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Abstract

Introduction. Smoked kong is a traditional fish smoked at a small scale in Sénégal in lot of African countries. Previous works have already dealed about microbiological in Senegal reveals that 57.15% are of unsatisfactory quality; 2.85% fair and 40% satisfactory. The presence of staphylococci CNS and of lactobacillus in these smoked fish suggests a follow-up of the microbial flora during the process to precise their role in the process of smoking. The objectives of this deliverable are to master and have a better understanding of the process in order to identify good improvement ways of reengineering. **Materials and methods**. Two producers in Dakar were followed through dry and wet kong processing. One basic traditional and a more modern site of producers were chosen. The methodology allowed to analyze four samples for each defined processing's step and for each type of smoked kong (dry and wet). **Results**. The total aerobic flora loads of 5,44±5,33 to 5,86±5,10 Log cfu/g decrease to 3.48± 2.54 and 1.00 ± 1.00 Log cfu/g in the end-product whatever the processing site (dry or wet). None *Staphylococcus aureus* nor CPS in (coagulase positive Staphylococci) was not meet in samples. Yeasts, lactic bacteria and CNS (coagulase negative Staphylococci) are present till the end-product: 75 % in the cases for the lactic bacteria and 100 % for CNS. According to processing sites end-products contain always CNS and often lactic bacteria. **Discussion and conclusion**. This results show that the smoking process ensure a good microbiological assessment of smoked kong. CNS's load either in fresh fish or end-product does not suggest to be considered like technological flora during smoked kong. Nevertherless CNS and lactic bacteria are well known for their antibacteria activities (Nykänen et al., 1999; Diop *et al*., 2010) and can be used to improve the process.

Introduction

Smoked kong is a traditional fish smoked at a small scale in Sénégal. Owning to the family of catfish wich are often smoked in lot of African countries such us Ivory coast (Oulaï et al., 2007), Ghana (Okafor & Nzeako, 1985), Nigeria (Bukola, et al., 2008; Efiuvwevwere & Ajiboye1996), Tanzania (Mugula & Lyimo, 1992), Sierra-Leone (Jonsyn & Lahai 1992), Egypt (El-Akeel, 1988) and Senegal (Ndoye et al., 2002). Previous works have already dealed about microbiological quality of smoked fish in Africa, inventoring the technological flora and pathogenic (D1.2.5.2; Salaudeen et al., 2010; Goueu, 2006; Adu-Gyamfi 2006; Da Silva et al., 2008 ;Nickelson *et al*., 2001; *Abolagba et. al., 2011*). As it is shown by the results microbiological quality of african smoked fish still doubtful. In Senegal, the overall sample health assessment based on criteria set, reveals that 57.15% are of unsatisfactory quality; 2.85% fair and 40% satisfactory (D1.2.5.2).The microbial loads are raised and the risk of presence of pathogenic germs is present considering the hygienic conditions of smoking. On the other hand, the presence of staphylococci CNS and of lactobacillus in these smoked fish suggests a follow-up of the microbial flora during the process to precise their role in the process of smoking and the efficiency of the smoking on possible pathogenic germs.The objectives of this deliverable are to master and have a better understanding of the process in order to identify good improvement ways of reengineering.

Material and methods

Two processors are followed up during the production of dried and wet smoked kong. The two variants of technology used for the processing are based on the smoking time. The first producer is located at “Yarakh” and represents the typical traditional producers. The second one is located at “seuty ndiaré” presenting a better involved hygienic condition (figure 1).


Site of « Seuty ndiaré »


Site of « Yarakh »

Figure 1: Outline of the environmental conditions of production on working sites

- Sampling was done at different steps to make analyses in laboratory as its shown on Diagram of production and sampling (figure 2).

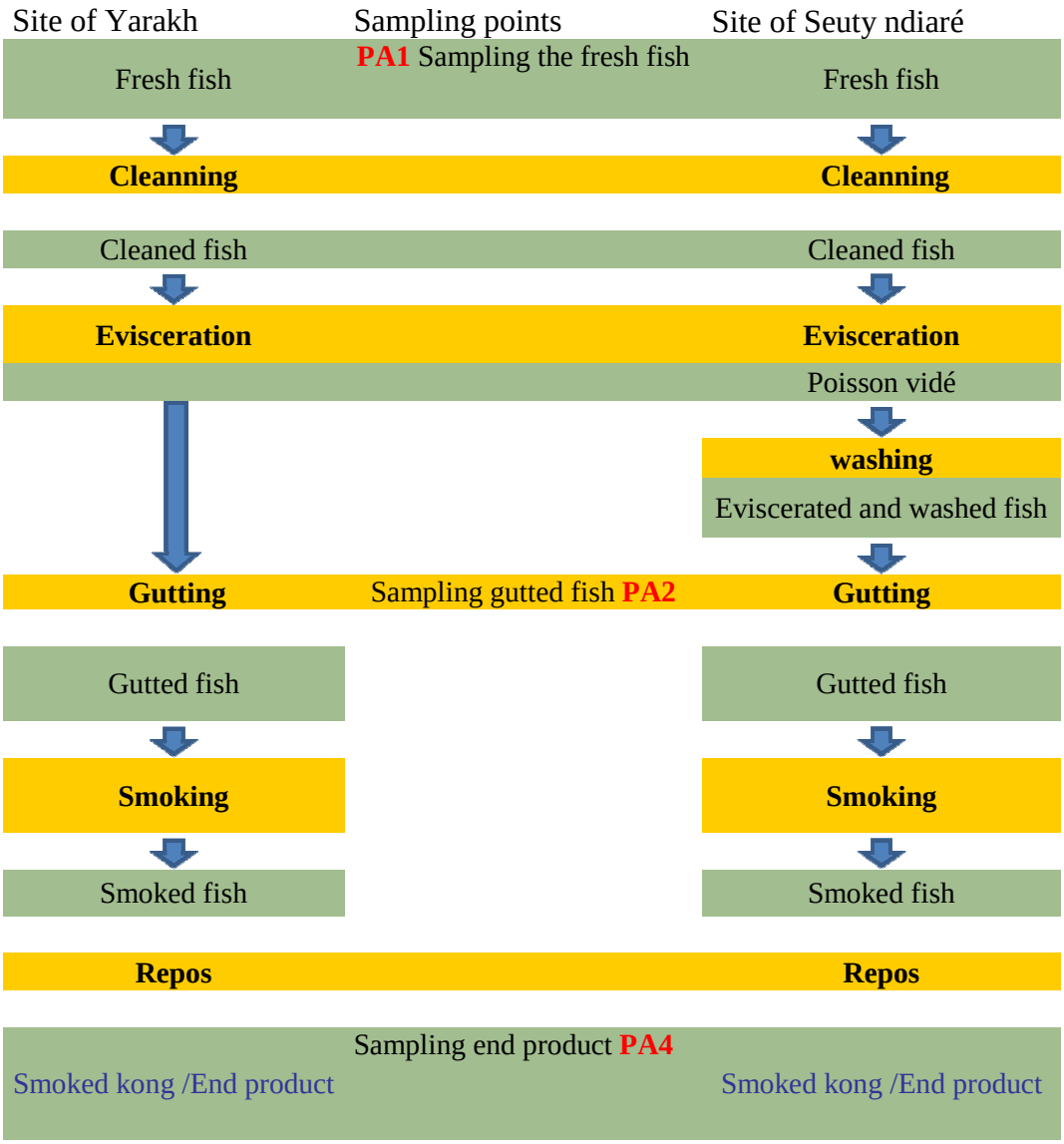

Figure 2: Diagram of production and sampling

Two samples were collected at each unit operation's step as defined (figure 2). The sampling steps and microbiological parameters analysed are listed in table1. This methodology allowed to analyze four samples for each defined processing's step for each type of smoked kong (dry and wet).

Table 1: Sampling steps and microbiological criteria analysed

Sampling steps		**PA_1**	**PA_2**	**PA_4**
Microbiological criteria	SOP number			
Total aerobic flora	Micro-01, ISO 4833	+	+	+
Enterobacteriaceae	Micro-02, ISO 21528-2	+	+	+
Escherichia coli	Micro-03,ISO 16649-2	+	+	+
Staphylococcus aureus and CPS	Micro-05, ISO 6888-1	+	+	+
Coagulase Negative Staphylococci (CNS)	Micro-05, ISO 6888-1	+	+	+
Lactic acid bacteria (LAB)	Micro-10, M-METH-MO-13	+	+	+
Yeasts and moulds	Micro-09, ISO 7954	+	+	+
Clostridium perfringens	Micro-08, ISO 7937	+	+	+
Bacillus cereus	Micro-04, ISO 7932	+		+
Salmonella	Micro-07, ISO 6579:	+		+
Listeria monocytogenes	Micro-06, ISO 11290 1/A1:2004	+		+

PA_1: fresh kong; PA_2: gutted fish; PA_4: smoked end product

Results and discussion

In the raw material considered as fresh fish the total aerobic flora loads of 5,44±5,33 to 5,86±5,10 Log cfu/g. After evisceration, gutting and smoking it decreased between 3.48± 2.54 and 1.00 ± 1.00 Log cfu/g in the end-product whatever the processing site (tables 3 and 4).

This evolution is also observed for enterabacteriacea, *Clostridium perfringens*, *E.coli* and molds when they are present in the raw material. None *Staphylococcus aureus* nor CPS in (coagulase positive Staphylococci) was not met in samples. Yeasts, lactic bacteria and CNS (coagulase negative Staphylococci) establish the group of flora which resists the heat. Then, their level of presence is left almost constant up to the end-product: 75 % in the cases for the lactic bacteria and 100 % for CNS. According to processing sites, « Yarakh's » end-products contain always CNS and lactic bacteria while « seuty ndiaré » site's end-products are without lactic bacteria. No pathogenic germs such us *Salmonella*, *Listeria monocytogenes and Bacillus cereus* were not found either in fresh fish or in end-product.

Table 3: Microbiological status of fish during “dry smoked kong” (Log cfu/g)

Dry smoked kong	Site of Yarakh			Site of Seuty Ndiaré		
	Fresh fish	Gutted fish	End-product	Fresh fish	Gutted fish	End-product
Total aerobic flora	5,44±5,33	4,39±4,18	3,48±2,54	4,74±4,65	4,88±4,74	1,00±1,00
Enterobacteriaceae	4,84±4,18	4,93±4,93	<1	3,27±2,40	3,13±2,18	<1
C. Perfringens	2,08±2,08	1,93±0,60	1,74±1,74	2,97±2,83	1,00±1,00	<1
Staphylococcus aureus and CPS	<1	<1	<1	<1	<1	<1
CN Staphylococcus	6,47±6,44	6,29±6,18	3,13±3,13	3,88±3,88	3,98±3,98	7,25±7,23
Lactic Bacteria	5,61±5,50	5,93±5,82	4,79±4,77	5,11±5,09	5,10±5,10	<1
Yeast	3,28±2,68	4,24±3,65	<1	4,28±3,30	4,09±3,78	6,69±6,69
Mould	<1	<1	<1	1,00±1,00	0,70±0,70	<1
Escherichia coli	3,40±3,08	3,96±3,65	<1	<1	<1	<1
Salmonella (/25 g)	A	ND	A	A	ND	A
L. monocytogenes (/25 g)	A	ND	A	A	ND	A
Bacillus cereus	A	ND	A	A	ND	A

A: absent ; ND: not determined

Table 4: Microbiological status of fish during “wet smoked kong” (Log cfu/g)

Wet smoked kong	Site of Yarakh			Site of Seuty Ndiaré		
	Fresh fish	Gutted fish	End-product	Fresh fish	Gutted fish	End-product
Total aerobic flora	5,86±5,10	5,40±5,19	5,89±5,80	4,20±3,30	4,68±4,53	1,54±1,54
Enterobacteriaceae	2,77±2,42	4,10±3,54	<1	1,00±0,00	2,65±2,65	<1
Clostridium Perfringens	0,74±0,65	<1	<1	<1	<1	<1
Staphylococcus aureus and CPS	<1	<1	<1	<1	<1	<1
CN Staphylococcus	5,93±4,97	6,69±6,39	5,22±5,21	6,09±6,07	5,37±4,18	4,75±4,54
Lactic Bacteria	6,43±6,35	6,61±6,60	6,31±6,19	2,04±2,04	4,02±3,98	<1
Yeast	2,51±2,50	3,15±3,14	<1	<1	1,40±1,40	<1
Mould	2,90±2,90	3,01±2,99	1,02±0,98	<1	<1	<1
E. coli	1,02±0,98	3,50±2,93	<1	<1	<1	<1
Salmonella (/25 g)	A	ND	A	A	ND	A
L. monocytogenes (/25g)	A	ND	A	A	ND	A
Bacillus cereus	A	ND	A	A	ND	A

A: absent ; ND: not determined

This results show that the smoking process ensure a good microbiological assessment of smoked kong. CNS's load either in fresh fish or end-product does not suggest to be considered like technological flora during smoked kong. Nevertherless CNS and lactic bacteria are well known for their antibacteria activities (Nykänen et al., 1999; Diop *et al*., 2010) and can be used to improve the process. According to the diagram of smoking and the microbiological quality of end-products some investigations need to be performed for reeingineering. Several ways of reengineering can be used during washing such us the use of salt by brinning (Omojowo *et al*., 2010), Essential oil or extracted vegetables (Tiamiyu et al., 2005; Salaudeen *et al*., 2010); introducing fermentation stage with lactic bacteria (Nykänen et al., 1999; Diop *et al*., 2010); improvement of the smoking by the choice of fuels (Nenaah, 2010; Zuraida *et al*., 2011)

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