UJMR, Volume 3 Number 1 June, 2018 *ISSN: 2616 - 0668*
https://doi.org/10.47430/ujmr.1831.002
Received: 12th February, 2018 **Accepted: 23rd May, 2018**

MICROBIOLOGICAL STUDIES OF FERMENTED AFRICAN LOCUST BEAN CAKE STORED UNDER GINGER EXTRACT AND ASCORBIC ACID TREATMENT

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Abstract
Daddawa also known as iru, among the Yorubas in South-west Nigeria, is a popular condiment used as taste and flavour enhancer in soup and dishes in Africa. Daddawa is traditionally produced from locust beans (*Parkia biglobosa*) seeds. This work was carried out on the preservation of fermented *Parkia biglabosa* seeds sourced from local producers and laboratory produced. The local and fermented laboratory controlled samples were treated with of Ginger extract 8mg/g and 2.5mg/g of Ascorbic acid. A control experiment was left untreated. The samples were stored at ambient temperature (34ºC and 30ºC) for 30 and 120 days. The analysis consisted of aerobic and anaerobic mesophilic count, Staphylococcus count and Fungal count, detection of *Escherichia coli*, *S.aureu*s, *Salmonella* sp, *Mucor* sp and *Rhizopus* sp. Contaminant isolates were identified from locally produced, laboratory treated and untreated (Control) using standard procedure.The proximate analysis and organoleptic assessment of the purchased, laboratory treated and untreated (control) locust bean cake were carried out using standard procedure.The treated locust bean cake indicated microbial log reduction at120 days due to the effects of the preservatives; the Control shows microbial Log increase in the untreated locust bean cake.Isolated and characterized bacterial isolates at 30 and 120 days in the treated and untreated locust bean cake was *E.coli* only isolated in Kwanar yandaddawa, *Staphylococcus aureus* were isolated in all the purchased Locust bean cake, *Salmonella* sp was not detected and a predominant fungal genera were *Mucor* sp and *Rhizopus* sp. The result indicated 40% elimination of contaminants at Gude,Jogana and Kwanar yandaddawa. The mean proximate composition percentage differences between 30 and 120 days shows nutritional quality of treated locust bean cake. The Organoleptic assessment indicated that the judges rejected control daddawa due to off flavor.
Keywords: African locust bean cake, Ginger extract, Ascorbic acid, Nutritional quality.

INTRODUCTION

Daddawa also known as iru, among the Yorubas in South-west Nigeria, is a popular condiment used as taste and flavour enhancer in soup and dishes in Africa. Daddawa is traditionally produced from locust beans (*Parkia biglobosa*) seeds (Farinde *et al*., 2017).Odunfa (1981) stated that fermented locust bean seed is commonly consumed in Ghana, Nigeria, Sierra-Leone and Togo. In Nigeria it is called iru in Yoruba, dawadawa in Hausa and ogiri `igala in Igbo. It is also referred to as kinda in Sierra-Leone and kpalugu in Ghana. Preservation and preservatives are designed to inhibit/control the activities of spoilage causing organisms in food, a process also referred to as sanitization. Spoilage causing organisms due to their growth and metabolic activities produce by-products, which change the texture, taste, flavor and the aroma of the food. Preservatives by their nature are intended to keep the food devoid of these changes. Preservatives act on both Gram positive and Gram negative food spoilers (Jay, 2000). The general idea of products having preservatives is to increase shelf life and prevent items from spoiling. The more shelf life a product has, the more marketable it becomes. The use of preservatives makes products stay fresher, longer and give more time for products to be used (Bumpres, 2010).

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MATERIALS AND METHODS

The African locust bean condiment was purchased from local producers at the point of harvest at Gude (Sample C), Tofa Local Government Area, Kano State with the bearing of $12^{0}03^{1}N8^{0}16^{1}E/12.050^{0}N8.26$, Jogana/Gezawa Local Government Area (Sample D) with GPS N12° 11^{1} 30.0^{11} E 008° 42^{1} 11.5^{11} elevation 1593ft and KwanarYandaddawa (Sample E), DawakinTofa Local Government Area with GPS N12° 06^{1} 12.8^{11}E 008° 26^{1} 45.1^{11} elevation 1669ft.Laboratory Production of standard Daddawa used as control condiment was done according to the method of Gberikon and Agbulu (2015).In preparing a ginger extract treated daddawa, 8mg of freshly prepared ginger extract was added to 5 g of Daddawa (8mg/5g w/w). For ascorbic acid, treated Daddawa 2.5mg was mixed with 5g of *Parkia biglobosa*Daddawa (2.5mg/5g w/w),the laborarory control (Sample B) was left untreated (Kolapo *et al.,*2007). The microbiological quality (Aerobic mesophilic count,Anaerobic mesophilic count,Staphylococcus count and Fungal count) were determined according to the method of FAO (1992). Microorganisms associated with Daddawa product were isolated and characterized according to the methods of FAO (1992). The proximate analysis of African locust bean cake was conducted according to the procedure of AOAC (2000). The Sensory Quality of the products were determined according to 9 – point Hedonic scales (David, 2005).

RESULTS AND DISCUSSION

It was observed that there was microbial log reduction in the treated African locust bean cake at 120 days and microbial log increase in the untreated (Control) Daddawa (figure 1-8). This is actually due to the fact that the samples treated with ginger extract and ascorbic acid experience moisture reduction which discourage microbial growth and proliferation. Both ginger extract and Ascorbic acid reduced the bacterial load of the stored daddawa samples.These findings are consistent with the works of Kolapo *et al.,* (2007) who also observed microbial reduction in the treated locust bean cake and microbial increase in the untreated sample of Daddawa.Isolated and characterized bacterial isolates before treatment were *E.coli, Staphylococcus aureus, Mucor* sp and *Rhizopus* sp while *Salmonella* sp was not present (Table 1). Isolated and characterized bacterial isolates at 30 and 120 days in the treated and control fermented African locust bean cake were *E.coli* only isolated in Kwanar yandaddawa. The occurrence of *E. coli* in KwanarYandaddawa might be attributed to use of recent feacally contaminated water in the Daddaw a preparation or could be due to unhygienic activities of the Daddawa/Food handlers Bukar *et al.,* (2009) reported that 5(10.0%) out of 50 food handlers in three small scale industries in Kano Metropolis investigated carried *E.coli* on their hands. *Staphylococcus aureus* (was isolated in all the locally purchased Locust bean cake. The *Salmonella* sp was not detected in the Laboratory treated, control (laboratory untreated) and purchased Daddawa. *Salmonella* specie has been reported to be transmitted via water and salmonella carriers as food handlers (Bukar *et al.,* 2012). At 30 days *Mucor* sp and *Rhizopus* sp were the predominant fungal species,this is in line with the findings of Rabi *et al.,* (2013), at 120 days *Mucor* sp and *Rhizopus* sp were detected only in Control Daddawa. The result indicated 40% elimination of contaminants at Gude, Jogana and Kwanar yandaddawa (Table 2). The proximate composition at120 days shows improvement in the nutritional quality of treated locust bean cake (Table 3-4).

The sensory evaluation of the treated samples indicated the effect of the treatments which extended the shelflife of treated sample to 120 days. The organoleptic assessment shows that the judges rejected Laboratory untreated daddawa (Control) as a result of what the panelist termed as "unpalatable taste" due to off flavor (Table5-6). Recently, the use of more natural preservatives has become more popular than the synthetic antimicrobials and antioxidants (Ahn *et al.*, 2007).

Microbial Log Reduction Of African Locust Bean Cake

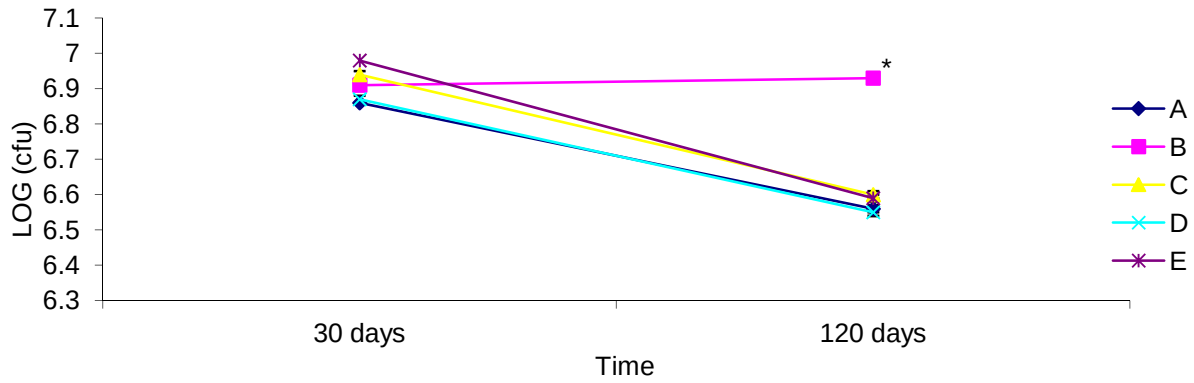

Figure 1: Aerobic mesophilic count reduction of Ginger Extract treated Daddawa (8mg/g)

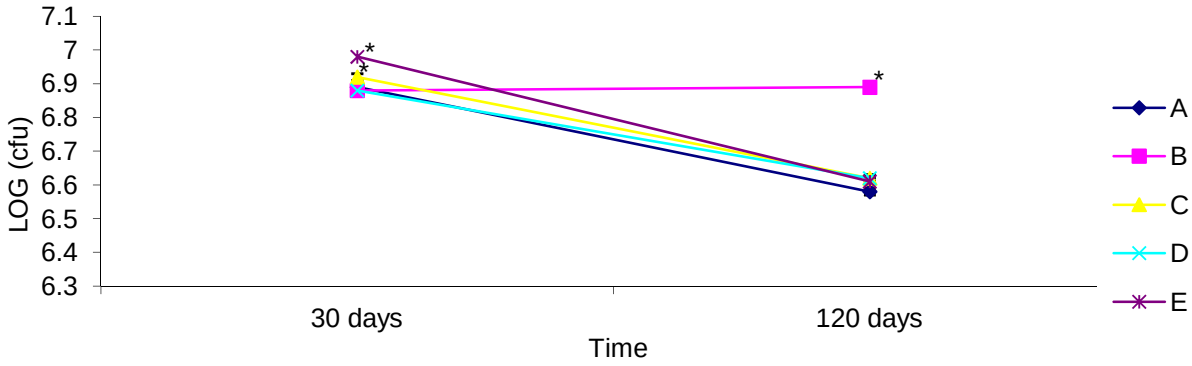

Figure 2: Anaerobic mesophilic count reduction of Ginger Extract treated Daddawa (8mg/g)

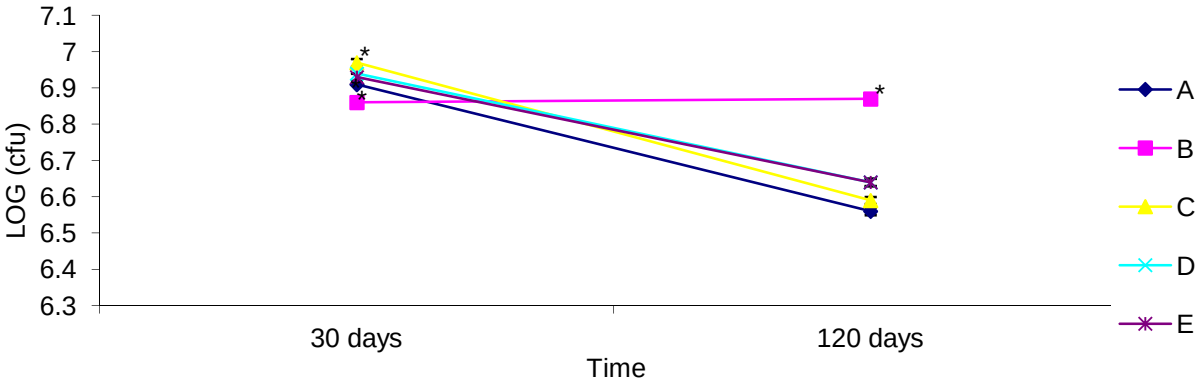

Figure 3: Staphylococcus count reduction of Ginger Extracts treated Daddawa (8mg/g)

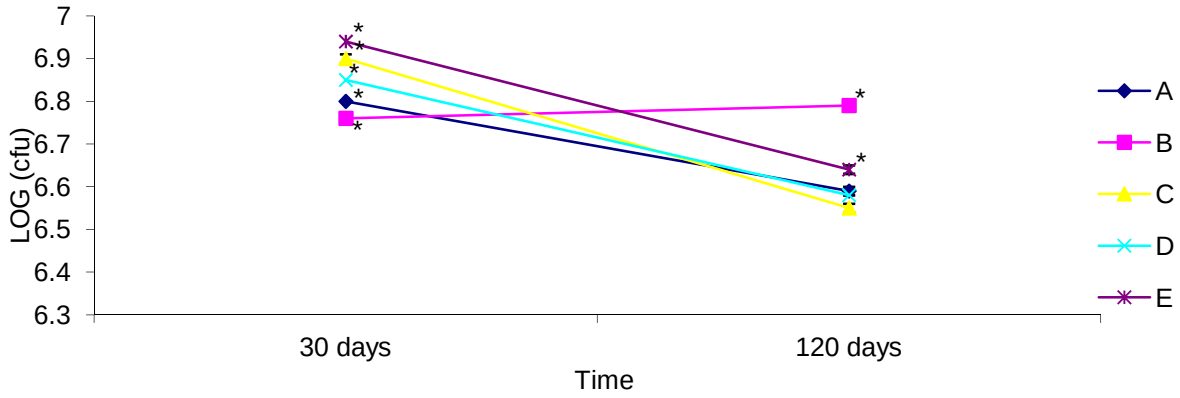

Figure 4: Fungal count reduction of Ginger Extracts treated Daddawa(8mg/g)

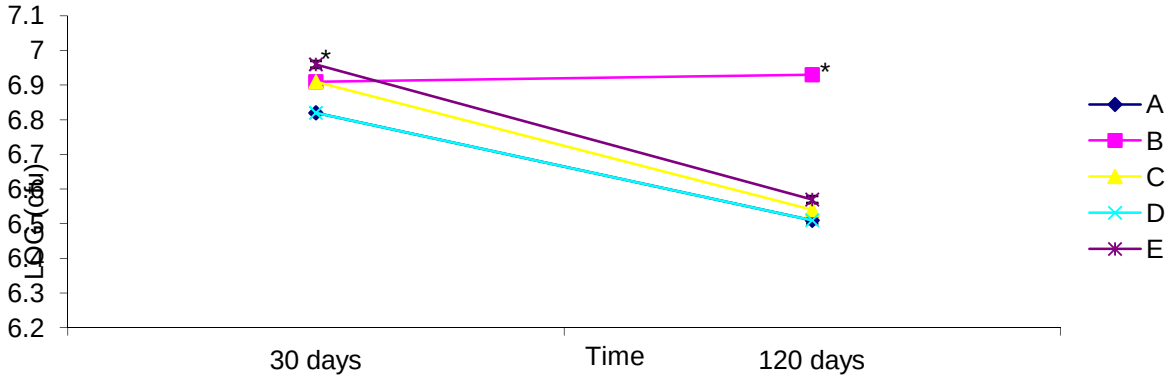

Figure 5: Aerobic mesophilic count reduction of Ascorbic Acid treated Daddawa (2.5mg/g)

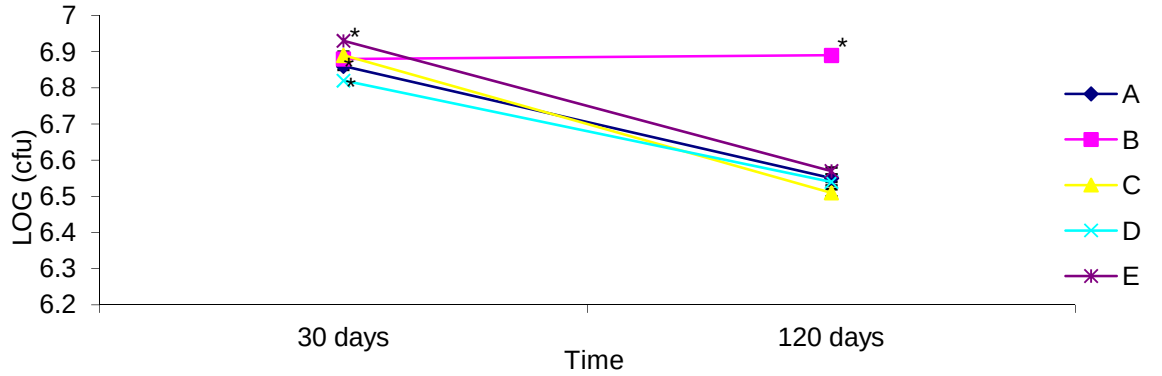

Figure 6: Anaerobic mesophilic count reduction of Ascorbic Acid treated Daddawa (2.5mg/g)

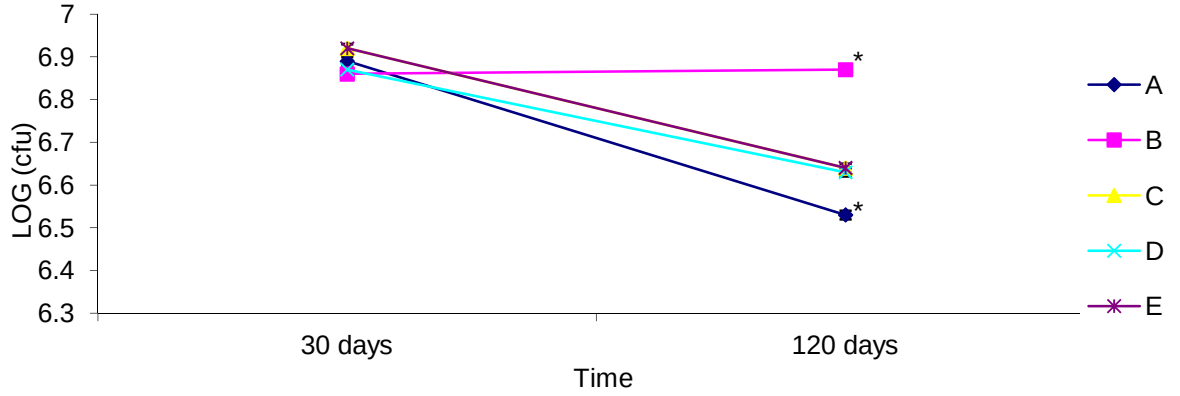

Figure 7: Staphylococcus count reduction of Ascorbic Acid treated Daddawa (2.5mg/g)

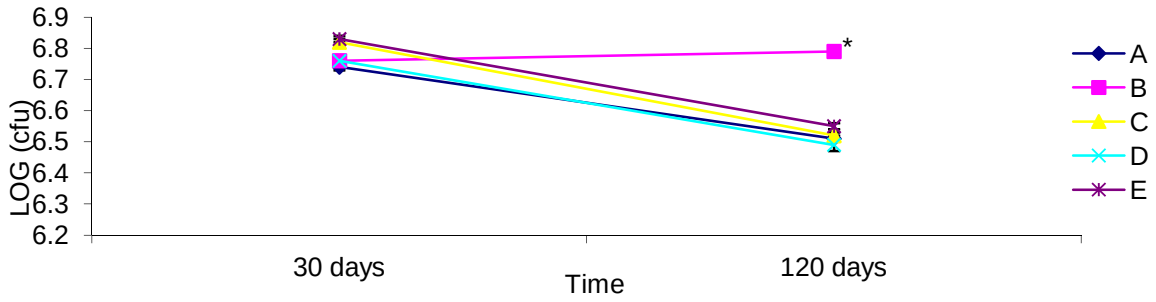

Figure 8: Fungal count reduction of Ascorbic Acid treated Daddawa (2.5mg/g)
* Line Graphs with asteric are significantly different at 0.05 level, values are means of three replicates ± SE
KEY: A= Laboratory Treated; B= Laboratory Untreated (Control); C= Gude; D= Jogana; E= Kwanar Yandaddawa

Table 1: Types of Microorganisms Isolated from African Locust Bean Cake of Different Sources Before Preservation
KEY: B= Control; C= Gude; D= Jogana; E= Kwanar yandaddawa; += present; - = negative; M=Mucor;

Sample	*E. coli*	*S. aureus*	*Salmonella* sp	*Fungal* sp		Rate of Recovery Before Treatment (%)
				M	*R*	
B	-	-	-	+	+	40
C	-	+	-	+	+	60
D	-	+	-	+	+	60
E	+	+	-	+	+	80

R=Rhizopus

Table 2: Effect of Ginger Extract and Ascorbic acid on Microbial Specie at 120 Days

Sample	Ginger extract and ascorbic acid treated locust bean cake at 30 days						Ginger extract and ascorbic acid treated locust bean cake at 120 days						
	E.coli	*S.aureus*	*Salmonella* sp	Fungal sp		% recovery	*E.coli*	*S.aureus*	*Salmonella* sp	Fungal sp		% recovery	% Eliminate
				M	R					M	R		
A	-	-	-	-	-	0	-	-	-	-	-	0	0
B	-	-	-	+	+	40	-	-	-	+	+	40	0
C	-	+	-	+	+	60	-	+	-	-	-	20	40
D	-	+	-	+	+	60	-	+	-	-	-	20	40
E	+	+	-	+	+	80	+	+	-	-	-	40	40

KEY: A= Laboratory Treated; B= Laboratory Untreated (Control); C= Gude; D= Jogana; E= Kwanar Yandaddawa; + = positive; - = negative; M = *Mucor* sp; R = *Rhizopus* sp

Table 3: Effect of Ginger extract on Proximate Composition (%) of African Locust Bean Cake at at 30 and 120 days

Sample	Time (Day)	Moisture 8mg/g	Ash 8mg/g	Crude fat 8mg/g	Crude protein 8mg/g	CHO 8mg/g	Crude fibre 8mg/g
	30						
A		7.24	6.14	20.43	35.01	23.88	7.30
B		9.04	7.79	26.32	28.16	20.01	8.68
C		6.33	5.56	20.02	37.45	23.32	7.33
D		6.62	5.72	20.75	37.39	26.42	9.72
E		7.41	7.12	20.40	37.21	20.44	7.42
	120						
A		3.76	8.14	13.21	40.02	26.78	8.11
B		10.73	6.75	31.32	25.78	18.78	6.64
C		4.52	7.12	15.20	40.13	25.01	8.02
D		4.13	7.41	16.04	39.54	24.94	7.97
E		4.53	9.24	15.42	32.58	29.02	9.24

KEY: A= Laboratory Treated; B= Laboratory Untreated (Control); C= Gude; D= Jogana; E= Kwanar Yandaddawa

Table 4: Effect of Ascorbic acid on Proximate Composition (%) of African Locust Bean Cake stored at 30 and 120 days

Sample	Time (Day)	Moisture 2.5mg/g	Ash 2.5mg/g	Crude fat 2.5mg/g	Crude protein 2.5mg/g	CHO 2.5mg/g	Crude fibre2.5mg/g
	30						
A		7.01	6.52	20.02	38.01	23.12	5.32
B		9.04	7.79	26.32	28.16	20.01	8.68
C		5.96	4.62	21.37	37.83	25.21	5.04
D		6.40	5.12	20.62	32.72	28.14	6.20
E		7.21	5.14	24.30	32.11	25.20	6.04
	120						
A		3.10	8.21	13.00	42.51	25.72	7.46
B		10.73	6.75	31.32	25.78	18.78	6.64
C		4.24	7.02	18.13	41.04	23.51	6.09
D		4.00	8.21	15.12	34.61	30.05	8.01
E		4.78	8.65	14.75	35.18	29.13	7.54

KEY: A= Laboratory Treated; B= Laboratory Untreated (Control); C= Gude; D= Jogana; E= Kwanar Yandaddawa

Table 5: Distribution of Responses on HEDONIC SCALE for Ginger Extract Treated and Untreated (Control) African Locust Bean Cake at 120 Days.

		Laboratory		Purchased		
		Treated	Untreated (Control)	Gude	Jogana	Kwanar yandaddawa
Option	Scale	A	B	C	D	E
Like extremely	9	2		3		4
Like very much	8	3		3	3	2
Like moderately	7	4			1	1
Like slightly	6	1		2	5	3
Neither like nor dislike	5		4	2	1	
Dislike slightly	4		2			
Dislike moderately	3		1			
Dislike very much	2		3			
Dislike extremely	1					
Mean ± Standard deviation		7.6±0.92	9.25±7.46	7.3±1.55	6.5±10.34	7.7±1.27
Total response		10	10	10	10	10
% Dislike		0	46	0	0	0

KEY: A= Laboratory Treated; B= Laboratory Untreated (Control); C= Gude; D= Jogana; E= Kwanar Yandaddawa

Table 6: Distribution of Responses on HEDONIC SCALE for Ascorbic acid Treated and Untreated (Control) African Locust Bean Cake at 120 Days.

		Laboratory		Purchased		
		Treated	Untreated (Control)	Gude	Jogana	Kwanaryandaddawa
Option	Scale	A	B	C	D	E
Like extremely	9	2		2		1
Like very much	8	3		2	3	3
Like moderately	7	4		5	5	2
Like slightly	6	1		1	2	4
Neither like nor dislike	5		4			
Dislike slightly	4		2			
Dislike moderately	3		1			
Dislike very much	2		3			
Dislike extremely	1					
Mean ± Standard deviation		7.6±0.92	9.25±7.46	2.50±1.73	7.10±0.70	7.1±1.04
Total response		10	10	10	10	10
% Dislike		0%	46	0	0	0

KEY: A= Laboratory Treated; B= Laboratory Untreated (Control); C= Gude; D= Jogana; E= Kwanar Yandaddawa

CONCLUSION

African locust bean condiment was purchased from local manufacturers at the point of production. Control standard Daddawa was produce in the Laboratory.The local and fermented laboratory control samples were treated with the preservatives and control experiment was left untreated.The quality control indicated microbial log decrease in the treated daddawa while untreated daddawa shows microbial log reduction. Contaminant isolates were identified from locally produced, laboratory treated and untreated (Control) African locust bean cake. The proximate analysis and organoleptic assessment of the purchased, laboratory treated and untreated (control) locust bean cake indicated the effect of Ginger extract and Ascorbic acid which improve the shelf life of processed *P.biglobosa* seeds by reducing the number of microbial load on the treated samples which could have been agents of deterioration or spoilage and reduce the shelf life.

Recommendation

However, further studies are needed to determine the effect of Ginger extracts and Ascorbic acid at various concentration without adversely affecting organoleptic and Nutritional contents of stored processed *P.biglobosa* seeds.

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