CUMIN(*Cuminum cyminum* L.) EFFECTS ON BIOCHEMICAL AND QUALTY ATTRIBUTES OF RED TILAPIA FILLETS (*Oreochromus niloticus*) STORED IN ICE

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Abstract – The effect of powdered cumin sprinkling on the biochemical and sensory properties of fresh and ice-stored tilapia fillets during 21 days was evaluated. Initially, significant differences in pH, TMA-N, odour, flavour, appearance and overall acceptability were found between cumin-treated and untreated tilapia fillets at ($p<0.05$). Cumin powder addition (2% w/w) exhibited a preservative effect in treated fillets since significant lower levels of TMA-N were observed during ice storage. Both of TVBN and TMAN values were lower than acceptability limits during the storage of 21 days. The Sensory quality of cooked tilapia fillets was assessed by ten semi- trained panels at zero time and after 3, 6, and 9 days of ice storage. The present findings showed that cumin-treated tilapia fillets maintained their quality better than untreated fillets during the ice storage, since they achieved higher scores than untreated fillets.

Key Words – Sensory Assessment, Treated Fillets, TVBN, TMAN

I. INTRODUCTION

Spices have in recent years gained importance as bio nutrients, both as functional food ingredients and nutritional supplements; they are used primarily for enhancing food flavour rather than shelf life extension [1]. Cumin (*Cuminum cyminum* L.) is a small annual plant belonging to the *Apiaceae* family. It is one of the popular spices regularly used as a flavouring agent [2]. Cumin's distinctive flavour and strong, warm aroma is due to its essential oil content which may be considered as an interesting source of antibacterial, antifungal and antioxidants components used as potent agents in food preservation and for therapeutic or nutraceutical industries. Its main constituent and important aroma compound is cuminaldehyde (4-isopropylbenzaldehyde) [3]. However; any processing technologies used in the production of such compounds have to prove their technical/scientific efficiencies and the product quality to meet the basic requirement of hygiene and safety standards. Therefore it would be economically more suitable to use powdered spices or herbs as ingredients rather their extracts to preserve food including fish fillets [4]. Till date, there is no study on the effect of cumin extract or powdered cumin (*Cuminum cyminum* L.) on physicochemical and sensory attributes of ice stored tilapia (*Oreochromis niloticus*) fillets. Additionally, no studies have so far been successfully conducted to produce such ice stored spiced tilapia fillet with cumin flavour. Although there is potential for its palatability and acceptability in the local market in Malaysia, studies on its effect on the physicochemical and sensory properties of fish fillets are not available. The main objective of this study was therefore, to produce ice stored spiced tilapia fillet with a new flavor (cumin) and to demonstrate its effect on the physicochemical and sensory properties of cumin-treated fish fillets.

II. MATERIALS AND METHODS

Live red tilapia (*Oreochromi sniloticus*) was killed, scaled, headed, gutted, and filleted. The fish fillets were divided into two batches. The first batch was treated and sprinkled with fine cumin at concentration (2% w/w), while the second batch was left without treatment as a control. Fillets were placed into polyethylene bags individually and stored in sealed polystyrene

boxes with flaked ice (2:1w/w) in a cold room at 4ºC. The filleted tilapia was sampled and subjected to chemical and sensory analyses after 0, 3, 6, 9, 12, 15, 18, and 21 days of storage. The pH, TVB-N and TMA-N were measured according to Gökoğlu et al. [5], Malle & Tao [6], and Malle & Poumeyrol [7] respectively. The sensory attributes of cooked tilapia fillets were evaluated by a panel of 10 semi-trained panelists at zero time and after day 0, 3, 6 and 9 of ice storage. An eight-point hedonic scoring scale, was employed for odour, flavor intensity, juiciness, hardness, chewiness and tenderness, respectively, while a nine-point was used for evaluation of the appearance. A six-point scoring scale was utilized for evaluation of the off-flavour/off-flavour. Tilapia fillets receiving overall scores of more than 4 were considered acceptable. While a score between 3 and 4 was considered the borderline of acceptability [8].

III. RESULTS AND DISCUSSION

The changes in pH for untreated and cumin-treated tilapia fillets during the 21-day storage period in ice are shown in table 1. All tilapia fillets showed an initial low pH. Towards the end of storage (days 21), lower pH values in cumin-treated samples were recorded in comparison to untreated samples which may be due to cumin inhibitory effects on microbial growth, which delay the formation of basic nitrogen compounds. The pH was significantly changed ($p<0.05$) between treated and untreated fillets at the same day of storage**.**

Table 1Changes in pH of untreated and cumin-treated tilapia fillets stored in ice

Days in ice	Untreated fillets	Cumin-treated fillets
0	$6.07 \pm 0.03^{a\,C}$	$6.01 \pm 0.01^{a\,C}$
3	$6.23 \pm 0.03^{a\,B}$	$6.23 \pm 0.02^{a\,B}$
6	$5.89 \pm 0.03^{b\,D}$	$6.17 \pm 0.06^{a\,B}$
9	$6.25 \pm 0.01^{a\,B}$	$6.25 \pm 0.01^{a\,B}$
12	6.40 ± 0.02^{aA}	6.40 ± 0.01^{aA}
15	6.43 ± 0.01^{aA}	6.43 ± 0.01^{aA}
18	$6.21 \pm 0.01^{a\,B}$	$6.20 \pm 0.01^{a\,B}$
21	$6.38 \pm 0.02^{b\,A}$	$5.97 \pm 0.01^{a\,C}$

[a-b]Mean values of each parameter individually within a row with the same letter are not significantly different ($p<0:05$).
[A-D] Mean values within a column with the same letter are not significantly different ($p< 0:05$).

The variation of TVB-N contents for untreated and cumin-treated tilapia fillets are presented in fig. 1(a). The initial TVB-N values in fillets tilapia analyzed ranged from 4.85 ± 0.13 to 10.94 ± 0.15 mg N100 g $^{-1}$ flesh for untreated fillets and from 4.97 0.12 ± to 10.78 ± 0.15 mg N100 g $^{-1}$ flesh for cumin-treated tilapia fillets during the 21-day storage period. During ice storage, had no significantly ($p<0.05$) changes in TVB-N contents between untreated fillets and treated fillets. The TVB-N values increased according to time of storage. Generally, the amount of TVB-N was low throughout the iced storage. It has been shown that initial TVB-N values of a particular fish species is related to the fish non-protein nitrogen content, which in turn depends on fish feeding type, catching season and fish size [9]. Moreover, this change is related to age, locality and culture method [10]. The level of TVBN for white fish is generally considered to be fresh if the TVB-N is less than 20 mg N100 g $^{-1}$ sample. If the TVBN reaches 30 mg N100 g $^{-1}$, most authorities consider the fish to be stale, while at a level of 40 mg N100 g $^{-1}$, the fish is regarded as unfit for consumption [11]. The pungent odour of spoiled fish has often been related to the TMA-N tissue levels, also with the number of spoilage organisms present in many fish species, the rejection limit is usually from 5 to 10 mg TMA-N/ 100 g muscle [12]. The changes in TMA-N content in cumin-treated and untreated tilapia fillets stored in ice are shown in Fig. 1(b). Initially, TMA-N values of treated and untreated fillets were 1.16 ± 0.13 and 1.62 ± 0.13mg N100g^{-1N} flesh respectively, By the day 6 and 9 of storage, the TMA-N values of treated samples remained steady, attaining a final value of 2.90 ± 0.12 mg N100 g $^{-1}$ flesh by the end of the storage period (day 21). The highest value of 3.01 mg N100 g $^{-1}$ flesh was detected for untreated tilapia fillets on 12 and 18 days, which was, however, within the limit of acceptability. The small increase in TMA-N over the storage period in ice reflects the low level of trimethylamine oxide (TMAO) in the flesh of aqua cultured whole tilapia. TMA-N is produced by the decomposition of TMAO caused by bacterial spoilage and enzymatic activity. In addition, it reflects the low number of spoilage organisms present in raw fish. Cumin powder exhibited a

preservative effect in cumin-treated tilapia fillets since significant lower levels of TMA-N were observed during ice storage. Both TVB-N and TMA-N values remained below the limit of acceptability throughout the entire storage period.

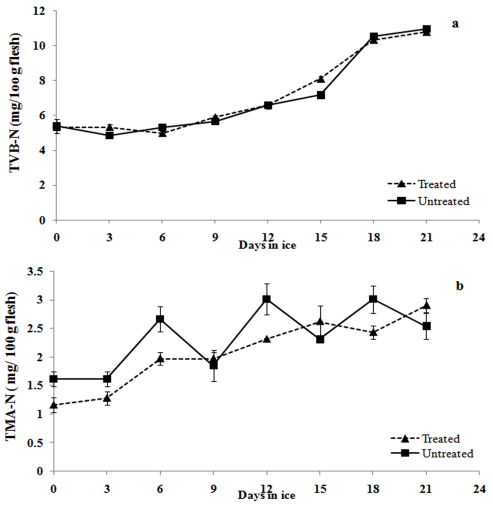

Figure1.The changes in TVB-N (a) and TMA-N, (b) for untreated and cumin-treated tilapia fillets during the 21-day storage period in ice

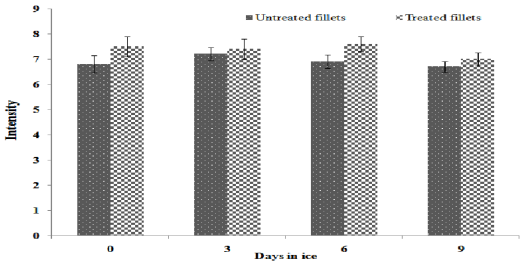

Figure 2 .Changes in appearance scores of cooked untreated fillets and cumin-treated fillets during iced storage.

Fresh fish is susceptible to spoilage caused by both microbiological and chemical reactions. The changes in sensory quality of cooked cumin-treated and untreated tilapia fillets through 9 days of storage are shown in Fig.4, and Fig.5. The storage time had no effect ($P<0.05$) on the sensory attributes of all cooked tilapia fillets. No significant difference ($P<0.05$) was detected for the juiciness, tenderness, chewiness, hardness between the control and cumin-treated samples. However significant differences were found in odour, flavour, appearance and overall acceptability between untreated and cumin-treated fillets. At the end of the present study; the cumin-treated tilapia fillets showed the highest score (7.4 ± 0.30) of overall acceptability, while the score for untreated fillets was (6.7 ± 0.26). Fig. 6 shows the changes in off-odour and off-flavour of cooked cumin-treated and untreated tilapia fillets through 9 days of storage. Generally, the off-odour or off-flavour in fish and fish products causes a major reduction in acceptability for consumers or makes them unsuitable for sale [13]. No Significant differences ($P<0.05$) were identified for the intensity of the off-odour and off-flavour scores between the control and fillets treated with cumin.

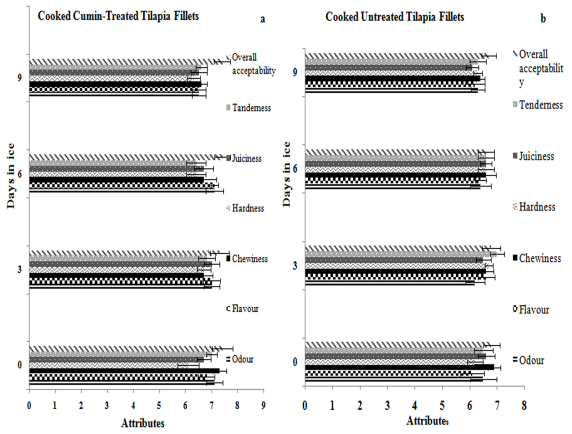

Figure 3. Changes in sensory attributes of untreated (a) and cumin-treated fillets (b) during iced storage

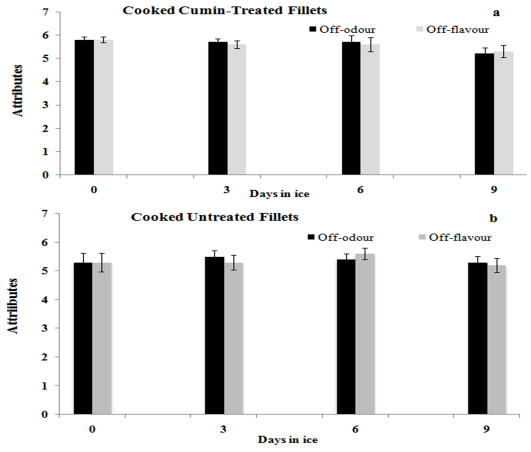

Figure 4 .Changes in off-odour and off-flavour intensity of cumin-treated fillets (a) and untreated fillets (b) during iced storage.

IV. CONCLUSION

No significant differences ($p<0.05$) in TVB-N parameter exist between untreated and treated fillets. However, cumin inhibitory effect was more marked in TMA-N values and sensory attributes for treated than untreated fillets. Regardless of treatment, our results indicate that from the beginning of the storage for tilapia fillets, the amounts of TVB-N and TMA-N were low during the edible storage period and only increased slightly at the end of storage(not exceed 10.97 and 3.01 respectively). Therefore, the TVB-N and TMA-N are considered to be unreliable for estimating the degree of freshness in the early stages of the storage of tilapia fillets; as they do not reflect the degree of spoilage in the later stages. The Sensory assessment of cooked tilapia fillets showed that no score of the fillet attributes dropped to the limit of acceptability, since all mean acceptability scores were still above 4 by the end of the evaluation.

ACKNOWLEDGEMENTS

Authors are thankful to the School of Chemical Science and food Technology for providing necessary facilities for conducting the present work.

REFERENCES

1. Babu, A. J., Sundari, A. R., Indumathi, J., Srujan, R. V. N. & Sravanthi, M. (2011). Study on the Antimicrobial activity and Minimum Inhibitory Concentration of Essential Oils of Spices. *Veterinary World* 4(7): 311-316.
2. Thippeswamy, N. B., & Naidu, K. A. (2005). Antioxidant potency of cumin varieties cumin, black cumin and bitter cumin-on antioxidant systems. European Food Research Technology 220:472–476.
3. Hajlaoui, F., Mighri, H., Noumi, E. Snoussi, M., Trabelsi , N., Ksouri, R. & Bakhrouf, A. (2010). Chemical composition and biological activities of Tunisian *Cuminum cyminum* L. essential oil: A high effectiveness against Vibrio spp. Strains. Food and Chemical Toxicology 48:2186–2192.
4. Smid, E. J. & Gorris, L. G. M. (1999). Natural antimicrobials for food preservation. In M. S. Rahman, Handbook of food preservation (pp285–308). New York: Marcel Dekker.
5. Gökoğlu, N., Cengız, E. &Yerlıkaya, P. (2004). Determination of the shelf life of marinated sardine (*Sardinapil chardus*) stored at 4 ºC. Food Control 15(1): 1–4.
6. Malle, P. & Poumeyrol, M. (1989). A new chemical criterion for the quality control of fish: trimethylamine/total volatile basic nitrogen (%). Journal of Food Protection 52:419–423.
7. Malle, P. & Tao, S. H. (1987). Rapid quantitative determination of trimethylamine using steam distillation. Journal of Food Protection 50:756–760.
8. Sallam, K. I. (2007). Chemical, sensory and shelf life evaluation of sliced salmon treated with salts of organic acids. Food Chemistry 101(2):592–600.
9. Goulas, A. E., & Kontominas, M. G. (2007). Combined effect of light salting, modified atmosphere packaging and oregano essential oil on the shelf-life of sea bream (Sparusaurata): Biochemical and sensory attributes. Food Chemistry, 100: 287–296.
10. Kyrana, V. R., Lougovois, V. P., &Valsamis, D. S. (1997). Assessment of shelf-life of maricultured gilthead sea bream (Sparusaurata) stored in ice. International Journal of Food Science and Technology 32:339–347.
11. Egan, H., Kirk, S. R. and Sawyer, R. (1981). Pearson´s chemical analyses of foods; 8th Edition; London: Churchill Livingstone.
12. El Marrakchi, A., Bennour, M., Bouchriti, N., Hamama, A., &Tagafait, H. (1990). Sensory, chemical, and microbiological assessments of Moroccan sardines (*Sardina pilchardus*) stored in ice. Journal of Food Protection 53: 600–605.
13. Robin, J., Cravedi, J. P., Hillenweck, A., Deshayes, C., & Vallod, D. (2006). Off -flavour characterization and origin in French trout farming. Aquaculture 260:128–138.