Banana (*Musa sapientum*) Peels As A Potential Ripening Agent For Its Fruits

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ABSTRACT

Commercial ripening is an essential part of the fruit business, as ripe fruits are not suitable for long storage due to their fast-decaying nature. Therefore, fruit traders pick unripe fruits and distribute them early. Thereafter different methodologies are used to fasten the ripening process of fruits. The present study is aimed at investigating the efficacy of the use of banana peel as a ripening agent for its fruit. Ripe banana peel and unripe banana were obtained from Anyigba market in Kogi state, Nigeria. The peels were weighed (25g, 50g, and 100g) and subsequently bagged with 5 unripe bananas (about 118g each), including control (without banana peel), all in triplicates and stored in a dark cupboard for 96 hours. One banana from each replicate was assessed for sugar content and texture as ripening parameters after every 48 hours. The results revealed that the bananas within treatment groups were riper with significantly ($p < 0.05$) higher sugar content (117.70 ± 5.67, 119.59 ± 14.44 and 104.98 ± 14.26 mm/dL at 25g, 50g and 100g, respectively) than the control (35.90 ± 12.90^a mm/dL). Also, banana fruits treated with banana peels were significantly lower in texture (4.25 ± 0.55^b, 5.65 ± 1.15^b and 4.50 ± 0.10^b cm at 25g, 50g and 100g, respectively) than the control (10.65 ± 0.15^a cm). From the study, it can be concluded that banana peels hastened the ripening process of bananas and may be exploited by local farmers as a cheaper and eco-friendlier method.

KEYWORDS: Artificial Ripening; Commercial Ripening; Senescence; Fruit Farmers.

ABBREVIATIONS

M.: Musa, ANOVA: Analysis of Variance, DMRT: Duncan Multiple Range Test, SD: Standard Deviation, SPSS: Statistical Software for Social Sciences, IBM: International Business Machines,

1.0 INTRODUCTION

Fruit ripening (senescence) is a natural process that begins once fruits are fully mature, ensuring sweetness, flavor, aroma, color, softness and palatability [1-3]. This occurs as a result of different chains of physiological and biochemical processes [4]. With consumers' growing demand for fruits, most producers have adopted artificial methods, using either artificial or natural agents for fruit ripening. They capitalize on the advancement in science and technology as against the normal event initiated naturally by ethylene (a natural plant hormone).

However, the use of artificial agents like calcium carbide, ethylene glycol, acetylene, ethephon, and kerosene has been linked to a number of health issues, for example, acute renal failure from the use of ethylene glycol [5,6], hypoxia from acetylene [7], skin burn and fatal systematic poisoning from ethephon [8], pulmonary injuries from kerosene [9] and diarrhea, burning sensation, eye irritation, skin ulcer, shortness of breath from Calcium carbide among others [10,11]. These have necessitated the need for natural agents as safer alternatives.

Banana (*M. sapientum),* a herbaceous plant of the Musaceae family, is not spared in the use of artificial agents in its ripening. Banana is the world's second most important fruit crop [12]. It is rich in vitamin C, B6, minerals and dietary fiber. They are also a rich energy source. Usually, bananas are not allowed to ripen on trees as it takes longer time amidst other reasons. Pedapati [13] reported that banana fruits left on trees fail to develop good color and aroma. Hence, the marketable quality deteriorates, so bananas must be ripened artificially.

Artificial banana ripening can be seemingly triggered naturally by the ethylene released from the peel/rind of its fruits. A report from Moirangthem and Tucker [14] suggests that ripe bananas placed beside unripe ones can initiate ripening in the

unripe ones. Banana peels that fall under agricultural wastes are renewable and can be valuable [15]. Environmental pollution can be minimally curbed if its use as ripening agent is widely accepted. The use of natural agents is considered safer, cheaper and eco-friendlier as opposed to artificial agents.

Fruit sellers pick up unripe fruits and use several methods to hasten ripening, including calcium carbide. Fruits ripened with calcium carbide are too soft, has less flavor and taste, and develop uniform, attractive surface color, but the tissue inside may remain unripe. When fruits are very unripe, they will need excess application of carbide, and they tend to become more tasteless, unhealthy and even toxic [11].

This study aims at investigating the use of banana peel as a natural ripening agent for its fruits and equally suggest its practicability on other fruits.

2.0 METHOD(S)

2.1 COLLECTION OF SAMPLES

Samples of unripe fruits (banana) were obtained from the fruit market in Anyigba, Kogi state, which lies between latitude 7˚15' - 7˚29' N and longitude 7˚11' - 7˚32' E. Ripe banana peels were obtained from ripe bananas purchased from the same market.

2.2 EXPERIMENTAL DESIGN

The unripe fruits of about the same size (about 118g each) were placed together with ripe banana peels in black polythene bags, labeled accordingly (Figure 1) and kept in a dark cupboard all through the time of the experiment (96 hours). All treatments were carried out in triplicates.

Fruit	Treatments	
BANANA	I	Five unripe bananas (Control).
	II	Five unripe bananas + 25gram ripe banana peels.
	III	Five unripe bananas + 50gram ripe banana peels.
	IV	Five unripe bananas + 100gram banana peels.

Figure 1: Experimental design.

2.3 ASSESSMENT OF REDUCING SUGAR

One fruit from each treatment unit was assessed every 48 hours for reducing sugar. Two grams of each fruit sample was pulverized (using a laboratory mortar and pestle) to a uniform consistency; to create a thin paste, the sample was then diluted with 10 ml of deionized water to make a fruit mixture. The sugar content of these fruit mixtures was assessed using the GOD-PAP ASSAY method [16].

2.4 ASSESSMENT OF TEXTURE

Banana texture measurements were taken after every 48 hours with a vernier caliper. The caliper was placed at the banana's center, the force was applied until it became tightly held to the banana, and the caliper reading was taken in centimeters. A higher vernier caliper reading suggests a harder texture and vice versa [17].

2.5 STATISTICAL ANALYSIS

Values were expressed as mean ± SD. One-way ANOVA was used to compare the mean of corresponding parameters (reducing sugar and texture) and measured for each treatment; $p < 0.05$ was considered significant; DMRT was used to separate the mean where significant. SPSS version 20 by IBM was used in the computation of results.

3.0 RESULTS

The effect of banana peels on the sugar content of banana fruit is presented in Table 1. At 0 hrs, there was no significant difference in the sugar content ($p > 0.05$) of treatment groups (25 g, 50 g and 100 g of ripe banana peels) compared to the control. After 48 hrs, the sugar content of the treatment groups was significantly higher ($p < 0.05$) than that of the control (35.90 ± 12.90 mm/dL), and there was no significant difference ($p > 0.05$) in the sugar content within the treatment groups (117.70 ± 5.67, 119.59 ± 14.44 and 104.98 ± 14.26 mm/dL respectively). At 96hrs, the sugar content of all the treatment groups was significantly higher ($p < 0.05$) than that of the control (87.24 ± 28.76 mm/dL), and there was no significant difference in the sugar content within the treatment groups (191.52 ± 24.01, 202.35 ± 2.71 and 201.27 ± 13.54 mm/dL respectively).

Table 1: Sugar composition of banana fruits (*M. sapientum*) ripened with banana peel (sample) and banana fruit ripened without banana peel (control).

	Sugar Content (mm/dL)		
Treatment(g)	0 hrs	48 hrs	96 hrs
0	5.40 ± 0.60^a	35.90 ± 12.90^a	87.24 ± 28.76^a
25	5.41 ± 0.41^a	117.70 ± 5.67^b	191.52 ± 24.01^b
50	5.40 ± 0.28^a	119.59 ± 14.44^b	202.35 ± 2.71^b
100	5.40 ± 1.40^a	104.98 ± 14.26^b	201.27 ± 13.54^b

Values with different superscript alphabets across the rows are considered significantly different ($p<0.05$).
Values are Mean ± SD, Using Independent Sample t-test.

The daily effect of ripe banana peels on the texture of banana fruit is presented in Table 2. At 0 hrs, there was no significant difference ($P > 0.05$) in the texture of treatment groups (25 g, 50 g and 100 g of ripe banana peels) compared to the control. After 48 hrs, the texture of the treatment groups was significantly lower ($p < 0.05$) than that of the control (10.65 ± 0.15 cm), and there was no significant difference in the texture within the treatment groups (4.25 ± 0.55, 5.65 ± 1.15 and 4.50 ± 0.10 cm respectively). After 96 hrs, the texture of the treatment groups was significantly lower ($p < 0.05$) than that of the control (10.00 ± 1.20 cm), and there was no significant difference in the texture within the treatment groups (3.50± 0.00, 2.95 ± 0.05 and 4.00± 0.10 cm respectively).

Table 2: Texture comparison of banana fruit (*M. sapientum*) ripened with banana peel (sample) and banana fruit ripened without banana peel (control).

	Texture (cm)		
Treatment(g)	0 hrs	48 hrs	96 hrs
0	11.20 ± 0.70^a	10.65 ± 0.15^a	10.00 ± 1.20^a
25	11.10 ± 0.70^a	4.25 ± 0.55^b	3.50 ± 0.00^b
50	11.00 ± 0.50^a	5.65 ± 1.15^b	2.95 ± 0.05^b
100	11.15 ± 0.65^a	4.50 ± 0.10^b	4.00 ± 0.10^b

Values with different superscript alphabets across the rows are considered significantly different ($p<0.05$).
Values are Mean ± SD, Using Independent Sample t-test.

4.0 DISCUSSION

Bananas treated with banana peels ripened more and had higher sugar content at the end of the experiment. This could be due to the release of ethylene. Bower *et al*. [18] suggest that a rise in ethylene concentration is considered the main factor for the ripening of bananas. Scott [19] equally opined that bananas make other fruits ripen because they release ethylene gas. The gas

causes the ripening or softening of fruits by the breakdown of the cell wall, subsequent conversion of starch to sugar and the disappearance of acid, hence the increase in sugar content.

Another possible explanation for the ripening of banana fruit treated with banana peels may be associated with an increase in humidity. The banana peels gradually generated moderate humidity at different levels. The interaction of ethylene with humidity shows that ethylene has a greater effect at higher humidity levels than at lower humidity levels [20].

The treatment with banana peels affected the texture of the bananas by softening them. Finney *et al.* [21] explained that hydrolysis of starch to sugar during ripening causes an increase in osmotic pressure in the banana flesh. Further stating that an increase in osmotic pressure is usually associated with a decrease in turgor pressure, which may account for softening during ripening and would cause the firmness to decrease during ripening. Broughton's [20] explanation for the corresponding effect of humidity and ethylene interaction on sugar content is also a plausible reason for this result.

5.0 CONCLUSION

The present study indicates that banana peels can considerably induce ripening in banana fruits. The peels have the potential to exert changes on the textures of the fruit, thereby making it softer than the unripe fruit and increasing the fruit's sugar content by converting starch to simple sugar. Currently, there are so many synthetic products in the market, and some of them have been reported to have adverse effects on the health of consumers. Hence local farmers may consider exploiting ripe banana peels as an alternative means of ripening bananas as this is cheaper and equally eco-friendlier.

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AUTHOR CONTRIBUTIONS

PROE - Provided the Idea for the work, supervised, experimental design and statistical analysis.
GTO – Supervised the work.
RE - Literature review and carried out laboratory experiments.
JOO - Drafted the manuscript.
OO - Carried out laboratory experiments.
VUO, MOM, CNE – Proofread the manuscript.

CONFLICTS OF INTEREST

None.

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