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The Effect of Tamarind (*Tamarindus indica*) and Lime (*Citrus medica*) Juice Washing on the Sensory Attributes and the Rancidity Development in Breaded Tilapia - A Preliminary Study

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ABSTRAK

Keberkesanan bagi menyah bau dan citarasa lumpur di dalam ikan tilapia hitam (Oreochromis mossambicus) *dengan perlakuan pembasuhan (15.% b/isipadu jus asam jawa, 1.5% jus limau nipis dan campuran: 0.75% jus limau dan 0.75% jus asam jawa) telah dikaji. Kesan pembasuhan terhadap ketengitan di dalam ikan tilipia bersalut yang disimpan di suhu -20°C juga dibuat. Pembasuhan dengan larutan asid berjaya mengurangkan bau dan citarasa lumpur mengikut ahli panel. Sampel yang dibasuh dengan asam jawa menunjukkan perbezaaan daripada sampel lain dan mendapat lebih tinggi yang ketara bagi citarasa, bau dan warna. Kesemua sampel yang diberi perlakuan menunjukkan perbezaan kekenyalan yang ketara dari sampel kawalan. Walaubagaimanapun, proses ketengitan di dalam sampel berdasarkan nilai peratus asid thiobarbituric (TBARS) yang di simpan tidak dapat direncatkan.*

ABSTRACT

The feasibility of removing the muddy flavour and odour of black tilapia (Oreochromis mossambicus) *with natural acid extracts from tamarind and lime by washing treatment (1.5% w/v tamarind juice, 1.5% v/v lime juice and a mixture of lime juice 0.75% and tamarind juice 0.75% was investigated. The effect of the washing treatment on rancidity development in breaded tilapia kept at -20°C was also monitored. Acid washing improved the acceptability for flavour and odour as detected by sensory panellists. Samples treated with tamarind juice were different from other samples and were scored significantly higher for flavour, odour and colour than other treatments. All treated samples had a significantly tougher texture than the control. However, the rancidity development as indicated by the percentage of thiobarbituric acid reactive substances (TBARS) values in stored samples was not retarded.*

INTRODUCTION

Fish is a major source of protein, especially in the Asian region. However, fish consumption is mainly limited to marine species as freshwater fish is still less acceptable. One deterrent to the acceptability of freshwater fish is its characteristic muddy or earthy flavour and aroma which are mainly due to the presence of geosmin and 2-methylisoborneol (Yurkowski and Tabachek 1974, 1980; Kuusi and Suihko 1983). Geosmin is a volatile compound (Tyler *et al.* 1978), which can be transformed into an odourless compound by acids (Marshall and Hochstetler 1968). The marketability of fish can also be increased if it is formulated as a convenience food such as a breaded product. Attempts to remove the muddy flavour from live fish in holding tanks have been reported in pond-cultured channel catfish (Lovell 1983) and rainbow trout (Yurkowski and Tabachek 1974). Van Allen and Pessoney (1982) demonstrated that the off-flavour in cultured catfish can be reduced by the addition of potassium ricinoleate to the pond water to inhibit the growth of the blue-green algae believed to be

the source of the compound that causes the muddy flavour. In either case, it takes time to be effective, e.g. 14 days for rainbow trout (Yurkowski and Tabachek 1974). Hence it is time consuming compared with a method that removes the smell during the processing itself. However, Rohani and Yunus (1994) reported that soaking for 30 min in 5% salt solution leached out some of the muddy attribute as reflected by the sensory scores of the deboned red tilapia meat.

Traditional practices, such as washing whole fish with lime juice, tamarind juice and flour, are said to remove the muddy flavour and thus increase the acceptability of the fish. The effectiveness of this procedure has not been scientifically tested, but may have some basic since tamarind and lime juice are rich tartaric and citric acids, respectively. We here report the results of a preliminary study on the effect of washing tilapia fillets with tamarind juice, lime juice or a mixture to removal its muddy flavour, to evaluate the sensory attributes of the fillets and to monitor rancidity development in the breaded product. The rancidity factor is taken into account since the breaded tilapia is a deep-fried product and the development of rancidity may be induced by the presence of the additional oil in the fish and breading.

MATERIALS AND METHODS

Live black tilapia (*Oreochromis mossambicus*) weighing approximately 500-600 g each were procured from a nearby farm and brought alive to the laboratory. The procedure for their preparation is shown in *Fig. 1.*

Preparation of Washing Solutions

The lime juice solution was prepared by squeezing ripe fresh limes (*Citrus medica*) and diluting the juice to the percentage (v/v) with distilled water. The tamarind (*Tamarindus indica*) paste (the form used locally) was purchased from the nearby retail shop. The percentage of tamarind juice for washing was prepared on w/v basis (excluding the seeds). The pH of the juice extracts was not determined. A higher percentage of the juice is not desirable as a preliminary study showed it caused excessive gaping and toughening of the muscle and also imparted a slightly acidified flavour to the cooked samples.

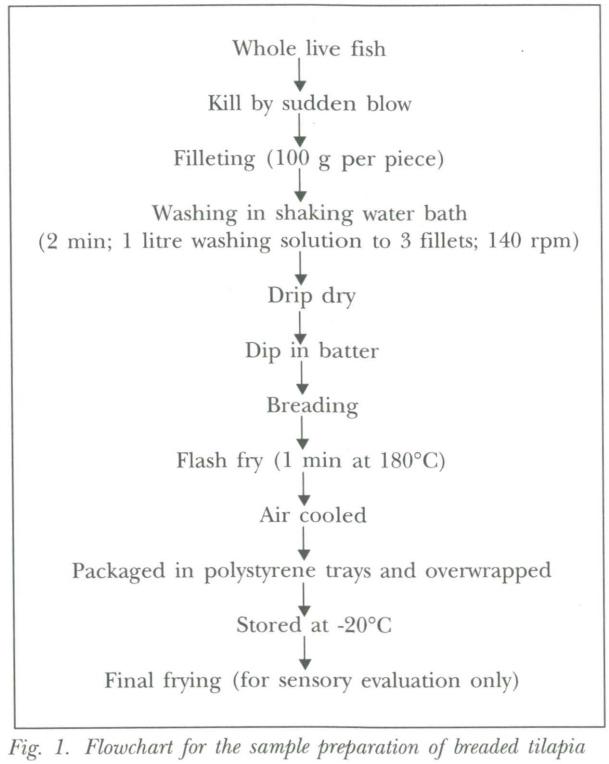

Fig. 1. Flowchart for the sample preparation of breaded tilapia

Titrable Acidity

The titrable acidity of both juice was determined by the method used by Ranganna (1986).

pH Determination

Determination of pH of unbreaded fillets was carried out after the drip-drying process. Ten grams of the samples were homogenized in 100 ml of distilled water and the pH was determined by a pH probe. Readings were done in triplicates.

Sensory Evaluation

The sensory evaluation was carried out by 12 untrained panellists according to the scale of Kosmark (1986) where 7 = like very much; 4 = neither like nor dislike and 1 = dislike very much. It is presumed that samples that were liked did not have a muddy odour or flavour, which if present would have been scored as less than 4, i.e. are disliked. The attributes scored were flavour, odour, colour, texture and acceptability. It was done fully cooked samples, i.e. after frozen storage they were further deep-fried to golden brown prior to evaluation.

Thiobarbituric Acid Reactive Substances (% TBARS)

The percentage of thiobarbituric acid reactive substances (% TBARS) values (Ramanathan and Das 1992) was measured after samples had been stored at -20°C. Storage was carried out mainly to observe the possible effect of the washing treatment on the rancidity development of the product.

RESULTS AND DISCUSSION

The titrable acidity of both tamarind and lime juice was 2.0 ± 0.1%. The fillets washed with LIJ had a pH significantly lower than those that were unwashed (control), washed with TAJ and washed with mix (Table 1). This lower pH of the LIJ washed samples may be the reason why these samples were slightly springy in texture as compared to the others (Kramer 1971).

Table 2 shows the sensory scores of cooked breaded tilapia. The TAJ samples scored significantly higher ($P<0.05$) for flavour and odour compared to other treatments. However, fillets washed in TAJ, LIJ were scored significantly higher for colour. The samples looked more bleached than the control and those washed with the MIX. The texture of the control scored significantly lower than all treated samples. A slight toughening of the fillets was noted. TAJ received the highest acceptability score. Hence, the effectiveness of the treatment can be ranked as TAJ > LIJ > control, mix.

TABLE 1
pH of tilapia fillets

Item*	pH**
fish muscle (unwashed)	6.67[a]
Control	6.68[a]
TAJ	6.68[a]
LIJ	6.57[b]
MIX	6.73[c]

* Control - washing with water; TAJ - washing with 1.5% tamarind juice; LIJ - washing with 1.5% lime juice; MIX - washing with 0.75% lime juice + 0.75% tamarind juice

** Means followed by a different superscript are significantly different at 5% level.

TABLE 2
Sensory scores of cooked breaded tilapia

Treatment*	Flavour	Odour	Colour	Texture	Acceptability**
Control	5.7[b]	6.0a[b]	5.9[b]	5.3[a]	5.7[b]
TAJ	6.1[a]	6.3[a]	6.5[a]	5.9[b]	6.2[a]
LIJ	5.8[ab]	5.8[b]	6.8[a]	5.7[b]	6.0[ab]
MIX	5.5[b]	5.9[b]	6.0[b]	5.7[b]	5.7[b]

* Control - washing with water; TAJ - washing with 1.5% tamarind juice; LIJ - washing with 1.5% lime juice; MIX - washing with 0.75% lime juice + 0.75% tamarind juice

** Based on the average scores of flacour, odour, colour and texture

\- Means followed by a different superscript are significantly different at 5% level.

The % TBARS values (*Fig. 2*) in breaded tilapia increased linearly with storage time. Washing with either lime juice or tamarind juice did not retard the rancidity development in frozen samples. Ramanathan and Das (1992) indicated that samples with % TBARS > 100% are indicative of the presence of rapid lipid oxidation. This value was achieved by all samples after about eight weeks of frozen storage. However, no samples were scored unfavourably or rejected for off-flavour development (*Fig.3*). Similarly, no samples was rejected for off-odour development (*Fig 4.*) The rapid decline in both flavour and odour scores of the samples indicates they may be rejected after a few more weeks' storage at -20°C.

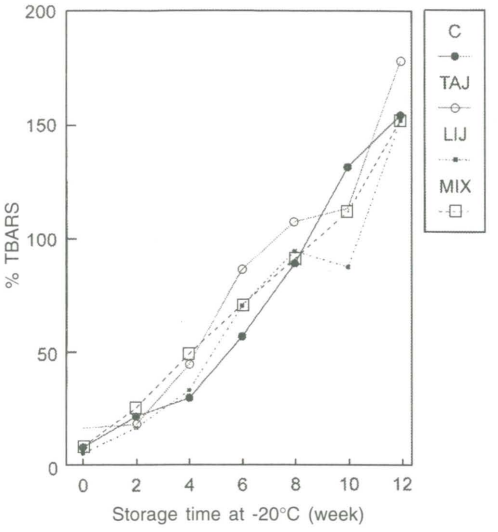

Fig. 2. % TBARS values of breaded tilapia stored at -20 °C

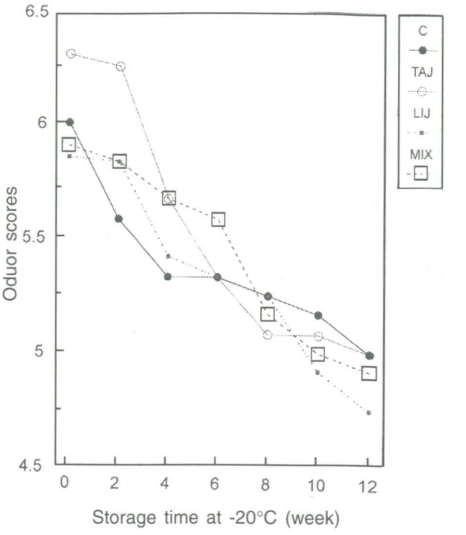

Fig. 4. Odour scores of breaded tilapia kept at -20 °C

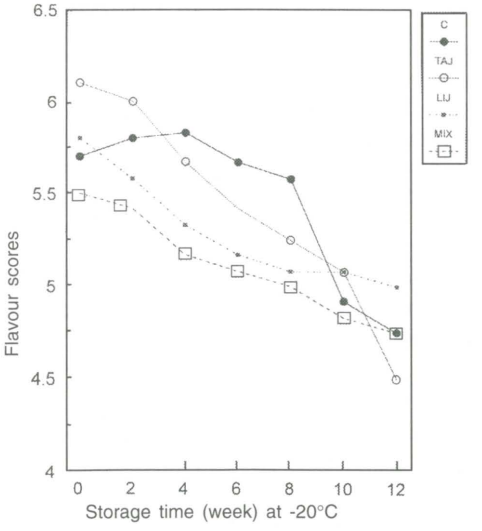

Fig. 3. Flavour scores of breaded tilapia kept at -20 °C

CONCLUSION

Washing with TAJ, LIJ or the MIX improved acceptability score for the odour and flavour of tilapia fillets. Tamarind juice washing scored highest for overall acceptability. None of the washing treatments retarded rancidity development in breaded fillets during storage as measured by the % TBARS value.

REFERENCES

KOSMARK, J.J. 1986. Standardizing sensory evaluation methods for marketing fish product. In *Proceedings of the International Symposium on Seafood Quality Determination*, ed. D. Kramer and J. Liston, p. 99-108. Amsterdam: Elsevier.

KRAMER, D.E. 1971. Hypoxanthin and nucleotide levels in Pacific halibut stored in refrigerated sea water, in ice, and plate frozen. In *Technical Aspects of Fish Quality Control*, p. 28-38. FAO Fisheries Report No. 115.

KUUSI, T. and M. SUIHKO. 1983. Occurrence of various off-flavours in fish in Finland from 1969-1981. *Water Science and Technology* **15**: 47-58.

LOVELL, R.T. 1983. Off-flavours in pond-cultured channel catfish. *Water Science and Technology* **15**: 67-73.

MARSHALL, J.A. and A.R HOCHSTETLER. 1968. The synthesis of (+)-geosmin and the other 1, 10-dimenthyl-9-decalol isomers. *Journal of Organic Chemistry* **33**(**96**): 2593-2595.

RAMANATHAN, L and N.P. DAS. 1992. Studies on the control of lipid oxidation in ground fish by some polyphenolic natural products. *Journal of Agricultural and Food Chemistry* **40**(**1**): 17-21.

RANGANNA, S. 1986. Proximate constituents. In *Handbook of Analysis and Quality Control for Fruit and*

Vegetable Products, 2nd edn. p. 1-15. New Delhi: Tata McGraw-Hill.

ROHANI, A.C. and M. YUNUS. 1994. Processing of surimi from freshwater fish-tilapia. In *5th Asean Food Conference,* 26-29 July, Kuala Lumpur, Malaysia. p. 286-288.

TYLER, L.D., T.E. ACREE, R.R. NELSON and R.M. BUTTS. 1978. Determination of geosmin in beet juice by gas chromatography. *Journal of Agriculture and Food Chemistry* **26**(**3**): 774-775.

VAN ALLEN, R.T. and G. PESSONEY. 1982. Algal research affects catfish off-flavour. *Aquaculture* **8**: 18-23.

YURKOWSKI, M.M. and J.L. TABACHEK. 1974. Identification, analysis and removal of geosmin from muddy flavoured trout. *Journal of Fisheries Research Board Canada.* **31**: 1951-1858.

YURKOWSKI, M. and J.L.TABACHEK. 1980. Geosmin and 2-methylisoborneol implicated as a cause of muddy odour and flavour in commercial fish from Cedar Lake, Manitoba. *Canadian Journal of Fisheries and Aquatic Science* **37**: 1449-1450.

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