Using Local Materials in Traditional Storage of Mango (Mangifera indica L.) Fruits in Sudan

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Abstract- This investigation was carried out at the Department of Agricultural Engineering, Faculty of Agricultural and Natural Rescores, University of Bakht Er-Ruda, Ed Duiem, Sudan. The objectives of this investigation were to design two stores from local materials for mango fruits and study the effect of these stores in prolonging the storage period and fruit firmness and colour of fruits. Among traditional stores, Jute store showed the lowest temperature. Furthermore, the store made from jute material obtained the highest value of the relative humidity compared with the other stores. Mango stored in Jute showed significant increase in storage period and fruit firmness and delay colour change.

Index Terms- Mango, Jute, Bamboo, Temperature, Relative Humidity, Storage period

I. INTRODUCTION

A mango fruit (Mangifera indica L.) is an important and very popular tropical fruit throughout the world and India is leading world production[1]. In Sudan the total mango cultivated area was 0.03 million hectares produced 0.64 million tons in 2012[2]. Sudanese cultivates more than 40 varieties of mango [3].The largest producing area is Abu-Gepaha in western Sudan. Mango is the leading Sudanese horticultural export crop[4].

Mango fruits are classified according to its respiratory behavior, as a climacteric fruits as stated by [5]. In mature green mango, after harvesting, the ripening process takes 9-12 days[6], during which, the fruits should be stored at temperatures of 10o C -12o C and relative humidity 85%-90%[7]. Mango fruits have highly perishable and possessing a short shelf life which limits the long distance commercial transport[8].

The basic principle of storage fruits and vegetable is that the products are cooled through evaporation units. When water evaporates, it draws energy from its surroundings, producing a considerable cooling effect. There are many different types of evaporative coolers stores designed used on the available materials to store fruits and vegetables such as straw, wire mesh, saw dust, burlap, brick, sand, bamboo gunny bags and lofa (bath brush) as a filling material[9, 10]. The evaporation processing done as simple technology and practices without using fan if the unit is kept shaded and used a well-ventilated area to reduce losses and extend storage life of fruits and vegetables. There are many storage methods to preserve or extend the shelf life of fruits, like natural or field storage, forced air cooling, hydro-cooling and cooling storage room[9].

Due to poor post-harvest practices and lack of proper storage facilities, mango losses are estimated between 20%-35% and sometimes jumped over 60% [10]. Techniques of prolonging shelf life of mango fruits are costly and may not be readily available to local farmers[11]. Furthermore, cold-storage is potentially problematic due to high cost and lack of electric energy in many production areas. Therefore, there is a great need to develop affordable means for prolonging the shelf life of mango and reduce the quality losses. This work is aimed to design tow traditional stores made from Jute and Bamboo and compare them with ambition temperature. Furthermore, study the effect of these stores in prolonging the storage period and fruit firmness and colour change in mango fruits.

II. MATERIALS AND METHODS

This study was carried out at the Department of Agricultural Engineering, Faculty of Agriculture and Natural Resources, University of Bakht El Ruda, Elddium, Sudan. Two stores were designed from traditional materials (Jute and Bamboo) to store mango fruits. The stores were constructed with a wooden frame with an entrance door. One store was covered with Jute, while the other was wrapped with Bamboo sheets. The walls of the store were wetted twice daily at 07:00 and19: 00 with a predetermined amount of water (500 ml). Two environmental factors, air temperature (o C) and relative humidity (%) at three different locations of store at the entrance, middle and exit inside the stores were measured. The measurements were made during the day at 7:00am, 11:00 am, 15:00 pm and 19:00 pm using a digital Thermo-hygrometer. All the readings were triplicates and the average value at each temperature and relative humidity were determined.

Fruits at the mature green stage of Kitchener cultivar were sorted for uniform size and absence of mechanical damage. Fruits were washed, air-dried and placed in carton boxes and divided into three equal groups. The boxes were kept inside the tow traditional stores and third group of boxes was kept outside at the room temperature as a control. The experiment was arranged in a completely randomized design with three replications. The storage period was recorded. Color was visually assessed using a scale of 1 to 4 as follows:

1: Yellow, 2: Light yellow, 3: Light green and 4: Light green.

Firmness was evaluated by measuring the resistance of fruit to hand pressure using a scale of 1 to 4 as follows:

1: Very soft, 2: soft, 3: fairly soft and 4: Fairly firm.

Data were subjected to analysis of variance using MStatC computer program.

III. RESULTS AND DISCUSSION

Environmental Factors Affecting the Traditional Stores:

a. Temperature:

The mean values of the air temperature, (°C) measured at the three different locations entrance, middle and exit for inside the traditional stores are shown in Figure (1). There were no a clear difference in location data. The lowest value was obtained from jute store at different times throughout the experiment mainly at 7:00 am and 19: pm (22.8° C and 29.5° C), respectively, after wetting operation, while the highest values were observed at 15:00 pm time for all the stores designed. The bamboo and control stores were attained the higher values compared with jute store (38.6 C°, 39.9 C°36.8C°), at the same time.

Comparison between the different traditional stores regarding the temperature factor determined as presented in fig. 2 indicated that Jute store was the lowest one. This result indicates a lower temperature had effectiveness on quality of mango samples. Similar results of evaporative cooling unite designed were observed in storage different types of fruit and vegetables[9, 10].

b. Relative humidity:

The store that made from wetting jute material reached the highest value of the relative humidity at the different locations and during the experiment compared with the other stores as presented in fig.3 and fig 4.This result showed that the evaporative cooling store increased the relative humidity to a satisfactory level that suite the storage life of mango fruits for nine days, compared to the outside as control store the fruits damaged after 5day.

Using the conditioned air for the wetting walls of jute material at least twice daily preserved the quality of fruits. This finding is similar to results reported by [9] and [10]who worked on traditional materials used in different stores to storage some fruits and vegetables.

Storage period:

Different local materials in mango storage showed a significant increase in storage period (Fig. 5). The highest storage period was obtained when fruit stored in jute made store. This is due to decrease of temperature and increase of (RH%) inside jute made store. This finding is in agreement with findings that obtained by (12) who reported that decreasing of temperature increasing the storage life of mango fruit.

Product temperature, an important factor that affects post-harvest life has a

A profound effect on the biological reactions. Low temperature storage is usually used to prolong the storage period of fruit and vegetables. For every 10 °C reduction in temperature, the shelf life, in general, double [13]

Fruit firmness:

The different storage materials showed significant increase in fruit firmness (Fig.3). Control showed deterioration in fruit firmness while fruit stored in jute showed retention in fruit firmness. Firmness is one of the important quality parameters that play a significant role in fruit selection by the consumer. This trend of fruit firmness is due to the cell wall digestion by pectin esterase, polygala cturonase, and other enzymes and this process were decreased by decreasing in storage temperature [14].

Fruit colour:

In the present study, the color of the fruits was significantly different regardless of the storage materials (Fig. 3). Ambition temperature showed a less colour change compared with other storage materials. This may be due to decrease of temperature and increase of relative humidity in these materials. This finding is in line with [15] reported that the rate of skin color development differs between the variety and the maturity of the fruit, and depends on the storage conditions, particularly temperature.

IV. CONCLUSIONS

The use of jute material in the present study showed a significant increase in mango storage period and reduced firmness and colour change. The jute is affordable material and easy to use in small-scale farm to prolong the shelf life and retain the fruit quality due to reduce the temperature and increasing the relative humidity by watering the jute regularly. More research must be done by using jute to study its effect on weight loss and chemical attributes.

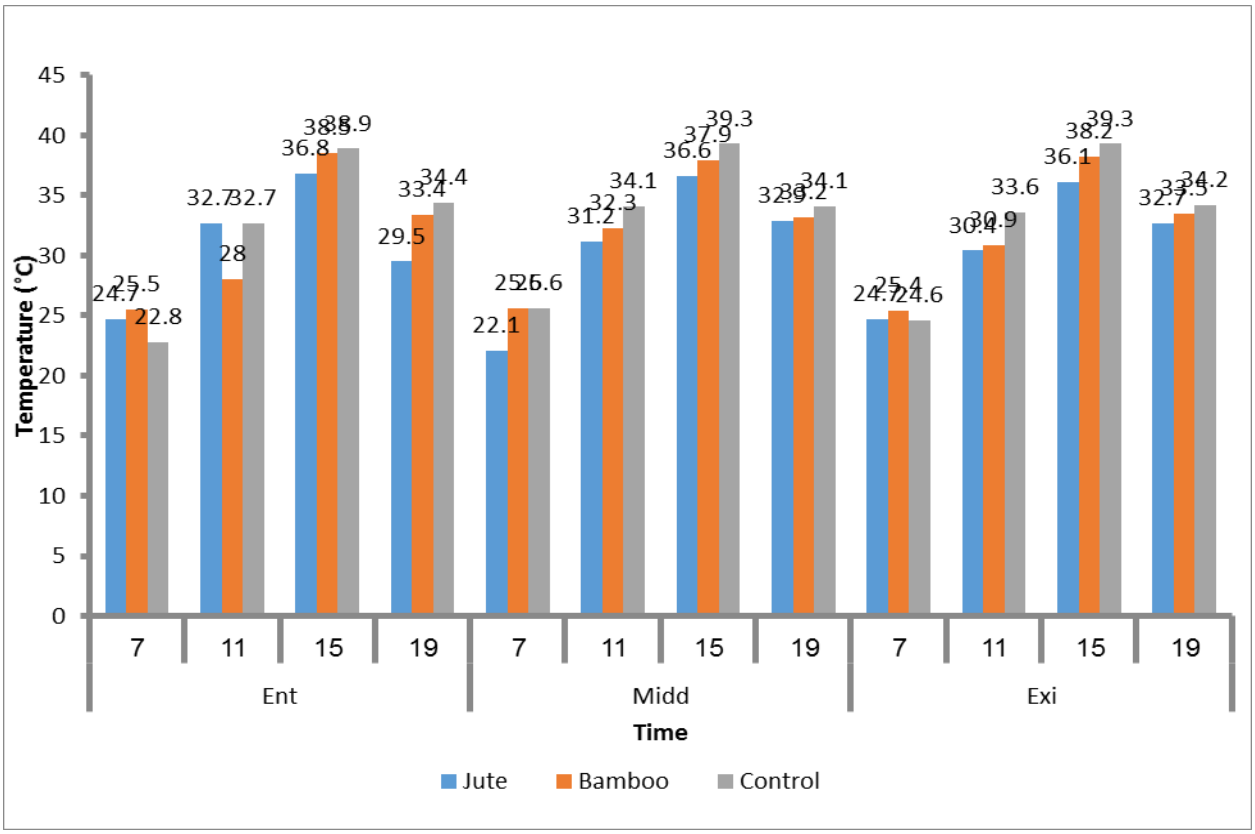

Fig. (1) Temperature at different time on the three traditional stores.

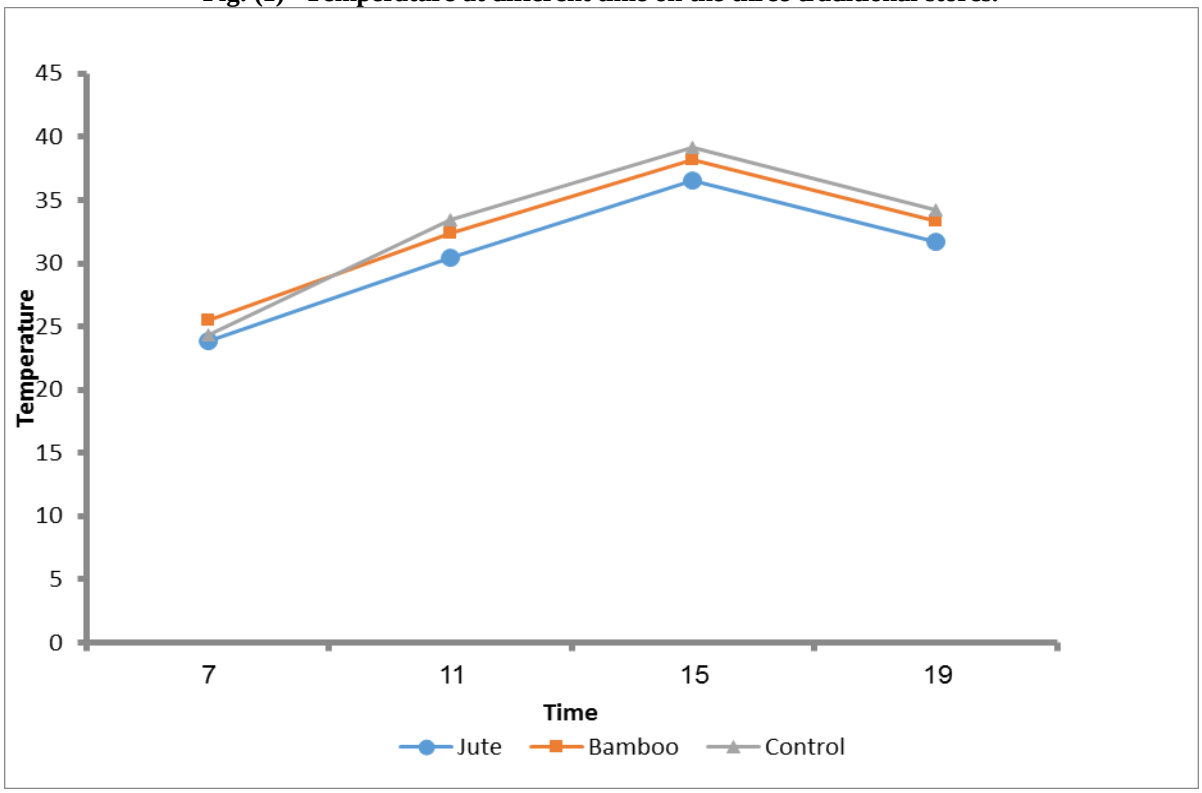

Fig. (2) Temperature in different traditional stores

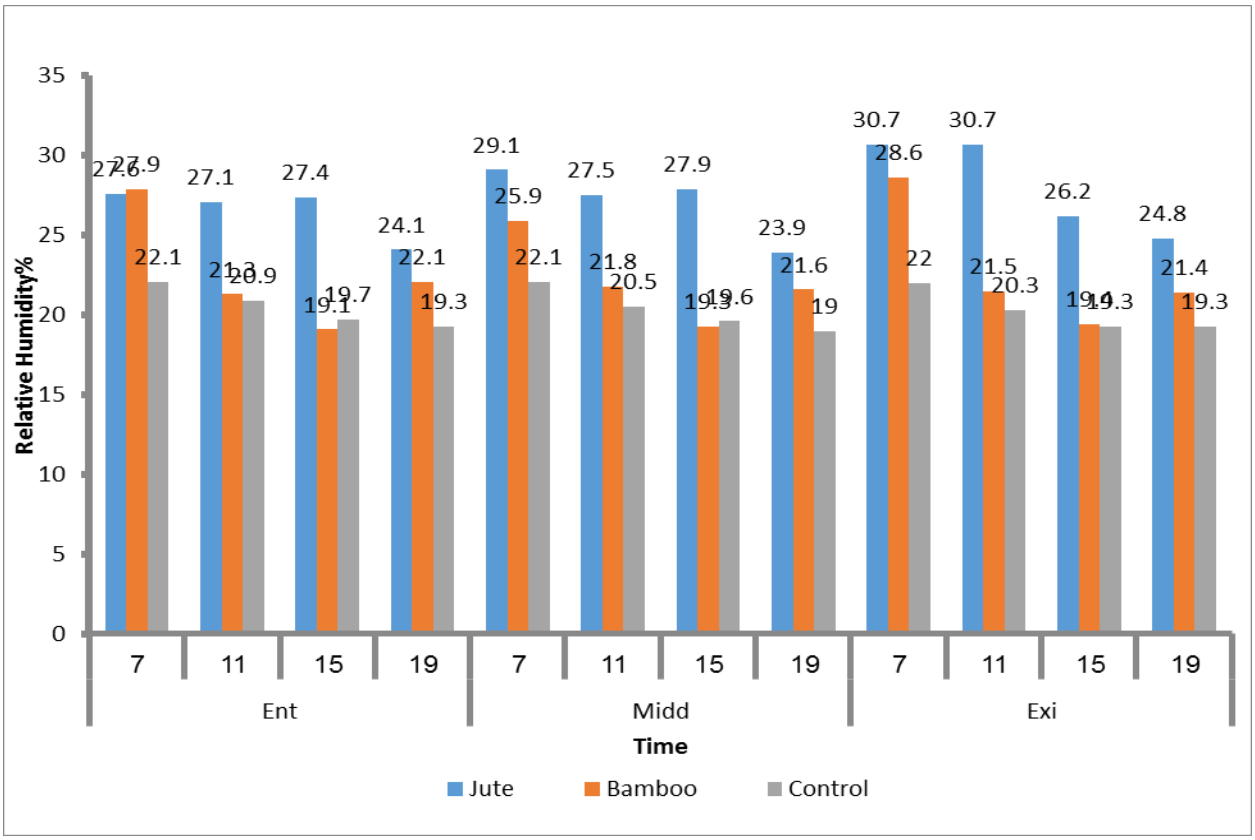

Fig. (3) Relative humidity (%) at different time on the three traditional stores.

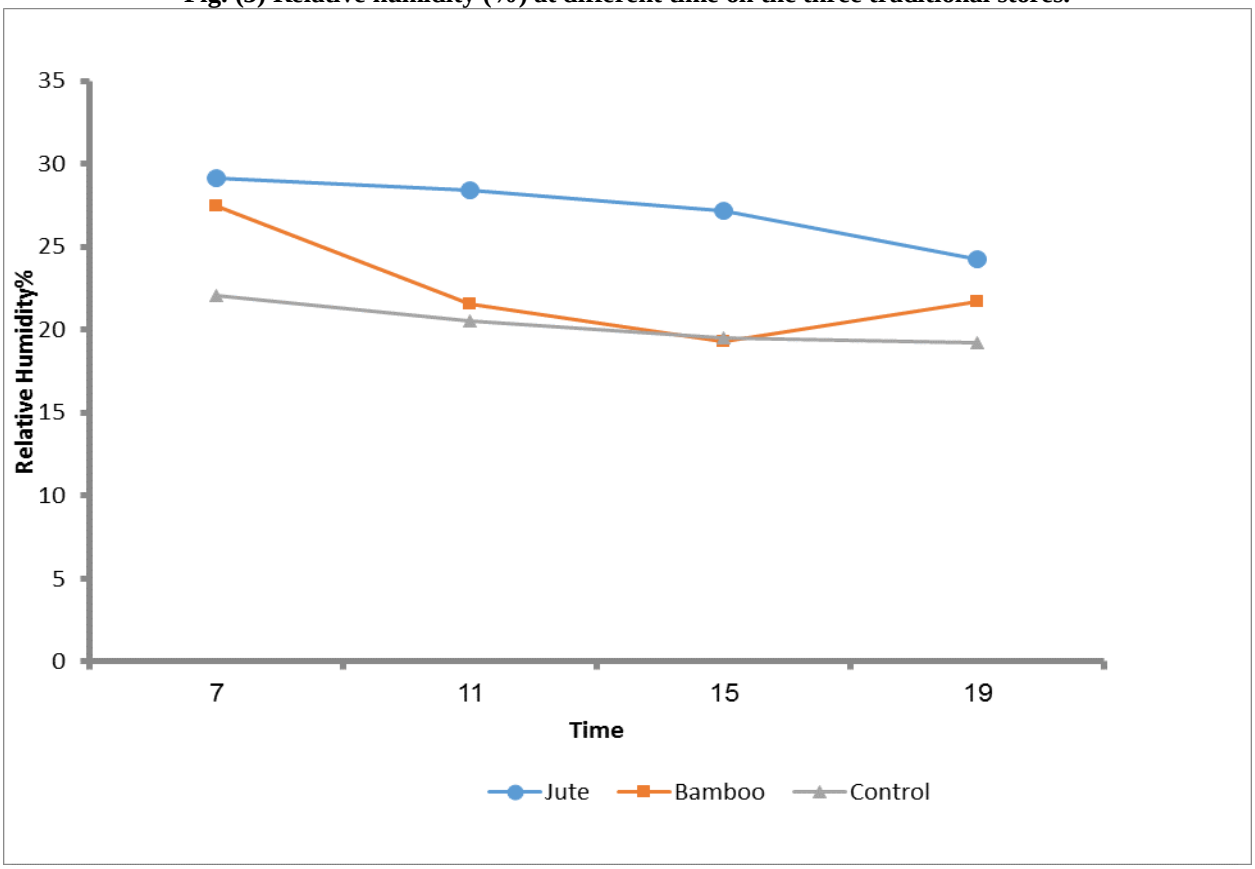

Fig. (4) Relative humidity (%) in different traditional stores.

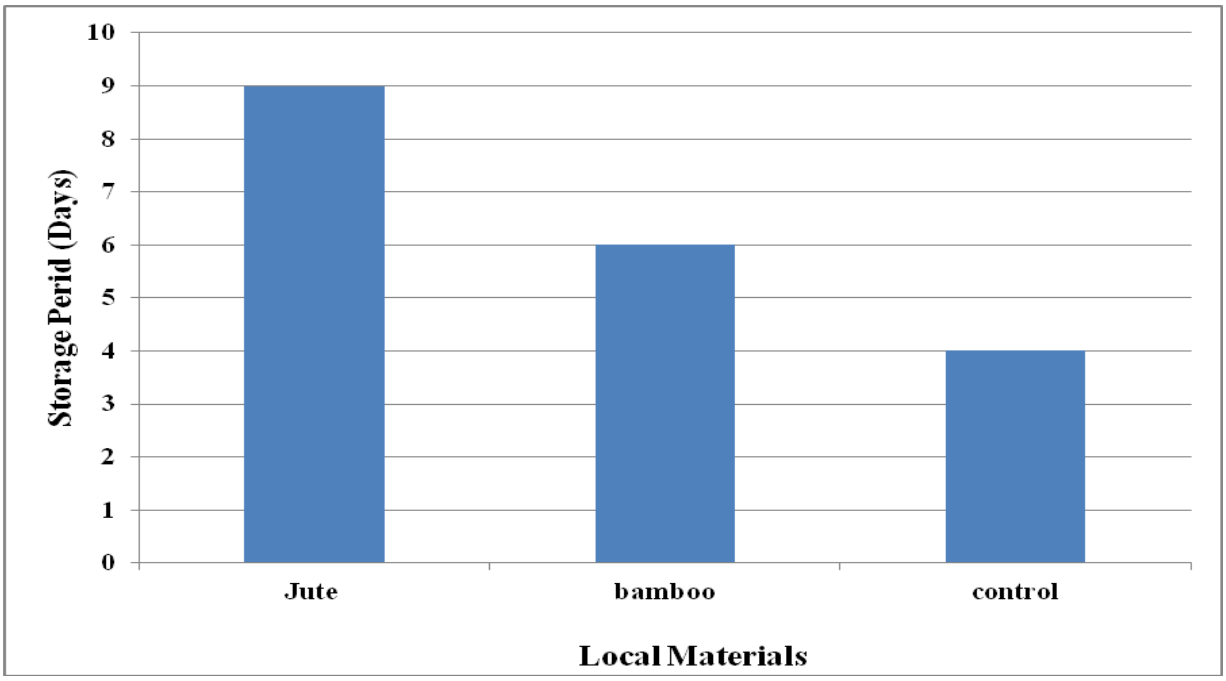

Fig (5): Effect of different local materials on storage period of mango fruit

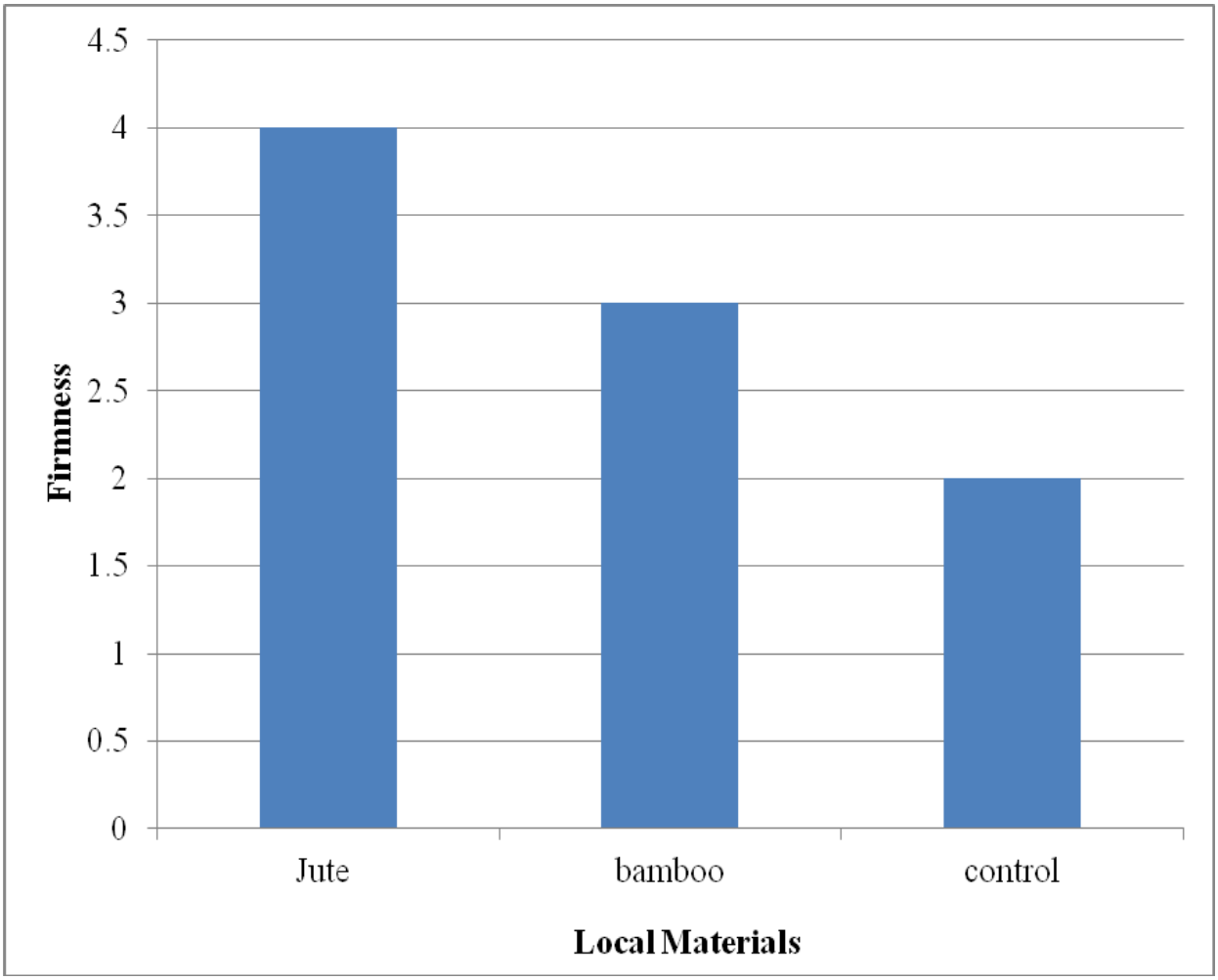

Fig (6): Effect of different local materials on mango fruit firmness at the last day of storage

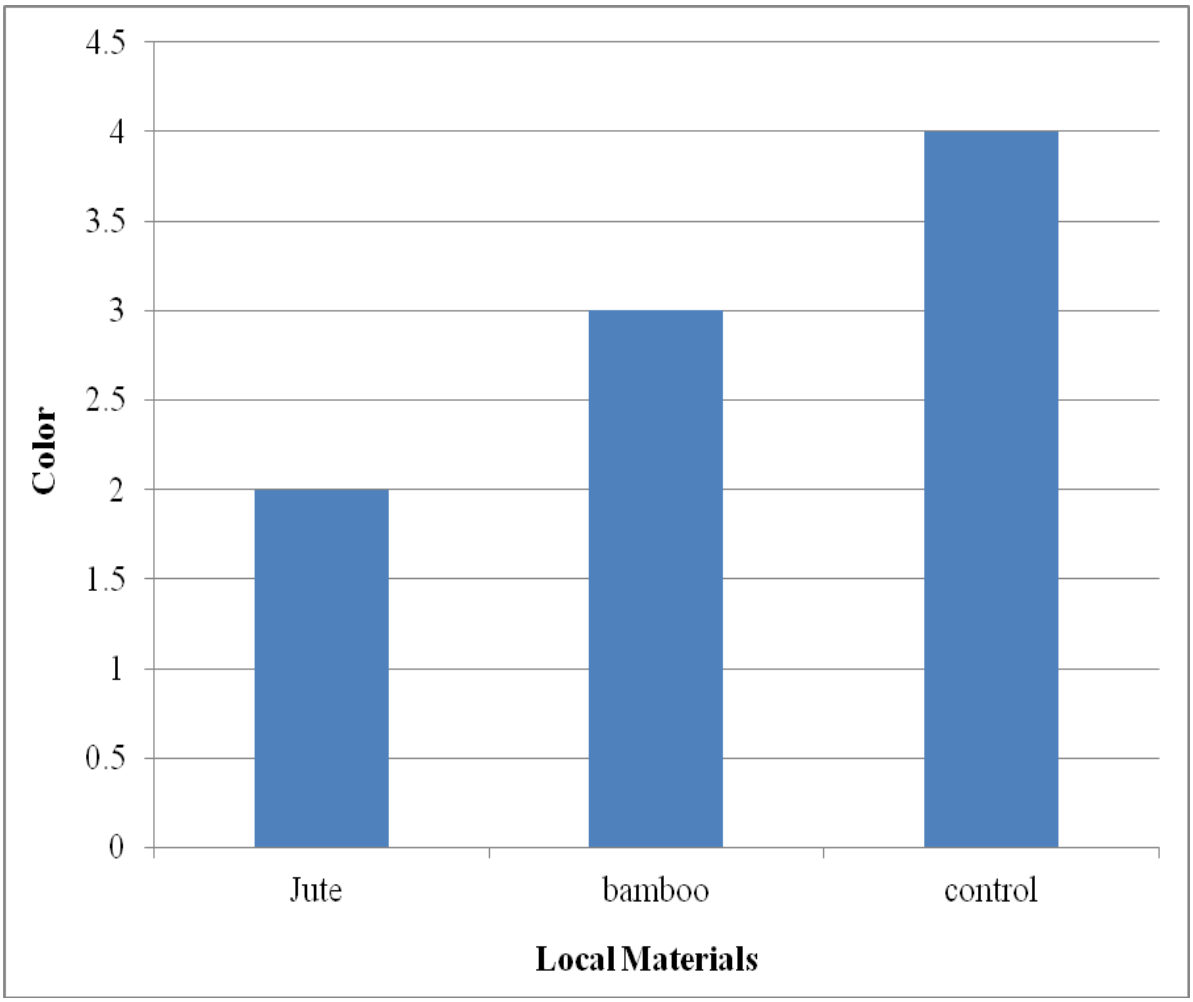

Fig (7): Effect of different local materials on mango fruit colour at the last day of storage

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