

# Firmness Evaluation of Freshly Harvested Bottle Gourd Fruits using Penetrometer

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## Abstract

The bottle gourds are unique fruit vegetables composed of varied types of fleshed that play a critical role in the perception of firmness. The firmness may serve as an indicator of processability to the food processor and of eating quality to the consumer. Various investigations were conducted to evaluate important physical properties of freshly harvested bottle gourd fruits and also to assess the firmness of freshly harvested bottle gourd fruits so as to develop the relationship between physical characteristics and firmness of freshly harvested bottle gourd fruits. Fifteen freshly harvested bottle gourd fruits (cv. ABG-1) were selected randomly for determining their physical properties. The Magness-Taylor fruit firmness tester (type: 53201) was used to evaluate the firmness. All the routine calculations like obtaining mean value, standard deviation and also correlating different physical parameters to fruit firmness were done for each of the test using Microsoft Excel 2007 programme. From the data, the significant relationship between various physical parameters and fruit firmness was observed. It was noted that the firmness of fruit was reduced with the increase in length of fruit while the increase in fruit width increased the fruit firmness. Hence, the fruits having comparatively more width and less length will be better in firmness. Also, the fruit of comparatively lower weight are better than the fruits of heavy weight from the firmness point of view.

**Keywords:** Bottle gourd; Physical characteristics; Firmness; Fruit quality; Penetrometer.

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## Introduction

The fruits of bottle gourd (*Lagenaria siceraria* (Mol.) Standl.) are used as a vegetable and for making sweets (e.g., *halva*, *kheer*, and *burfi*) and pickles. As a vegetable, it is easily digestible, even by patients. The fruit has a cooling effect and is a cardiac tonic. The pulp is used for overcoming constipation, cough and night blindness. The fruits are fleshy, light greenish in colour and vary widely in shape and size. The bottle gourd fruit contains 0.2 g protein, 2.5 g carbohydrates, 0.1 g fat, 0.5 g mineral

matter, 0.3 mg thiamine, 0.01 mg riboflavin, 0.2 mg niacin and 12 kcal energy per 100 g fresh weight (Gopalan *et al.*, 1982). The bottle gourds are unique fruit vegetables composed of varied types of fleshed that play a critical role in the perception of firmness. The firmness is one of the principal quality characteristics for most vegetables. It is the most important quality characteristic of bottle gourd while in other vegetables it takes second place behind colour (as in tomatoes and beets) or flavour. Fruits and vegetable texture properties and requirement are dependent upon the product itself, as well as, subsequent use or consumption. The same fruits or vegetable may be consumed raw or cooked, whilst different varieties and stages of maturity will result in different physical properties and ultimately expectations from the consumer or processor.

The firmness may serve as an indicator of maturity or processability to the food processor and of eating quality to the consumer. The measurement of bottle gourd firmness is not

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as straightforward as one might imagine, in part because of the number and diversity of physical and chemical properties falling under the designation of firmness and in part because of the discontinuous and varied nature of fleshy tissues themselves. Several techniques for quality evaluation based on the detection of various physical properties of horticultural products have been developed. As each of these methods is based on measuring a given physical property, the effectiveness of the method depends on the correlation between the measured physical property and the quality factor of interest. Although several researchers developed relationships between physical properties and quality factors for a number of horticultural products, firmness is the property that is often used for evaluating fruit quality.

Bourne (1980) has reviewed various objective methods for measuring textural properties of foods and classified them on the basis of their physical variable(s) being measured. Jackman *et al* (1990) and Marangoni *et al* (1995) also evaluated firmness of tomato using the flat plate compression method while Soltani *et al* (2010) predicted banana quality during ripening stage using capacitance sensing system. Fekete and Felföldi (1994) reported four rapid penetration methods where the values of force or deformation were measured. Studman and Boyd (1994) also evaluated firmness in different fruit and vegetables using penetrometer. Duprat *et al* (1995) used a multi-purpose penetrometer based on a high accuracy measurement of deformation and force to estimate fruit firmness. Dobrzański and Rybczyński (1997) developed a new

firmness meter for fruit quality grading. Looking to the available literature it was found of interest to evaluate the physical properties and firmness of freshly harvested bottle gourd fruits using the penetrometer and also to develop the relationship between various physical parameters and firmness.

## Methods

The freshly harvested bottle gourd fruits of Anand Bottle Gourd -1 (ABG-1) cultivar were procured from Vegetable Research Station (VRS) of Junagadh Agricultural University, Junagadh (Gujarat). Fifteen freshly harvested bottle gourd fruits were selected randomly for determination of their physical properties. The Magness-Taylor fruit firmness (pressure) tester (type: 53201) was used to evaluate the firmness of freshly harvested bottle gourd fruits. All the routine calculations like deriving maximum, minimum and mean value and also to find out the standard deviation were done for the each of the test mentioned above using Microsoft Excel 2007. Also, the physical parameters were correlated with the firmness using the same programme.

## Results and Discussion

The physical properties like fruits diameter, effective fruits length, effective fruits width and total fruits weight of the freshly harvested bottle gourd fruits utilized in the investigations were measured using the standard procedures and equipments. The analyzed data are

**Table 1: Physical and firmness characteristics of freshly harvested bottle gourd fruits (Cv. ABG-1)**

Particular	Variable				
	Fruit diameter (mm)	Fruit length (mm)	Fruit width (mm)	fruit weight (g)	Firmness (kgf)
Minimum	52.45	234.55	57.19	376.54	5.4
Maximum	65.68	365.91	83.24	737.58	7.8
Mean	58.22	309.86	67.25	560.00	6.4
SD	3.63	38.88	7.81	98.05	0.7
CV, %	6.24	12.55	11.62	17.51	11.37