P: ISSN No. 2231-0045 RNI No. UPBIL/2012/55438 VOL. -5, ISSUE-4, May - 2017
E: ISSN No. 2349-9435 Periodic Research

Study on Physical Properties of Jamun Fruit(*Syzyiumcumini L.*)

P.H.Bakane
Associate Professor,
Deptt.of Agricultural Process Engineering,
Dr. Panjab Rao Deshmukh Krishi Vishvavidyalaya,
Akola (M.S.)

M.B. Khedkar
Junior Research Assistant,
Deptt.of Agricultural Process Engineering,
Dr. Panjab Rao Deshmukh Krishi Vishvavidyalaya,
Akola (M.S.)

H. M. Khobragade
Senior Research Assistant,
Deptt.of Agricultural Process Engineering,
Dr. Panjab Rao Deshmukh Krishi Vishvavidyalaya,
Akola (M.S.)

M. M. Dange
Associate Professor
Deptt.of Agricultural Process Engineering,
Dr. Panjab Rao Deshmukh Krishi Vishvavidyalaya,
Akola (M.S.)

Abstract

The physical properties of Jamun fruits (*Syzyiumcumini* L.*)* obtain from the Akola market were determined. The objective of this study was determine some physical properties of Jamun fruit in order to facilitate t design of some machines for its processing.The wet basis moisture content Jamun fruits was found to be 71.11 %. The fresh fruit weight, size, arithme mean diameter, sphericity, surface area, bulk density, true density, poros pulp content and seed content were varied in the range of 3.09 to 6.35 16.06 to 24.07 mm, 16.71 to 24.21 mm, 0.81 to 0.95, 86.5 to 181.92 mr 0.464 to 0.507 g/cc, 0.83 to 1.25 g/cc, 41.05 to 60.65%, 53.15 to 80.27% a 17.32 to 38.44%, respectively. This study showed considerable variation some physical properties of Jamun fruit. These properties can be useful designing and fabricating for handling, transporting, processing and stora equipment of Jamun fruit.

Keywords: Jamunfruit, Chemical and Physical Properties,

Introduction

Jamun (*Syzygiumcuminii* L.) is an important underutilized tropical fruit that grows widely in different agro climatic conditions in India belonging to the family Myrtaceae (Vijayanand*et al*., 2001). The pulp of Jamun is highly nutritive and contains important minerals like sodium, potassium, calcium, phosphorous, iron, and zinc; water-soluble vitamins like ascorbic acid, thiamine, and niacin; carbohydrates like glucose, mannose, sucrose, maltose, fructose, galactose, and mannose; free amino acids like alanine, asparagine, tyrosine, glutamine, and cysteine (Paul and Shaha, 2004).

Jamun fruit are unique in that they constitute a set of properties and characteristics, which distinguish them from all major fruits. Jamun have significance as a stable food as well as an ornamental fruit plant, whilst their use in Jamun products and industrial applications could be increased. According to variety and growth conditions, Jamun fruit vary in shape, size and weight. Usually they are elliptical and ovoid though certain varieties may reach a near round shape. Agricultural materials and food products have several unique characteristics which set them apart from engineering materials. Design of machines and process to harvest, handle and store agricultural materials and to convert these materials into food and feed requires an understanding of their physical properties (Stroshine, 1998).

Physical properties are often required for the development of post harvest techniques to make them a value-added product. The physical properties of fruits are important in designing and fabricating for handling, transporting, processing and storage, and also for assessing the behavior of the product quality (Kashaninejad*et al*., 2006; Bart-Plange and Baryeh, 2003). Size and shape are often used when describing grains, seeds, fruits and vegetables. Shape and physical dimensions are important in screening solids to separate foreign materials and in sorting and sizing of fruits and vegetables. The product shape can be determined in terms of its sphericity which affect the flowability characteristics of the products. Size and shape determine how many fruits can be placed in shipping containers or plastic bags of a given size. Quality differences in fruits, vegetables, grain and seeds can often be detected by differences in density.

In the present study, only a few but important properties have been evaluated whicharemore commonly considered for their greater applicability in assessing quality of product. The objective of this study was to determine some physical properties of Jamun fruit in order to facilitate the design of some machines for its processing.

Aim of the Study

The aim of the study is to study the physical properties of Jamun fruit. The physical properties of fruits are important in designing and fabrication of handling, transporting, processing and storage devices,and

also for devices, and also for assessing the behavior
of the product quality.

Review of Literature

Galedar*et al.* (2010) studied the moisture dependent geometric andmechanical properties of wild pistachio (*pistaciavera L*.) nut and kernel. As8the moisture content of pistachio nut increased from 5.83 to 30.73%(w.b.), the bulk density, apparent density and terminal velocity were found toincrease, whereas porosity was found to decrease.

Karaj and Muller (2010) determined the physical, mechanical andchemical properties of seeds and kernels of Jatrophacurcas L. It wasobserved that coefficient of static friction of seeds higher on rubber surfaceand lowest on stainless steel, namely 0.45 and 0.22. The coefficient of staticfriction was higher on all surfaces for kernels than for seeds. It was noticedthat angle of repose of kernels was higher than for seeds.

Goyal*et al.* (2007) studied physical properties of three aonla cultivars viz, krishna, NA-7, chakaiya. The result shows average length, diameter, size and sphericity ranged in between 3.12–3.24 cm, 3.44–3.60 cm, 3.37–3.44 cm and 1.04–1.10% respectively. Mass, volume and true density of the fruits from cultivar chakaiya was higher than the other fruits.

Shahnawaz and Sheikh(2011) studied the physicochemical characteristics of Jamun fruit cultivated in Pakistan.

Topuzet al.(2004) reported several physical and nutritional properties of four orange varieties They concluded that many physical properties of orange varieties were found to be statistically significant at 5%, 1% and 0.1% probability levels except bulk density and porosity

Materialsand Methods

Collection of Jamun

Jamun fruit was procured form local market of Akola. The samples of fruits were cleaned manually to remove all foreign materials such as dust, dirt, immature fruits etc.

Moisture Content

Moisture content of sample was determined by the loss in weight that occurs when a sample was dried in hot air oven. The fruits of 2 to 5 g transferred into aluminum box covered with lid. The boxes were uncovered and placed into hot air oven at 70-75ºC for 16 to18 hr (Ranganna, 1986).

Weight

Weight (g) of Jamun fruit was measured using an electronic balance with an accuracy of 0.01g Sartorius BT (2202 S).

Axial Dimensions

Three principal axes (length, breadth and thickness) of the fruit were measured with the help of Vernier calliper (Mitutoyo, Japan) having a least count of 0.02 mm.

Geometric mean Diameter

The geometric mean diameter of fruit was calculated by using following formula.

$Dg = (l \times w \times t)^{⅓}$….(1)

Where,

l = Major axial dimension, mm.
w = Intermediate axial dimension, mm.
t = Minor axial dimension, mm

Arithmetic mean Diameter

Arithmetic mean diameter (Da) for each Jamun fruit was calculated using following equation (Mohsenin, 1980).

$$\frac{(l + w + t)}{3} \quad \text{..... (2)}$$

Sphericity

The sphericity (Φ) of fruits was calculated using following formula.

$$\Phi = \frac{(l \times w \times t)^{⅓}}{l} \quad \text{……(3)}$$

Surface Area

The surface area of custard apple fruit were calculated by using following formula Topuz(2004).

$S = \pi \times Dg^2$... (4)

Where,

S= surface area, mm^2
Dg = geometric mean diameter, mm

Pulp and Seed Percent

Pulp of Jamun was separated from seed.The pulp and seed percentage was calculated by using following formula Kolekar and Tagad(2012).

$$\text{Pulp content \%} \quad \frac{W_P}{W_F} \times 100 \quad \text{……(5)}$$

Where,

W_P= Weight of pulp, g
W_F= Weight of fruit,

$$\text{Seed content \%} \quad \frac{W_S}{W_F} \times 100 \quad \text{…….(6)}$$

Where,

W_S= Weight of seed present in fruit, g
W_F= Weight of fruit, g

Bulk Density of Fruit

Bulk density which is defined as the ratio of the mass of the sample to its container volume was evaluated by weighing a Jamun fruit filled beaker of known weight and volume and calculated as Baryeh (2000).

$$\text{Bulk density } (g/cm^3) = \frac{\text{mass (g)}}{\text{volume } (cm^3)}$$

…… (7)

True Density of Fruits

It is the ratio of the mass of the sample to its true volume. For Jamun fruit, true density was determined by the water displacement method (Abdullah, 2011). The true density was calculated using following equation:

$$\text{True density}(g/cm^3) = \frac{\text{mass of individual fruit (g)}}{\text{volume of individual fruit } (cm^3)} \text{... (8)}$$

Porosity

Porosity is a vital physical property that characterizes the amount of air spaces in a bulk. It isneeded in modeling and design of various heat andmass transfer processes. It is defined as the volumefraction of air in the bulk sample and is calculated byEqn9:

$$Є = \frac{(\rho_t - \rho_b)}{\rho_b} \times 100 \quad \text{... ..... (9)}$$

Where,

Є= Porosity, %

ρ_t= True density, g/cm^3 and

ρ_b= Bulk density, g/ cm^3

Angle of Repose

The angle of repose was determined by standard circular platform method as given by Mohsenin(1980), the angle of repose was calcula ted by using formula.

$$\Phi = \tan^{-1} \frac{2h}{D} \quad \text{.....(10)}$$

Where,

Φ= angle of repose in degree

h= height of pile, mm

d= diameter of disc, mm

Colour of Fruits

Colour of Jamun fruit was determined by Minolta chromameter (CR-400) in terms of L, a, b value.

Statistical Analysis Properties of Fruit

Basis statistic of physical properties of Jamun fruit were carried out using software available on website www.icargoa.res.in.

Results and Discussion

Moisture Content

Moisture content of Jamun fruit, seed and pulpwerefound to be 71.11, 58.43 and 86.68 % (wb), respectively.

Weight of Fruit

The weights of corresponding 50 fruits were recorded with the help of electronic balance with least count 0.01 g. The maximum and minimum weight of fruit was found to be 6.35 and 3.09 g, respectively. The average weight of fruits was found to be 4.73 g with standard deviation 0.814.

A part from estimating yield of a tree, weight of a fruit is considered to be an important factor in judging its compactness, maturity, juice content, levels of chemical constituents. The weight of fruit also determines its acceptance to consumers and thereby the market price of it.

Shahnawaz and Sheikh, 2011 reportedthe weight of Jamun fruit cultivated in Pakistan was 9.55 and 6.75 g for improved and indigenous variety, respectively, which more than the recorded in the present study.

Axial Dimension, mm

The three principal of axes which is length, breadth and thickness of fruit were measured with the help of vernier calliper result are shown in Table1.The maximum and minimum value of length, breadth and thickness of fruit were found to be 26.61,23.69,22.34 and 18.79, 15.9, 14.96,respectively.The average length, breadth and thickness of fruits were found to be 21.84, 18.27, 17.88mmwith standard deviation1.706, 1.731, 1.692,respectively. Axial dimensions of Jamun fruit observed in this study was less than the reported by Shahnawaz and Sheikh, 2011. Difference in axial dimension may be due to variety and location. Kashaninejad et al. (2006), Bart-Plange and Baryeh (2003) in their studies pointed out that width of a fruit, that is, how much it has grown across is a measure which is perhaps of greater importance than the lengthwise growth of it, in order to judge its normal and healthy growth. In some countries, the maturity for harvest of many fruits is also assessed by observing their girth-wise growth. For example, in the fruit of Jamun, width is sometimes considered to determine their harvest-maturity condition.

Geometric mean Diameter

The geometric mean diameter of Jamun fruits were determined from the measurement of its axial dimensions i.e. length, width and thickness and results are summarized inTable1. The observed geometric mean diameter of fruits was varied in the range of 16.6 to 24.07 mm. The average geometric mean diameter of fruits was found to be 19.18mm with standard deviation 1.55

Arithmetic Mean Diameter

Arithmetic mean diameter of Jamun fruits was calculated from its axial dimensions. The maximum and minimum value of arithmetic mean diameter of fruit was found to be24.41 and 16.71, respectively as depicted in Table.An average value of arithmetic mean diameter was found to be 19.33 mm with standard deviation 1.54.

Sphericity

The sphericity of Jamun fruits was determined with the help of mathematical equation no. 3 summarised results are given in Table 2.The maximum and minimum value of sphericity of fruit was found to be 0.95 and 0.81,respectively. This property may be used for design of fruit grader.The average sphericity of Jamun fruit was found to be 0.88 with 0.041standard deviation.

Surface Area

The surface area of Jamun was calculated with the help of mathematical equation no. 4 and results are summarised in Table 2. The maximum and minimum value of surface area of Jamun fruits was found to be 181.92 mm^{2}and 86.5 mm^2, respectively. The average surface area of Jamun fruit was found to be 116.22 mm^2 with 19.59 mm^2 standard deviation. A part

Pulpand Seed content

The pulp content of Jamun fruits was calculated by using mathematical equation no.5and result are summarised in Table 2.The edible matter (pulp) was recorded 68.4% whereas non-edible portion (seed) was recorded 25.79%. To what proportion the human consumable matter is actually present in a fruit is, in fact, of practical concern to a food scientist. This varies greatly according to species, varieties under them, rootstocks used, edapho-climatic conditions of growing, agro inputs applied and so on. Dutta et al. (1988) stated that presence of seeds in a fruit is considered a merit or demerit. Seed are valued at least in some fruits for certain purpose like Jamun fruit. Experimental evidence provides proof to the fact that the seedless Jamun fruits tends to be less sweet than the seeded fruits. Jamun seeds can be used for

many purpose i.e medicinal, nutritional and food by-product etc.

Bulk Density

The maximum and minimum value of bulk density of Jamun fruits was found to be 0.507 g/cm3and 0.464 g/cm3, respectively. The average bulkdensity was found to be 0.4892g/cm3with 0.017g/cm3 standard deviation

Table 1
Variation in weight, axial dimensions, size and arithmetic mean diameter Jamun fruits

Particular	Weight of Fruit, g	Axial dimensions, mm			Geometric mean diameter, mm	Arithmeticmean diameter, mm
		l	b	t		
No. of observation	25	50	50	50	50	50
Max	6.35	26.61	23.69	22.34	24.07	24.21
Min	3.09	18.79	15.9	14.96	16.06	16.71
Avg	4.73	21.84	18.27	17.88	19.18	19.33
SD	0.814	1.706	1.731	1.692	1.557	1.548
Var	0.663	2.912	2.996	2.863	2.425	2.396
SEM	0.163	0.314	0.346	0.338	0.311	0.310
CV,%	17.82	7.813	9.474	9.458	8.118	8.006

Table 2
Variation in sphericity, surface area, pulp and seed content of Jamun fruits

Particulars	Sphericity	SurfaceArea, mm^2	Pulp Content, %	Seed Content, %
No. of observation	25	25	25	25
Max	0.95	181.92	80.27	38.44
Min	0.81	86.5	53.15	17.32
Avg	0.88	116.2	68.4	25.79
SD	0.041	19.59	6.43	5.24
Var	0.002	383.9	41.34	27.4
SEM	0.008	3.919	0.013	1.313
CV	4.706	16.86	9.39	20.32

Table 3
Bulk density, true density, porosity and angle of repose of Jamun fruit.

Particulars	Bulk density, g/cm^3	True density, g/cm^3	Porosity, %	Angle of Repose,deg	Colour		
					L	a	b
No. of observation	5	5	5	5	30	30	30
Max	0.507	1.25	60.65	41.87	26.94	5.12	0.71
Min	0.464	0.833	41.05	39.61	20.18	-0.02	-0.5
Avg	0.4892	1.062	52.99	40.61	24.548	1.429	0.431
SD	0.017	0.175	8.042	1.033	1.646	1.217	0.224
Var	0.000	0.031	64.68	1.067	2.709	1.482	0.05
SEM	0.008	0.078	3.597	0.462	0.301	0.222	0.041
CV	3.498	16.454	15.17	2.543	6.705	85.158	51.964

True Density

The maximum and minimum value oftrue density of Jamun fruits was found to be 1.25 g/cm^{3}and 0.833g/cm^3, respectively. The average truedensity was found to be 1.062g/cm^{3}with 0.175g/cm^3 standard deviation.

Porosity

The maximum and minimum value ofporosityofJamunfruits was found to be 60.65% and 41.05%, respectively.The average porosity of Jamunfruit was found to be 52.99 % with 8.042% standard deviation.

Angle of Repose

The maximum and minimum value ofangle of repose of Jamun fruits was found to be 40.61°and 39.61°, respectively. The average of angle of repose was found to be 40.61° with 1.033° standard deviationat moisture content of 71.11 % (wb).

Colour of Fruits

Colour of Jamun fruits were measured in terms of L, a, b value with help of chromameter (CR-400) (Table 3).The maximum and minimum colour value in terms of L, a, b of Jamun fruits was found to be26.94,5.12, 0.71 and 20.18,-0.02,-0.5, respectively. The average value of L, a and b was found to be 24.548,1.429and 0.431 , respectively with standard deviation1.646, 1.217, 0.224, respectively.

Conclusion

The wet basis moisture content of Jamun fruits was found to be 71.11%. It can be concluded that there was a significant variation in the fresh fruit weight, size, arithmetic mean diameter, sphericity, surface area, bulk density, true density, porosity, pulp content and seed content. The fresh fruit weight, size, arithmetic mean diameter, sphericity, surface area, bulk density, true density, porosity, pulp content and seed content were varied in the range of 3.09 to 6.35 g, 16.06 to 24.07 mm, 16.71 to 24.21 mm, 0.81 to 0.95, 86.5 to 181.92 mm2, 0.464 to 0.507 g/cc, 0.83 to 1.25 g/cc, 41.05 to 60.65%, 53.15 to 80.27% and 17.32 to 38.44%, respectively.

Refereces

1. *Abdullah MR, ChngPE and Lim TH(2011).Some physical properties of Parkia speciosa seeds. Int ernational Conferenc on Food Engineering and Biotechnology, IPCBEE, IACSITPress, Singapor e.*
2. *Bart-PlangeandBaryeh EA (2003).The physical properties of category B cocoa beans.Journal of Food Engineering, 60:219-227.*
3. *Baryeh EA (2001). Physical properties of Bamb aragroundnuts. Journal of Food Engineering,47: 321-326.*
4. *Dinesh kumar V and Anandakumar S (2016) Physical and engineering properties of turmeric rhizome.Journal of Food research and technology 4(1):30-34.*
5. *Dutta SK, Nema VK, Bhardwaj RK (1988). Physical properties of grain. J. Agric. Eng. Res., 39:259-268.*
6. *KashaninejadM, Mortazavi A, Safekordi and Tabil LG (2006). Some physical properties of Pistachio (Pistaciavera L.) nut and its kernel. Journal of Food Engineering,72:30-38.*
7. *Mohsenin NN (1980).Physical properties of plant and animal materials. Gorden and Breach Science Publication, New York.*
8. *Paul DK and Shaha RK(2004).Nutrients, vitamins and mineralcontent in common citrus fruits in the northern region ofBangladesh.Pakistan Journal of Biological Sciences, 7: 238-242.*
9. *VijayanandP,Jagan L, RaoMandNarasimham P (2001).Volatileflavour components of Jamun fruit (Syzygiumcumini L). FlavourFragrance Journal, 16 (1): 47-49.*
10. *Ranganna S (2004). Handbook of analysis and quality control for fruit and vegetable products (2nd Edn).TMH Publishing Company Ltd., ISBN-10: 0074518518.*
11. *Stroshine R (1998). Physical properties of agricultural materials and food products. Course Manual, Purdue University, USA.*
12. *Topuz A, Topakci M, CanakciAIandOzdemir F (2005).Physical andnutritional properties of fourorange varieties.Journal of Food Engineering, 66: 519-523.*
13. *ShahnawazM and Sheikh SA (2011). Physiochemical characteristic of Jamunfruit. Journal of Horticulture and Forestry, 3(10):301-306.*
14. *ShahnawazM, Sheikh SA and Nizamani SM (2009). Determinationof nutritive values ofJ amun fruit(Eugenia jambolana) products. Pakistan Journal of Nutrition,8(8):1275-1280.*
15. *www.icargoa.res.in*