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Use of iodized salt in processed Philippine food products

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The effects of iodized salt use on the quality of processed Philippine food products were evaluated. Samples for the study included dried-salted and smoked fish products, nitrite-cured pork, and fermented plain and flavored shrimp pastes. Generally, no significant differences were detected between the physicochemical, microbiological and sensory characteristics of the test products prepared with iodized and unfortified NaCl salts. The salting process in each food operation significantly increased the iodine content of the test products. However, subsequent losses in the absorbed iodine were recorded due to the boiling, smoking, drying, fermenting and heating processes in the different operations. It was recommended that studies be undertaken on the addition of iodine to semi-processed or completely processed food products to lessen iodine losses.

Key words: iodized salt, iodine, processed food.

Introduction

The Philippine Government passed Republic Act (RA) 8172, or the ASIN Law (An Act Promoting Salt Iodization Nationwide and for Related Purposes), on 20 December 1995 to help alleviate the Iodine Deficiency Disorder (IDD) problems of the country.[1] According to the Philippine Department of Health (DOH), one out of every three Filipinos live in an iodine-deficient area.[2] In a survey conducted by the Philippine Nutrition Service in 1987, the goitre prevalence rate in some parts of the country was above the World Health Organization's set standard of 10% of population.[3] The ASIN Law requires that local NaCl salt to be used domestically as food be iodized, and that all food processors use iodized salt in the production of their products, effective December 1996.[1]

This study aims to help local small- to medium-scale food processors involved in the production of smoked, dried-salted, and cured or fermented Philippine food products to determine the effects of using iodized salt in their operations. Small- and medium-scale processors generally do not have the necessary financial resources or the technical knowledge to scientifically establish the effects of using iodized salt on the quality of their products.

Methods

Test Products

The products analysed in this study include dried-salted roundscad and Indian mackerel; smoked milkfish and fimbriated herring; and cured or fermented products including nitrite-cured pork, and fermented plain and flavoured shrimp pastes.

Selection of processors

Participating commercial processors of the test products were preselected, except for the processor of the fermented shrimp paste samples. Pre-selection of processors involved the identification of one out of three commercial processors who could produce the most acceptable product per test commodity. Pre-selection was done by a consumer acceptability test. Analysis of variance and Duncan's multiple range test (DMRT) were used to analyse the results of the sensory tests.[4]

For the fermented plain and flavored shrimp paste samples, the process of a commercial processor from Navotas in Metro Manila was adopted.

Processing of food products

Preparations of the test products using iodized and unfortified NaCl salts were performed using the selected commercial processors. Figures 1, 2 and 3 show the details of the different processing procedures used in this study. The Navotas-Malabon method[5] and the commercial brine-salting method[6] were used for the smoking and dry-salting operations, respectively. For the nitrite-cured pork samples, a commercial formulation used by a wetmarket vendor from Balintawak in Quezon City was selected. The iodized and unfortified NaCl salt samples used in this study were obtained from Finetex Enterprises, a local iodized NaCl salt manufacturer of FIDEL (Fortification Against Iodine Deficiency Elimination) salt.

Physicochemical tests

The physicochemical analyses done for all of the test samples included determinations of pH using the Fischer pH meter (England) and NaCl content determination. For the fishery products, the Association of Official Analytical Chemists

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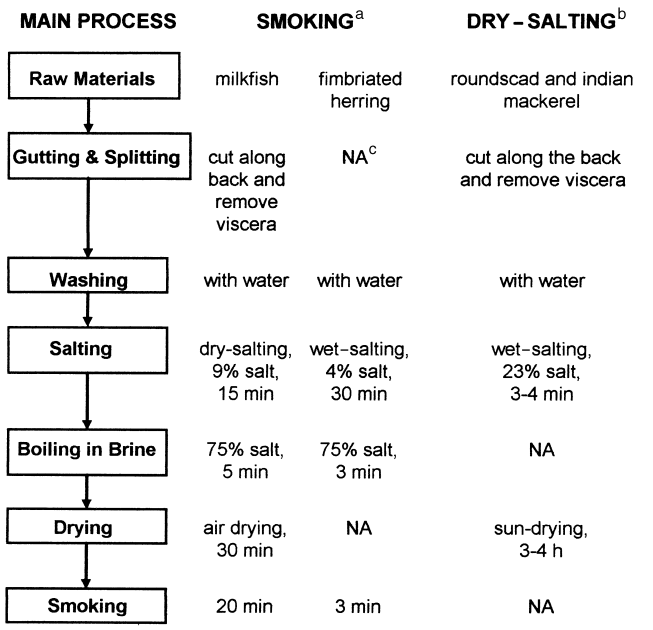
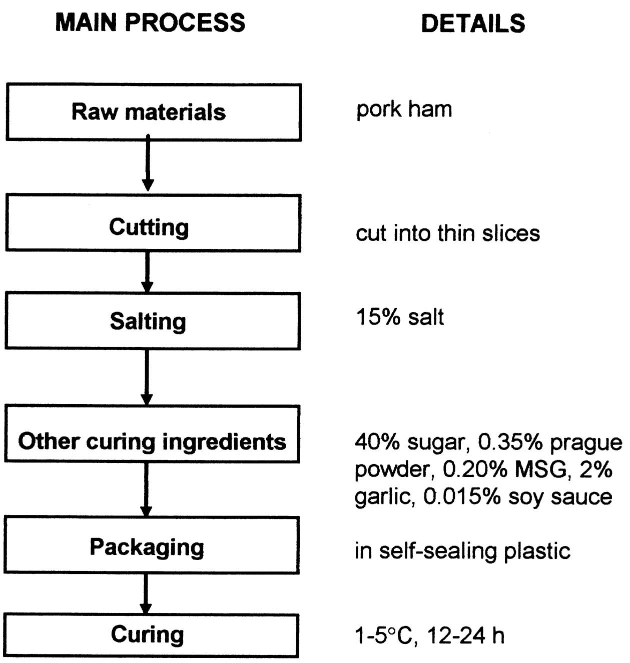


[a] *Navotas-Malabon method*
[b] *Commercial brine-salting method*
[c] *NA, not applicable*

Figure 1. Process flow for the production of smoked and dried-salted fishery products.

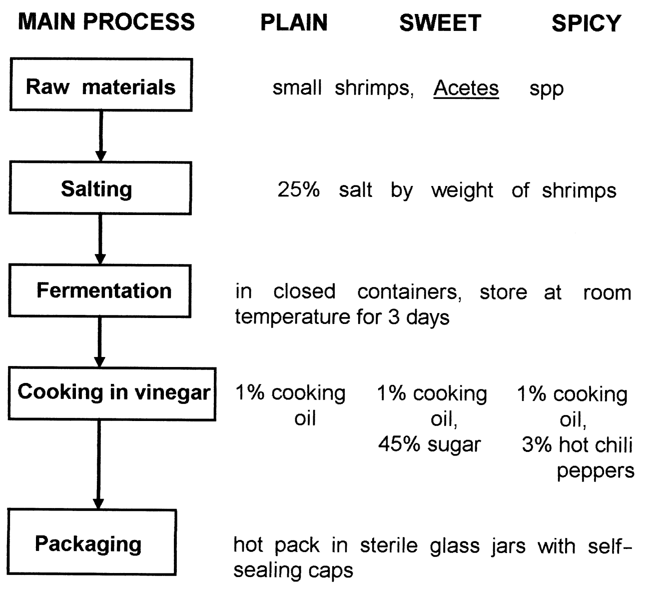


[a] *Formulation of vendor, Balintawak, Quezon City, Philippines*

Figure 2. Process flow for the production of nitrate-cured pork. [a]

(AOAC) titrimetric method (1990) for NaCl content determination of seafoods was utilized, while the AOAC volumetric method (1990) specified for meat and meat products was used for the NaCl determination of the nitrite-cured pork samples.[7] Water activity (A_W) was determined using the Lufft-Durotherm (Germany) calibration chambers.

The Ichikawa (1985) method for iodine analysis of food samples was used to determine the iodine content of all of the



[a] *Formulation of commercial processor, Navotas, Metro Manila, Philippines*

Figure 3. Process flow for the production of fermented plain and flavored shrimp paste.[a]

test food products.[8] The iodine content of the NaCl salt samples used in this study was also determined using the standard titration method described in the PAMM (Program Against Micronutrient Malnutrition) manual.[9]

Microbiological tests

Total plate count (TPC) using the plate count agar, and yeast and mold count (YMC) using potato dextrose agar acidified with 10% tartaric acid, were used to assess the microbiological characteristics of all of the test products. The Pour Plate technique was utilized for these microbiological analyses.[10]

Sensory evaluation

Different tests using the paired comparison method were used to determine whether a significant difference existed between sensory qualities of the test samples prepared with iodized and unfortified NaCl salts.[4] The age of the panelists used ranged from 40 to 80 years.

Data analysis

For quality assessment, the Student's *t*-test for paired difference was used to determine whether a significant difference existed between the test products prepared with iodized and those prepared with unfortified NaCl salts, at a 5% level of significance.[4]

Results and discussion

Physicochemical tests

The physicochemical test results for all of the test products are summarized in Table 1. Generally, the use of iodized salt has no significant effects on the pH, A_W and %NaCl content of the test products analysed at a 5% level of significance.

Iodine determination

Table 2 shows the results of the iodine content determination of all of the test products. An increase in the iodine content of the samples was detected after salting in all of the pro-

Table 1. Results of the physicochemical tests done on the test products prepared with iodized and unfortified NaCl salts*

Product	pH w/iodized salt	pH w/unfortified salt	A_w w/iodized salt	A_w w/unfortified salt	% NaCl w/iodized salt	% NaCl w/unfortified salt
Dried salted						
Roundscad	5.65[a]	5.47[a]	0.90[a]	0.89[a]	0.98[a]	0.89[a]
Indian mackerel	5.60[a]	5.30[a]	0.87[a]	0.89[a]	1.12[a]	0.90[a]
Smoked						
Milkfish	5.95[a]	5.75[a]	0.92[a]	0.92[a]	0.97[a]	0.98[a]
Fimbriated herring	5.90[a]	6.00[a]	0.98[a]	0.93[a]	0.96[a]	0.93[a]
Cured/fermented						
Nitrite-cured pork	5.83[a]	5.86[a]	0.81[a]	0.83[b]	7.64[a]	7.62[a]
Shrimp paste						
Plain	4.90[a]	5.10[a]	0.78[a]	0.78[a]	18.97[a]	20.19[a]
Sweet	4.90[a]	5.10[a]	0.71[a]	0.70[a]	13.14[a]	15.83[a]
Spicy	4.80[a]	5.10[a]	0.74[a]	0.75[a]	19.65[a]	21.18[a]

* Mean value of two trials.
[a,b] Values in the same row per physicochemical test with the same letter are not significantly different at a 5% level of significance.

cessing procedures used. The iodized NaCl salt used contained 62.10 μg I/g NaCl salt while the unfortified NaCl salt used contained 4.63 μg I/g NaCl salt. The range of increase in the iodine content of the test products was from 15.89 to 755.0% after salting.

Table 2. Changes in the iodine content of the test products during the different processing procedures

Product	Iodine content (mg/g)	% change
Dried salted		
Roundscad		
Fresh	0.26	
Salted	0.31	+15.89
Dried	0.03	–91.57
Indian mackerel		
Fresh	0.18	
Salted	0.26	+62.50
Dried	0.04	–85.00
Smoked		
Milkfish		
Fresh	0.08	
Salted	0.11	+25.61
Boiled	0.07	–39.33
Smoked	0.03	-43.83
Fimbriated herring		
Fresh	1.53	
Salted	2.49	+62.70
Boiled	1.17	–54.20
Smoked	0.66	–41.70
Cured/fermented		
Nitrite-cured pork		
Fresh	0.08	
Salted	0.10	+20.80
Cured	0.12	+12.93
Shrimp paste		
Fresh	0.04	
Newly salted	0.34	+755.00
Fermented	0.23	–32.75
Heated		
Plain	0.05	–76.52
Sweet	0.02	–89.96
Spicy	0.02	–93.04

The subsequent boiling, smoking, drying, curing/fermenting and heating steps involved in the different processing procedures caused a decrease ranging from 32.75 to 93.04% in the iodine content of the samples, except for the nitrite-cured pork samples. The loss of iodine in almost all of the samples may be attributed to the exposure of the test products to heat, sunlight and oxygen, which adversely affect iodine.[11] The continuous increase in the iodine content of the nitrite-cured pork samples even after the 12 h curing period could be explained by the more gradual uptake of salts in the curing solution during the low temperature treatment.

Microbiological tests

Results of the microbiological tests are summarized in Table 3. The TPC and YMC of the samples prepared with iodized NaCl salts were lower than the samples prepared with unfortified NaCl salts. However, no significant differences were detected on the TPC or the YMC for any of the test products,

Table 3. Total plate count (log colony-forming unit per gram (cfu/g)) and yeast and mold count (log cfu/g) of the test products prepared using iodized and unfortified NaCl salts*

Product	TPC w/iodized salt	TPC w/unfortified salt	YMC w/iodized salt	YMC w/unfortified salt
Dried salted				
Roundscad	4.85[a]	5.21[a]	2.60[a]	2.74[a]
Indian mackerel	4.76[a]	4.79[a]	2.98[a]	3.14[a]
Smoked				
Milkfish	4.07[a]	4.17[a]	2.00[a]	2.17[a]
Fimbriated herring	3.93[a]	4.38[a]	2.54[a]	2.77[a]
Cured/fermented				
Nitrite-cured pork	6.50[b]	6.51[a]	4.13[a]	4.23[a]
Shrimp paste				
Plain	3.00[a]	3.60[a]	< 3.00[a]	< 3.00[a]
Sweet	3.30[a]	3.84[a]	< 3.00[a]	< 3.00[a]
Spicy	300[a]	3.30[a]	< 3.00[a]	< 3.00[a]

* Mean value of two trials.
[a,b] Values in the same row per microbiological test with the same letter are not significantly different at a 5% level of significance.

except for the TPC of the nitrite-cured pork samples. The variations in the TPC and the YMC of all of the test products could be attributed to the antimicrobial effects of iodine on the indigeneous flora of the test products.[12]

Sensory evaluation

Difference tests using the paired comparison method showed that there was no significant difference detected in the overall acceptability of the test samples prepared with iodized and unfortified NaCl at a 5% level of significance. The binomial distribution was used to analyse the results.[4]

Recommendations

Statistical analysis using the paired difference test done on the physicochemical, microbiological and sensory parameters showed that there was no significant difference between the test samples prepared with iodized NaCl salts and those prepared with unfortified NaCl salts at a 5% level of significance.

This study also established that the salting process using iodized NaCl salt was a preparatory step to smoking, dry salting and curing/fermenting and could result in an increase in the iodine content of the test products. A decrease, however, ranging from 32.75 to 93.04% of the iodine absorbed by the test samples during salting, resulted with the subsequent boiling, smoking, drying, fermenting/curing and heating steps involved in the different processing procedures. It is therefore recommended that studies be undertaken to consider the addition of iodine, in whatever iodine carrier is appropriate, to semi-processed or completely processed food products.

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菲律賓食品加工中碘鹽的應用

摘　要

作者評估了加用碘鹽對菲律賓食品加工質量的影響。加工食品包括乾鹽和煙熏魚，醃豬肉，發酵食品和調味的蝦醬，通常加用碘鹽，但沒有強化食鹽（氯化鈉）的製品中，沒有發現在理化的，微生物的和感覺的特性有明顯的不同。

每種食品加工過程中明顯增加碘含量，但是由于煮沸、熏醃、乾燥、發酵和加熱等不同步驟中喪失了碘的吸收，作者建議在半加工過程中或加工之後再加入碘鹽以減少碘的喪失。

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Ang epekto ng paggamit ng asin na may yodo sa katangian ng mga iprinosesong pagkaing Pilipino ay pinag-aralan. Ang mga pagkaing sinuri ay ang mga pinatuyo at pinausukang isda, bagoong na hipon at tocinong karne. Walang nakitang mahalagang pagkakaiba sa pisikal, kimikal, bilang at uri ng mikrobyo at sa panlasang aspeto ng mga prinosesong pagkain na ginamitan ng asin na may yodo at walang yodo.

Ang pag-aasin ay naipakitang naging dahilan ng makabuluhang pagtaas ng taglay na yodo ng mga pagkaing sinuri. Ang pagpapausok, pagpapatuyo, pagbuburo at iba pang hakbang na kina-uugnayan ng pag-iinit ng pagkain ay naipakitang naging sanhi ng mahalagang pagbaba ng yodong taglay ng mga pagkain. Naimungkahi sa pag-aaral na ito na dapat pag-aralan pa ang posibilidad ng paggamit ng yodo sa mga pagkaing tapos nang iprinoseso.

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