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EFFECT OF ONION PEEL WASTE ON MICROBIAL LOAD OF SMOKED *Clarias gariepinus* FISH

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ABSTRACT

The use of onion peel (Allium cepa) waste (OPW) on the microbiological quality of smoked catfish (Clarias gariepinus) stored for 8 weeks was assessed. Concentrations of OPW at 0g, 2.5g and 5g were sprinkled on the fish samples before and after smoking. The microbial result indicated that onion peel acted as an antimicrobial agent on coliform bacteria throughout the preservation period. It inhibited the growth of aerobic bacteria and fungi for 2 weeks and reduced their count in the treated fish samples, compared to the control. OPW inhibited the growth of some isolated organisms Staphylococcus saprophytica during the initial week, while it inhibited the growth of Shigella sp, Samonella sp, throughout the preservation period in the treated samples. OPW 5g can be used to preserve smoked fish without change in quality, sensory and organoleptic assessment of fish for 8 weeks.

Keywords: Bio-preservation, Onion Skin, Phytochemical

INTRODUCTION

Fish is an extremely perishable food item (Pigott, 2015). Fish live in a microbe rich environment and are vulnerable to invasion by pathogenic and opportunistic microorganisms (Esmeray *et al.*, 2016). Bio-preservation is the use of natural or controlled microbiota or antimicrobials as a way of preserving food and extending its shelf life (Ananou *et al.*, 2007). Synthetic antimicrobial has been reported to be detrimental to consumers (Tohidpour *et al.*, 2010). Natural preservatives could be extracted from different sources like plants, animals and microorganisms (Medema *et al.*, 2011). With special reference to plants, these metabolites are found to be healthy ingredients that work as antimicrobials (Atarés *et al.*, 2010). They contain antioxidants and so are considered as a better option for food preservation as compared to synthetic preservative (Sofos *et al.*, 2008).

Onion (*Allium cepa L*) is a vegetable and widely cultivated species of the genus *Allium* with strong characteristic aromas and flavors which makes them important ingredients in food (Ly *et al.*, 2005). Its close relatives include the garlic, shallot, leek, and chive (Block, 2010). More than 500,000 tons of onion wastes are thrown away in the European Union each year. It has been reported that this could be used as food ingredient. The waste includes the dry skin of onion (outer scale), the root, and the stalk (Vanesa *et al.*, 2011). The use of onions as a spice can be

useful not only to increase the organoleptic quality of food but also to enhance the stability and preservation of food systems (Jonathan *et al.*, 2010). The flavonoids of the raw onion make it a good candidate for use in food preservation (Nuutila *et al.*, 2003). The high level of these compounds on the dry skin and the outer layer makes them have high antioxidant capacity (Vanesa *et al*., 2011).

Ayeloja *et al.*, (2011) reported that food is considered to be microbiologically unsafe owing to the presence of microorganisms which may invade the human body. Microbial growth and metabolism is a major causes of fish spoilage (Dalgaard *et al*., 2006). Onion peel extract acted as a bacteriostatic agent in meat against *B. cereus* which was the most sensitive to the extract followed by *E. coli, S. aureus, P. vulgaris* and *B. subtilis*. Onion peel has also been used to maintain the quality of rainbow trout (*Oncorhynchus mykiss*) fillets during refrigerated storage (Ilknur *et al*., 2018). This study assessed the effect of onion peel as preservative on the shelf life of *Clarias gariepinus*.

MATERIALS AND METHOD

Twenty four *C. gariepinus* (300-500 g) were purchased from a reputable fish farm in Ayetoro Ogun state. The OPW was obtained at no cost from the market in Ayetoro. The OPW were sorted and washed with clean water, sun dried and milled into powder. The fish were degutted and rinsed in clean water and were allotted into 3 treatments of eight fish each; treated with 5 g of OPW (Treatment 2); 2.5 g of OPW (Treatment 1) and control without treatment (Treatment 0). OPW was sprinkled on the treated fish samples. All the fish were folded and smoked for 18 h before analyzing the microbial, chemical and organoleptic quality. Samples were analyzed for phytochemical properties according to Marcano and Hasenewa (1991). The microbial analysis of the fish samples was according to Fawole and Oso (1995).

Statistical analysis

One way analysis of variance was used to analyse treatment values obtained, using SPSS version 20.0 and differences in mean (p=0.05) were used to test for significance.

RESULTS AND DISCUSSION

The phytochemical properties of OPW (Table 1) indicated that the most abundant phytochemical was phenol followed by coumarin and flavonoid, while xanthone was the lowest.

Table 1: Phytochemical properties of onion peel waste

Parameters (mg/100g)	OPW
Phenol	989.31±2.57
Flavonoid	182.25±0.29
Tannin	56.62±5.36

Saponin	62.21±0.24
Xanthone	3.78±0.20
Terpenoid	40.71±0.85
Coumarin	287.12±0.38
Phytate	98.67±0.45
Oxalate	15.08±0.24
Cardial glycoside	65.94±0.11

The result of the phytochemical analysis was in consonance with Ifesan (2017) on phenol content (714.33±66.09µg/ml^{-1}GAE) and flavonoid content (177.33±1.56µg/ml^{-1}QUE) which were reported to be high. Benitez *et al*., (2011) reported total flavonoids of 19.50 mg QE g^{-1}DW and phenol (19.70mg GAE g^{-1}DW) from the outer scales of onion to be high. This made onion peel an ideal natural preservative agent for food because phenol and flavonoid are the main compounds responsible for the antioxidant activity in onion (Santas *et al*., 2008).

Microbial content of *C. gariepinus* preserved with OPW (Table 2), showed microbial absence, both in TCC (Total Coliform Count) of T_1 and T_2 throughout the eight weeks of preservation period compared to T_0. The result made it evident that both the TAC (Total Aerobic Count) and TFC (Total Fungal Count) of T_1 and T_2 samples, showed no presence of any microbial growth from the start of the preservation until the fourth week of the preservation, which further increased in count overtime. There was significant differences ($p<0.05$) among the T_0, T_1 and T_2 as the result showed that the total mean of T_2 was the least count recorded in all the microbial parameters.

Table 2: Microbial content of *Clarias gariepinus* preserved with onion peels

	T0 (0g/0.5kg)			T1 (2.5g/0.5kg)			T2 (5.0g/0.5kg)		
Week	TAC	TCC	TFC	TAC	TCC	TFC	TAC	TCC	TFC
0	8.00±2.00^{a}	0.00±0.00^{d}	0.00±0.00^{e}	0.00±0.00^{b}	0.00±0.00	0.00±0.00^{d}	0.00±0.00^{c}	0.00±0.00	0.00±0.00^{d}
2	22.00±2.00^{a}	0.00±0.00^{d}	10.00±2.00^{d}	0.00±0.00^{b}	0.00±0.00	0.00±0.00^{d}	0.00±0.00^{c}	0.00±0.00	0.00±0.00^{d}
4	34.00±4.00^{a}	9.00±6.00^{c}	12.00±3.00	6.50±0.50^{b}	0.00±0.0	9.00±3.00^{b}	3.00±0.00^{b}	0.00±0.0	6.00±1.00^{c}

			[c]		0			0	
6	46.00±5.00[a]	10.00±2.00 [b]	18.00±3.00 [b]	10.00±2.00 [a]	0.00±0.0 0	20.00±3.00 [c]	9.50±0.50[a]	0.00±0.0 0	8.00±2.00 [b]
8	68.00±6.93[a]	17.00±1.00 [a]	23.00±0.00 [a]	6.00±1.00[a]	0.00±0.0 0	26.00±4.00 [a]	9.50±1.50[a]	0.00±0.0 0	7.00±3.00[a]

Note all values are in multiples of 10^{-5}CFU. Means within the same column with same superscript are not significantly different ($p>0.05$). TAC: Total Aerobic Count; TCC: Total Coliform Count; TFC: Total Fungal Count.

This showed that OPW possesses antimicrobial properties and is very effective in reducing microbial count. This result obtained is in conformity with the reports of Monica *et al.*, (2020), that used OPW on the nutritional and quality attributes of wheat pasta. Kumolu and Ndimele (2011); Sallam *et al*., (2010) also noted a reduction in the microbial count of fish preserved with garlic (*A. sativum*). With regards to the storage duration, there was no detectable growth in the TCC of the treated samples throughout eight weeks period of preservation, compared to that of T_0. The result also showed that increase in OPW concentration led to decrease in microbial count treated fish. These were in agreement with report of Ifesan (2017) that increase in the concentration of OPW led to decrease in microbial count. Thus, there was significant variation ($p<0.05$), among the fish samples, influenced by the onion peel treatment.

Isolated organism from *C. gariepinus* preserved with OPW (Table 3), showed no presence of the isolated organism in both T_1 and T_2 at week zero, while microbes were present in other weeks respectively.

Table 3: Isolated organism from *Clarias gariepinus* preserved with onion peel

Week	T_0(0g)	T_1(2.5g)	T_2(5.0g)
0	*Staphylococcus saprophytica*	Nil	Nil
2	*Saccharomyces cerevisae*	*Saccharomyces cerevisae*	*Saccharomyces cerevisae*
4	*Shigella sp, Samonella sp, Saccharomyces cerevisae*	*Saccharomyces cerevisae*	*Saccharomyces cerevisae*
6	*Shigella sp, Samonella sp, Saccharomyces cerevisae*	*Saccharomyces cerevisae*	*Saccharomyces cerevisae*
8	*Shigella sp, Samonella sp, Saccharomyces cerevisae*	*Saccharomyces cerevisae*	*Saccharomyces cerevisae*

This showed that OPW was able to inhibit the growth of *Shigella sp* and *Samonella sp* in the study. This is not in consonance with the report of Ifesan (2017) as the result reported, showed the growth of *Staphylococcus aureus* in the treated samples preserved with onion peel extract.

This may be due to the lower concentration of OPW used which was 2.7 mg, 5.4 mg, and 10.8 mg, compared to the concentration used in Table 3.

CONCLUSION

This study concluded that utilization of onion peel waste at 5 g preserved smoked *Clarias gariepinus* over 8 weeks period.

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