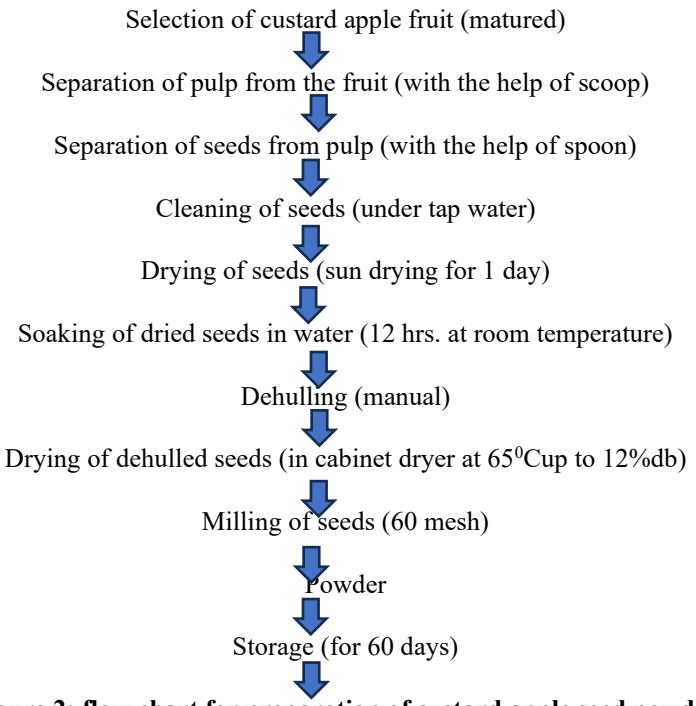


**Figure 2: flow chart for preparation of custard apple seed powder**

**Pharmacological activity:**

Seed examined the activity of antioxidant enzymes using the DPPH method. Annona Squamosa L. seeds were extracted in 95% ethanol at a 1:2.5% ratio and left at room temperature for 24 hours. The extract was filtered and concentrated using a rotary evaporator that was set at 45 °C. The percentage of inhibition for Annona squamosa L. seed extract was 98%. determined the antioxidant activity of Annona Squamosa L. seed oil using the DPPH and FRAP tests. Annona Squamosa L. seeds were steeped in distilled n-hexane for 72 hours, filtered, and then evaporated in a rotary evaporator set at 40 °C to get a concentrated extract. Annona squamosa L. seed oil was extracted using the Soxhlet extraction method, using n-hexane as the extraction solvent. The FRAP value of Annona Squamosa L. seed oil in DPPH was 34.8 ± 0.01 mg AAE/g (mg Ascorbic Acid Equivalents/g), while the IC50 value was 1.33 ± 0.001 mg/ml. examined the antioxidant qualities of Annona Squamosa L. seeds in four different solvents: petroleum ether, methanol, ethanol, and acetone. The extracts were concentrated using a rotary evaporator. DPPH, superoxide (O2 •–), hydrogen peroxide (H2O2), and nitric oxide (NO) assays were used to test the scavenging capacity of Annona squamosa linn seed extract. Antioxidant qualities exhibited by Annona squamosa Linn may aid in preventing oxidative stress and cell damage [9].

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**Evaluation test:**

**Preformulation studies:**

| Angle of repose | Powder flow |
|---|---|
| <25 | Excellent |
| 25-30 | Good |
| 30-40 | Passable |
| >40 | Very poor |

**Table 2 [10]:** acceptance criteria for dissolution test for capsule dosage form

| stage | Number of capsule tested | Acceptance criteria |
|---|---|---|
| S1 | 6 | Each unit is not less than Q+5% |
| S2 | 6 | Average of 12 units (S1+S2) is equal to or greater than Q and no unit is less than Q-15% |
| S3 | 12 | average of 24 units(S1+S2+S3) is equal to or greater than Q not more than 2 units are less than Q-15% and no unit is less than Q-15%. |

**Table 3 [10]:** acceptance criteria for stability test for capsule dosage form

| Test conditions | Observation |
|---|---|
| 80% RH at room temperature in an open container | Capsule are observed periodically for 2 weeks, both gross and subtle effects of the storage conditions are noted and recorded. The control capsule should not be affected except at the 80% RH station. |
| 40°C in an open container. | |
| 40°C in a closed container(glass bottle with tight screw-cap.) | |

Test conditions for accelerated stability tests for capsule dosage forms

**Result and discussion:**

Test for Annona squamosa linn seed capsule gives antioxidant property.

| **characteristics** | **observation** |
|---|---|
| Color | Brown |
| Odour | Characteristic, pungent |
| Extra feature | Oily in nature |

**Conclusion:**

Annona Squamosa L. possess significant antioxidant activity in different parts of the fruit. The presence of distinct chemical constituents, phenolic compounds, flavonoid compounds, and other active chemical constituents might present a great opportunity for developing Annona squamosa L. as a natural medicinal plant in the treatment of acute and chronic diseases. The assessment of

different parts of Annona squamosa L. for the antioxidant activity highlights the importance of research focusing on the pharmacological and medicinal properties of Annona squamosa L.

The formulation and evaluation of Annona squamosa linn seed powder capsules for antioxidant activity demonstrate the potential of this natural product in preventing oxidative stress-related diseases. The capsules exhibited significant antioxidant activity, attributed to the presence of bioactive compounds like acetogenins and flavonoids.

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Conflict of Interest Statement: All authors have nothing else to disclose.