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QUALITATIVE ASSESSMENT OF DRIED AND FRESH PEPPER *Capsicum annuum* L.

De Nandita and Risikat O. S.

Department of Biological Sciences
Federal University of Technology, Minna, Niger State, Nigeria

ABSTRACT

Fresh and dried pepper Capsicum annuum (Tatashe), commonly used in Nigeria as spice, were analyzed for microbial load, pH, protein, vitamin C, fat and moisture contents. The bacterial count and the fungal count from dried pepper samples purchased from three markets in Minna were $6.4x10^6$- $7.7x10^6$ cfu/g and 38-46 cfu/g whereas the respective values for fresh pepper were $3.2x10^6$- $4.4x10^6$ and 19-29 cfu/g. The isolated bacteria from both fresh and dried pepper were species of Staphylococcus, Bacillus , Streptococcus and E. coli. The isolated fungi were species of Penicillium, Aspergillus, Rhizopus and Mucor. Of these organisms, Bacillus species were the predominant contaminants followed by Aspergillus species. Nutritional analysis revealed that dried pepper contain less protein (1.12-1.20%) and less vitamin C (54-62 mg/100g) compared to protein content (3.0-4.1%) and vitamin C content (199-221 mg/100g) found in fresh pepper. The values of fat (%) for fresh and dried samples were 12.07-12.94% and 1.99-2.03% respectively. Preliminary investigation showed that both fresh and dried pepper extracts possess definite antibacterial activity against E. coli, S. aureus and B. subtilis.

INTRODUCTION

Pathological deterioration of fruits and vegetables is generally associated with microorganisms Microorganisms on the surfaces of freshly harvested fruits and vegetables include not only those of the normal surface but also those from soil, water and plant pathogens. The successful storage of fruits and vegetables involves the maintenance of their quality and other factors associated with edibility. Adebanjo and Shopeju (1993) identified species of *Aspergillus, Penicillium , Rhizopus* and *Fusarium* as the major fungi flora of sun dried stored vegetables. Barber and Oyebanji (1991) showed that *Fusarium solani, Fusarium oxysporium* and *Aspergillus flavus* were involved in the deterioration of pawpaw. Pepper has diversified applications but industrially sauces, pickles and curry powder are the most important derivatives of pepper that enter the international trade (Oyebiodun and Alector, 1982). It serves as condiment and also as preservative. Generally, pepper serves as condiments because of their flavor or odor and the ripe fruits are therefore used as spices in stew and curries in Nigeria. Botanically, pepper belongs to the family Solanceae. They are good source of vitamin C and minerals, notably Iron and vitamin E. Oyebiodun and Alector (1982) reported that tatashe contains 22.5% moisture, 8.6% ash, 10.5% fat and 13.5% protein For centuries, it has been known that pepper possesses naturally occurring preservative qualities but only recently has the technology been developed to extract, quantify and identify the substances responsible for preservative qualities. In order to limit the problem of post-harvest losses and ensure the availability of pepper in our homes throughout the year, preservation by sun

drying is employed. It is interesting to see whether the nutritional quality and antimicrobial activity of dried "tatashe" available in the market is comparable with those of fresh "tatashe" sold in the market.

MATERIALS AND METHODS

Collection of samples

Fresh and dried pepper samples were randomly collected from three markets namely Bosso market, Gwari market and Main market in Minna. Five samples for each of fresh and dried peppers were collected from each market . The experiment was done in FUT, Minna in July- September, 1997.

Determination of pH

pH of the samples were determined using the pH meter (MicropH 2000, Crison). One gram of ground fresh pepper was mixed vigorously with 100 ml of distilled water in a beaker and 10 ml of this mixture was used for determination of pH. In case of dried pepper, the procedure was same except 0.09 g of ground pepper was used considering the fact that 1 g of fresh pepper when dried to a constant weight was equivalent to 0.09 g of dried pepper.

Enumeration and isolation of bacteria and fungi from fresh and dried pepper

The collected fresh and dried peppers were sterilized by swabbing with 0.01% mercuric chloride. Then 0.1 g of each of the samples was transferred into 9.9 ml distilled water and using this as a stock solution , serial dilution up to 10^{-5} were made following the procedure of Fawole and Oso (1988). From each dilution, 0.1 ml was introduced onto agar medium (For bacterial isolates, Nutrient agar (NA) and Potato dextrose agar (PDA) for fungi isolates was used respectively) and the NA plates were incubated at 37°C for 24 hours and the PDA plates were incubated at 28°C for 18 hours respectively. Two NA plates and two PDA plates were used for each dilution of pepper samples. The total bacterial and fungal count was expressed in cfu/g. The bacterial isolates were identified following the procedure of Hudson and Sherwood (1997). The fungal isolates were identified by the procedure described by Smith (1977).

Determination of moisture content

Moisture content was determined using an electric protimetergrain master 2000.

Crude protein, Vitamin C and fat contents of fresh and dried pepper

One gram of each of fresh pepper and 0.09 g of each of dry pepper samples was added to 100 ml distilled water respectively and 5 ml of each sample was used for determination of **vitamin C content**. Five ml of this treated sample was taken in boiling tube and 1.0 ml chloroform and 1.0 ml glacial acetic acid were added and was titrated against the dye 2,6 dichlorophenol indophenol contained in a burette (Temple,1990). The **fat content** (2.0 g of each fresh and dried pepper samples) was determined by direct Soxhlet method (A.O.A.C., 1980) using petroleum ether as solvent. The percentage of nitrogen in the samples (N) was estimated by Kjeldahl method .The amount of dried and fresh samples used for this purpose were 0.25 g and 2.82 g respectively. The **crude protein content** (%) of the samples were then determined by multiplying the nitrogen content with a factor of 6.25

(Berrmner, 1965).

Determination of antimicrobial properties of dried and fresh pepper

Quantitative phytochemical screening of the plants for the presence of saponins, tannins and sesquiterpenes was performed using the methods of Sofowora (1982). Antimicrobial activities of the samples were determined by using cup plate method of Garod et al (1981). For this purpose, each of the tested bacterial species was inoculated into 5 ml of Nutrient broth and incubated at 37°C for 24 hours. At the end of incubation period, 1 ml of the culture was introduced into a test tube containing 9 ml of sterile water and shaken vigorously. Then 0.1 ml of the cell suspension was spread on NA and allowed to stand for 20 minutes. Three cups were bored on each of NA plates and 0.3 ml of pepper solution (5 g of dried pepper added to 20 ml distilled water and 55.5 g of fresh pepper added to 20 ml distilled water) was added to each of the cups. The inoculated plates were incubated at 37°C for 24 hours. At the end of incubation, the zones of inhibition were measured. Three plates were used for each of pepper samples.

RESULTS

Determination of pH

The pH of the samples of fresh and dried pepper were observed to be in the range of 6.0-6.2.

Enumeration and isolation of bacteria from fresh and dried pepper

Table 1: Total bacterial and fungal count of fresh and dried pepper (mean ± SEM; n=5)

Market	*TBC		*TFC	
	Fresh	Dry	Fresh	Dry
Bosso	$4.4\times10^{6}\pm 0.33$	$7.7\times10^{6}\pm 0.05$	29 ± 0.8	45 ± 1.0
Gwari	$3.2\times10^{6}\pm 0.20$	$6.4\times10^{6}\pm 0.06$	19 ± 0.8	38 ± 0.7
Main	$4.2\times10^{6}\pm 0.25$	$6.6\times10^{6}\pm 0.18$	20 ± 0.7	46 ± 1.0

*TBC and TFC are total bacterial and fungal count respectively (cfu/g).

It has been shown that the total bacterial count (cfu/g) for samples of fresh pepper collected from Bosso market, Gwari market and Main market were

$4.4x10^6 \pm 0.33$, $3.2x10^6 \pm 0.20$ and $4.2x10^6 \pm 0.25$ whereas the respective values for samples of dried pepper were $7.7x10^6 \pm 0.05$, $6.4x10^6 \pm 0.06$ and $6.6x10^6 \pm 0.18$. The total fungal count (cfu/g) for samples of fresh pepper collected from three markets were in the range of 19-29 whereas for samples of dried pepper the range was 38-46. Table 1 listed the total number of bacteria and fungi in the samples tested. The samples contained species of *Bacillus, Staphylococcus, Escherichia* and *Streptococcus*. The fungi were also identified in the samples and included the species of *Mucor, Penicillium , Rhizopus, Aspergillus niger* and *Aspergillus fumigatus*.

Determination of moisture content

The moisture content of fresh pepper collected from different markets were 90.00-91.15%. The moisture content of dried pepper samples were 4.0-4.6%. The temperature range during the collection period was 35°C-37°C.

Crude protein, vitamin C and fat contents of fresh and dried pepper

Table 2: Crude protein, vitamin C and fat content of fresh and dried pepper sample (mean ± SEM; n=5)

Market	Crude Protein (mg/100 g)		Vitamin C (mg/100 g)		Fat (%)	
	Fresh	Dry	Fresh	Dry	Fresh	Dry
Bosso	4.14±0.08	1.15±0.00	199±0.8	62±0.2	12.07±0.05	1.99±0.02
Gwari	3.07±0.05	1.12±0.05	221±1.0	60±0.2	12.10±0.10	2.88±0.02
Main	3.72±0.07	1.20±0.04	211±0.8	54±0.1	12.94±0.10	2.03±0.05

It has been shown that the values of vitamin C (mg/100g), crude protein (mg/100g) and fat content (%) of fresh pepper collected from Bosso, Gwari , Main market were in the range of 199-211, 3.07-4.14 and 12.07-12.94. The respective ranges for dried pepper were 54-62, 1.12-1.20 and 1.99-2.88. The results in Table 2 shows that the values of vitamin C, crude protein and fat content of samples of dried pepper was less than those of fresh peppers.

Antimicrobial activity of fresh and dried pepper

Table 3: Antimicrobial effects of both fresh and dried pepper on some microrganisms

Samples	Zones of inhibition (mm)							
	A	B	C	D	E	F	G	H
Fresh								
BO	+++	+++	+++	++	+	++	++	++
GW	+++	+++	+++	++	+	++	++	++
MA	+++	+++	++	++	+	++	++	++
Dried								
BO	++	+++	++	++	+	+	+	+
GW	++	++	++	++	++	+	+	+
MA	++	++	++	++	+	+	+	+

+++ Diameter of zones 5-6 mm; ++ Diameter of zones 3-4 mm; + Diameter of zones 1-2 mm. BO- Bosso market, GW- Gwari market and MA- Main market. A- *E.coli*, B-*S. aureus*; C- *S.faecalis*, D- *B. subtilis*, E- *P.aeruginosa*, F- *S. pyogenes*, G- *S.paratyphi* and H- *S. typhi*

Both dried and fresh pepper contained phytochemical components namely saponin and tannins. It has been shown from Table 3 that both the extracts possess antibacterial properties. However, extracts of fresh pepper showed high antibacterial properties against the tested bacterial species namely *E. coli, S. aureus, S. faecalis, B. subtilis* and *S. pyogenes* (diameter of zones 5-6 mm) compared to that of dried pepper (diameter of zones 2-5 mm).

DISCUSSION

This study showed that dried and fresh pepper sold in Minna markets harbored bacteria and fungi. Dried pepper had higher number of viable bacteria and fungi than fresh pepper probably because of the various processes the pepper undergoes during drying. The finding in this study agrees with the report of Adebanjo and Shopeju (1993) that the number of microorganisms, mostly fungi in processed vegetables was greater than that of fresh vegetables. *E. coil* and species of *Staphylococcus,*

Bacillus and *Streptococcus* contaminated both fresh and dried pepper samples analyzed. *Bacillus* species was the predominant organism followed by *Staphylococcus aureus*. The finding that *Bacillus* was predominant in the samples analyzed agrees with the report of Antai (1988) who reported the presence of *B.subtilis* in the 60% of Nigerian spices sold in Port Harcourt markets. The fungi isolates from fresh and dried pepper samples were species of *Aspergillus, Rhizopus, Penicillium* and *Mucor*. These fungi have been reported to be involved in the deterioration of fruits and vegetables (Atanda et al.,1990). The protein, fat and vitamin C contents of fresh pepper were higher than those of dried pepper. The vitamin C of dried pepper was less may be as a result of stability of vitamin C which is temperature dependent (Ihekoronye and Ngoddy, 1985). The low protein content of dried pepper compared to the fresh ones may be due to the hydrolysis of proteins by the heavy load of microorganisms present in the samples. Also because of heavy load of microorganisms, fat may be hydrolyzed by microbial lipase at a higher rate than that of fresh pepper (Frazier and Westhoff, 1978). Both fresh and dried pepper contained tannins and saponins and both fresh and dried pepper extracts were able to inhibit the growth of some pathogenic bacteria. This activity may be due to the phytochemical components present in the extracts (Mather and Gongalez,1982).

Conclusively, it may be mentioned that *Capsicum annuum* is a condiment of high nutritive value and both fresh and dried pepper possess antibacterial activity. Both types of pepper sold in Minna markets had high bacterial load and contained some pathogenic microorganisms.

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