Consumer preferences for Nile tilapia (*Oreochromis niloticus*) value-added products in Samoa

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Abstract

Nile tilapia (*Oreochromis niloticus*) is an introduced low-value freshwater fish available in the Pacific that has limited scope for consumption in its fresh form. With increased fishing activity and climate change posing threats to global food security, utilisation of this cultured fish may aid in alleviating food security issues in the Pacific. This study explores the potential for better utilisation of Nile tilapia by developing four processed forms – salted-cold smoked, cured-cold smoked, surimi and fish paste – and evaluating these forms through consumer preference testing. A list of sensory terminology and a scoring system for fresh and cooked tilapia were developed prior to the testing. The consumer preference testing was conducted in the fish market, Apia, Samoa with a total of 71 consumers. Fish paste was the most preferred product, followed by salted-cold smoked, then surimi while cured-cold smoked tilapia was the least preferred. However, no significant difference ($P \geq 0.05$) was observed between preference of these products, indicating the acceptability of all four products by Samoan consumers. This means that there is the potential for commercialising these products.

Keywords: consumer preference, food security, Nile tilapia, value-added products

Introduction

Fish is a significant contributor to food security, especially in coastal communities, including the Pacific Island nations (Brander 2007). Globally, fish provides more than 1.5 billion people with almost 20% of the average per capita intake of animal protein, and 3.0 billion people with at least 15% of such protein (FAO 2010). Climate change and variability are a threat to fisheries production. However, it is recognised that fish supplies in traditional marine and inland capture fisheries are stagnating (FAO 1997).

Aquaculture is an important and growing production sector for high-protein food, contributing to global tilapia production of 5,576,800 tonnes in 2015 (Fitzsimmons 2016). This confirms that tilapia contributed significantly to global food security. Tilapia is one of the most popular cultured fish in the world, produced in approximately 75 countries, and its production is continuing to increase (Josupeit 2005). It is one of the freshwater species available worldwide that meets the entire requirements for successful low-cost farming, it is hardy, easy to breed and grow, versatile in feeding, and has low-tech farming requirements (Jarding et al. 2000).

Tilapia has reached the top five preferred seafood items in the USA, overtaking salmon in 2009 (SPC 2011). Studies show that in 2000, global consumption of tilapia was worth USD 1.75 billion and in 2005 it reached USD 2.5 billion (FAO 1997). Tilapia flesh is white, and it has been a good substitute for the declining supply of other white fish such as cod. Availability of value-added tilapia products has been increasing since 2005 (Fitzsimmons 2016). Most edible products from farmed tilapia have been developed and scientifically tested for their shelf stability. These include surimi (Ramirez et al. 1999; Zhou et al. 2005, 2006), burger (Ninan et al. 2010), smoked products (Yanar et al. 2006), sausages (Oliveira Filho et al. 2010) and frozen fillets (Korel et al. 2001; Ou et al. 2002; Da Silva Afonso and Sant'Ana 2008; Odoli 2009; Liu et al. 2010). Different pre-treatments and packaging types, such as modified atmosphere packaging (Reddy et al. 1994, 1995, 1996; Peng et al. 2009), vacuum packing (Martinsdóttir et al. 2009), canning (Akande et al. 1993), liquid smoke (Siskos et al. 2005; Swastawati et al. 2011) and pre-treatments like irradiation (Abu-Tarboush et al. 1996; Al Kahtani et al. 1996) and ozone (Diao et al. 2007), have been developed to ensure food safety. Whole or gutted tilapia are still available but are sold primarily in ethnic markets. Other interesting by-products, including leather goods for clothing and accessories, gelatin from skins for time-released medicines and flower ornaments made from dried and coloured fish scales, have also emerged (FAO 2011).

There are many strains of tilapia. *Oreochromis mossambicus* was introduced to Samoa in 1955 to provide an alternative supply of fish in order to relieve pressure on over-exploited marine fishery resources as well as to provide a means of generating income (Mulipola et al. 1997). However, in 1991, the fisheries division introduced a better performing strain, *Oreochromis niloticus*, for aquaculture through the South Pacific Aquaculture Development Project (SPADP) (South et al. 2011). This is a genetically improved farmed tilapia

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(GIFT) which has been shown to have higher growth performance and salinity tolerance than other Nile tilapia strains.

Currently in Samoa, there are approximately 27 tilapia farmers of whom five are semi-commercial and 22 are subsistence farmers (South et al. 2011). Tilapia is usually sold live and whole directly to consumers; occasionally they are sold gutted and scaled. At harvest and prior to selling, farmers usually purge the fish in brackish water for 30 minutes to one hour. Chinese restaurants in Apia have been reported to be buying fresh tilapia at a cost of WST[4]3.00–5.00 per fish (South et al. 2011). Commercial tilapia farming is still low key in Samoa despite efforts by the government to develop a sustainable industry. Major constraints are financial and technical support for infrastructure development and accessing markets for products. Teri and Pickering (2007) propose developing additional sale outlets for live tilapia and product development to diversify the ways in which tilapia can be sold, which could help generate income, improve national food security and enhance livelihoods.

In Samoa in 1995, two sensory evaluation events were held that assessed the acceptance of tilapia as a food fish, with the tilapia cooked using different traditional methods (Bell et al. 1997). Results showed that tilapia was acceptable as a food fish. However, there have been few studies on the preservation and value adding of tilapia in Pacific Island countries, thus the need for further research in the area. The objective of this study was to facilitate consumer recognition of four tilapia value-added products through consumer preference testing. The testing also aimed to promote investor confidence for potential commercial processing of tilapia in Samoa.

Methods

Post-harvest preparation

A total of 400 fresh medium-sized tilapia with an average length of 23 ± 1.0 cm and weight 200 ± 0.1 g and in rigor condition were obtained from Naduroloulou Research Station in Nausori, Fiji. The fish were transported on ice to the post-harvest laboratory at the University of the South Pacific, Fiji, where they were scaled, gilled and gutted within 4.5 hours of their arrival. About 70% of the fish were treated as whole fish and were then packed in polythene bags in groups of 10; the remaining fish were manually filleted without skin on and were packed as 2 kg bags. All processed fish packed in sealed bags were stored at –24°C until further processing.

Value adding

Required quantities of the frozen tilapia were thawed at 0°C for 24 hours in the chiller prior to further processing into four value-added products. The recipe for each product was selected based on the descriptive assessment, flavour and texture profiling by the trained panelists for each prototype. A list of sensory terminology and a scoring system for fresh untreated and non-brined-smoked and brined-smoked Nile tilapia that were salted at different concentrations were developed by the trained panelists. The final four value-added products that were prepared were: smoked fish brined in 30 ppt salt solution; smoked-fish cured in a mixture of 30 ppt salt and 18 ppt sugar solution; surimi; and fish paste. These products were packed and stored at –24°C awaiting further packaging for transporting to Samoa.

Packing and storage

A day prior to departure for Samoa, all cold-smoked fish were individually wrapped in aluminium foil, steamed for 15 minutes, cooled for 30 minutes at ambient temperature and further cooled at 4°C for 1 hour. They were then packed in groups of three in polythene bags, sealed with a sealer machine and stored at –24°C. On the departure day, all four products were removed from the freezer and packed in ice boxes with gel ice. All the products were placed in the freezer upon arrival in Samoa until the sensory evaluation day.

Sensory evaluation

The consumer preference test was conducted in a central location at the fish market in Apia, Upolu, Samoa. A month prior to the sensory evaluation event, a public invitation for consumer panelists was made through TV, radio and newspaper advertisements. A special invitation was extended to restaurant owners especially seafood restaurant owners, hotel industry stakeholders and tilapia farmers. A total of 71 consumer panelists attended the sensory evaluation event. At the event, consumer panelists were interviewed on their background and fish consumption characteristics, prior to the sensory evaluation of the four products. About eight fisheries officers assisted in the face-to-face interviews, interpretation and filling of ballot papers. Consumers were asked to evaluate the degree of liking for each of the four value-added products based on the sensory attributes: appearance, aroma, flavour, texture/mouth feel and overall acceptance using a 9-point Hedonic scale (1 = like extremely, 5 = neither like nor dislike and 9 = dislike extremely). Consumers were also asked to rank the four products from 1 to 4, where 1 was the highest and 4 the lowest.

All Nile tilapia value-added products were thawed at 0°C overnight and steamed for 5–7 minutes and cooled prior to sensory evaluation. Each panelist was served with the four samples of the products on a plate. Panelists were instructed to rinse their mouth for 4–5 seconds with water provided before tasting each sample. Samples were evaluated in the following sequence: surimi, paste, salted-smoked and then cured-smoked tilapia. Plain breakfast crackers were provided as a carrier for the evaluation of paste samples. Each consumer panelist took approximately 20–30 minutes to evaluate all the samples. The questionnaire was tested and validated by Samoan fisheries officers prior to the sensory evaluation event.

Data analysis

Data were analysed at $\alpha = 0.05$ unless stated otherwise, using version 16.0 of Predictive Analytics Software (PASW), formerly known as SPSS, compatible. The distribution of all data collected was tested for normality using Shapiro–Wilk test. Due to the nature of the data collected, non-parametric

[4] WST (Samoan Tala) 1.00 = AUD 0.52 in June 2018.

tests were used as described by Lawless and Heymann (1998). Kruskal–Wallis test was used to analyse consumption characteristics of consumers. G-test was used as a post-hoc test wherever required. Friedman test was used for significant difference among the attributes of each product. Post-hoc analysis was carried out with Wilcoxon Signed-Rank tests by applying Bonferroni's correction. Wilcoxon Signed-Rank test was also used to test for significant difference in attributes for the two smoked products. Chi-square test was used to find the relationship between gender and preference, education and preference and age group and preference of tilapia products. Friedman test was also used to test for significant difference between the overall preferences for tilapia value-added products.

Results and discussion

Socio-demographic characteristics of participants

A total of 71 people participated in the sensory evaluation event, however only 65 questionnaires were accepted for data analysis. The rejected questionnaires were rejected due to incompletion. As shown in Table 1, of the 65 participants 97% were from the island of Upolu, while the remaining 3% were from Savaii and Manono. In terms of gender, 23% of participants were female. In terms of ethnicity, participants were 74% Samoan, 8% European, 9% mixed ethnicity, 4% Japanese and 5% other. The average age of the participants was 44 years; the most represented group was 21–40 years (43%) followed by 51–60 years (15%). The average length of education was 16 years, and 51% of panellists had 11–20 years of formal education.

It is not surprising that the majority of the people who participated in the sensory evaluation were from Upolu, where the event took place. People from outside Upolu who participated were people who run businesses on Upolu and reside on the island. It is interesting to note that the participation level of females in the current study is in line with the participation in a similar sensory evaluation event that took place in Samoa in 1995. One of the reasons fewer females participate in such events may be due to gender-bias cultural expectations. Usually in the Pacific Islands region, including in Samoa, females are expected to stay at home and prepare food and take care of other domestic duties including child care, while males have the freedom to leave the home and attend public events, especially on week days.

Table 1. Socio-demographic characteristics of participants in the sensory evaluation (n = 65).

Characteristic	Category	Number of participants	Percentage (%)
Gender	Male	49	75
	Female	16	25
Age group	15–17	0	0
	18–24	8	12
	25–34	12	18
	35–44	11	17
	45–54	11	17
	55–64	11	17
	65 and above	7	11
	No response	5	8
Ethnic background	Samoan	48	74
	European	5	8
	Mixed	6	9
	Asian	3	4
	Other	3	5
Origin	Upolu	60	92
	Savaii	1	2
	Manono	1	2
	Apolima	0	0
	Outside Samoa	3	5
Education	1–8 years	4	6
	9–13 years	18	28
	14+	25	38
	No response	18	28

Fish consumption characteristics of participants

Table 2 shows that 42% of participants consume fish more than twice per week at home (68%), in restaurants or both (28%), with home consumption significantly higher ($P < 0.05$). Results also showed that people prefer marine fish to freshwater fish. Only 9% of respondents had previously consumed tilapia, despite the fact that tilapia has been produced in Samoa for over a decade. As suggested by Fitzsimmons (2016), consumption of tilapia could be increased by more consumer recognition, improved quality and variety of products, better marketing and overall increased demand for fish products.

There are many different species of fish caught and readily available for sale in Samoa, with tuna (55%) the most commonly consumed fish, followed by parrotfish, and tilapia the least consumed. These data suggest that the people of Samoa appear to be marine fish eaters, with higher dependency on tuna and other reef fish.

Annual fishery product consumption in Samoa was estimated to be 46.3–71.0 kg/year/person (Gillet 2009). Bell et

Table 2. Fish consumption characteristics of participants in the sensory evaluation (n = 65).

Characteristic	Category	Number of consumers	Percentage (%)
Fish consumption	Once a month	3	5
	2–3 times a month	11	17
	Once a week	16	25
	≥ twice a week	27	42
	Seasonally	3	5
	Other	5	8
Where fish is consumed	Home	44	68
	Restaurant	1	2
	Both home and restaurant	18	28
	At a party or gathering	0	0
	Other	2	3
Fish types consumed*	Parrotfish	26	40
	Goatfish	16	25
	Emperor fish	22	34
	Mullet	22	34
	Snapper	22	34
	Tuna	36	55
	Grouper	21	32
	Spinefoot	13	20
	Tilapia	6	9
	Other	30	46
Attributes influencing choice of fish for purchase*	Appearance	23	35
	Flavour	17	26
	Taste	20	31
	Cost	15	23
	Freshness	31	48
	Texture	13	20
	Size	9	14
	Species type	8	12
'Farm-raised Nile tilapia tastes equal to marine fish'	Strongly agree	12	18
	Agree	18	28
	Neither agree nor disagree	11	17
	Disagree	9	14
	Strongly disagree	11	17
	Other	4	6

* Consumers were allowed to choose more than one category, so category percentages do not add up to 100.

al. (2008) worked out the annual per capita fish consumption in Samoa by household income and expenditure survey (HIES) results and showed an average national consumption of 87.4 kg, with 45.6 kg for people in urban centres and 98.3 kg for rural dwellers.

Fish consumption in Samoa and other Pacific Islands is remarkably higher than the global average per capita fish consumption of 16.5 kg (Bell et al. 2008; Gillett 2009). The result in the current study is not surprising because over 40% of Samoa's non-tourism export earnings come from the export of fish, especially tuna to the cannery in Pago Pago, American Samoa.

Perception of fish's sensory attributes

It is recognised that various attributes play a part in determining consumers' choice in the purchase of goods including food. Food attributes such as appearance, flavour, taste, texture, freshness, size or weight, species and price all contribute to the decision made by consumers, and understanding the decision making is therefore complicated.

The results in Table 2 show that freshness (48%) appears to be the most significant factor ($P < 0.05$) that influences the choice and purchase of fish in Samoa, followed by appearance and taste. This is in line with the findings of Drake et al. (2006), who demonstrated freshness as the most important factor influencing the choice of fish. Freshness in fish is usually associated with fresh mild seaweed and metallic odour; shiny, bright appearance with tightly adhered scales; firm, elastic and moist flesh with almost translucent colour; bright, clear and full eyes, with black pupils and transparent corneas; gills bright red or pink in colour with little visible mucus or slime; and no bruising, blood spots or browning.

Price of the fish is also a factor but not as important as freshness. Species and size of fish were indicated as contributing factors but were the least important attributes when choosing and buying fish in the market. However, to some customers size of fish may be important to ensure there is enough for the whole family. Some prefer to purchase serving portion size fish, i.e. a whole fish around 300–500 g, while others prefer bigger fish because of too many bones in small fish.

Perception of tilapia's sensory attributes

When consumer panelists were asked to respond to the statement 'Farm-raised Nile tilapia tastes equal to marine fish', 46% of respondents either agreed (28%) or strongly agreed (18%) to this statement, but these figures were not significantly different ($P > 0.05$), despite the fact that few participants (9%) had previous experience in tasting tilapia (Table 2). This is an interesting result indicating that Samoans do value and accept tilapia as being as good as marine fish, and may mean that tilapia has the potential to be marketed at a higher price in Samoa. This result is in agreement with findings of Mulipola et al. (1997) who reported that 62% of respondents preferred tilapia to reef fish. Similar sentiments for aquacultured Southern Flounder were expressed by consumers who believed that farmed fish normally exhibit different sensory properties to wild fish (Haard 1992; Drake et al. 2006). This was also stated by Mohr (1986) who wrote that meat of farmed fish tends to be softer in texture and have a milder, less robust flavour than that of wild fish. However, it appears that most consumers were unable to discern these differences between wild fish and cultured fish hence the reasons for variation in response and sensory behaviour of consumers. Perhaps further investigation of relationships between perceptions of farmed fish and its consumption is warranted due to limited research in the area.

Figure 1 shows that taste was the most important attribute for tasty tilapia (18%), followed by texture (16%) and appearance (15%). Size was the least important attribute, however some respondents also ranked fillet as an important attribute. It is interesting to note the difference in responses between fish in general (Table 2) and tilapia, with the most important attribute of fish in general being freshness, while tilapia's most important attribute is taste. These differences may be due to the common perception that tilapia is tasteless or bland when cooked on its own. This was one of the reasons for brining the tilapia, i.e. for flavour enhancement. Studies have also shown that different purging times mixed with different salinity levels could improve the taste of tilapia, and improve its popularity in the market over marine fish (Gell et al. 2010).

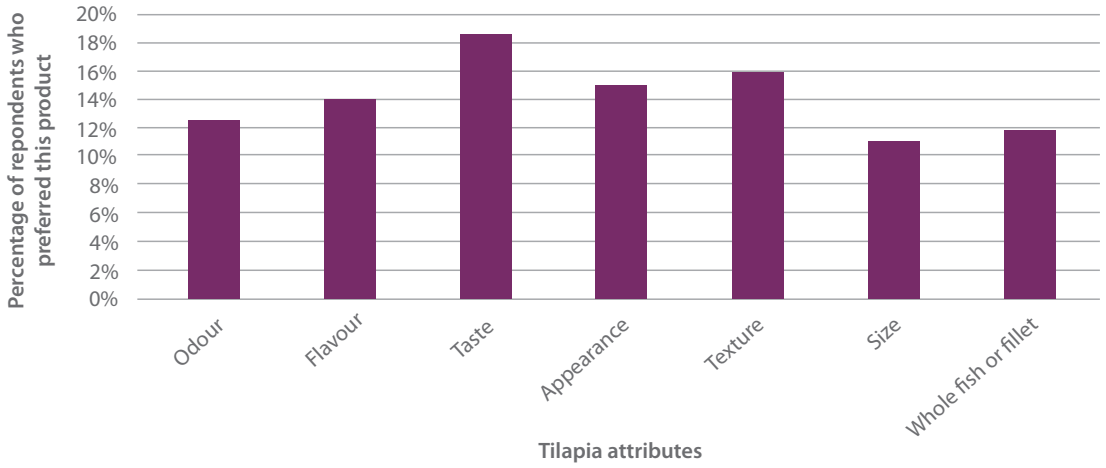

Figure 1. Perception of important attributes that contribute to tasty tilapia.

Acceptance of and preferences for tilapia products

Sensory evaluation of the four tilapia value-added products showed that all the products were liked by the consumer panelists in Samoa (Figure 2). Paste was preferred by 31% of the participants, followed by brine-smoked (28%), surimi (22%) and cure-smoked tilapia (19%). Statistical analysis by one-way ANOVA showed no significant difference ($P \geq 0.05$), implying that the products were all acceptable by the consumers, and indicating good market potential for such value-added products from farmed tilapia.

The mean scores and the inter-quartile range for the sensory attributes of the four value-added products are given in Table 3, which reveals very high acceptability scores.

There were no significant differences between attributes of brined cold-smoked fish ($P = 0.19$), surimi ($P = 0.745$) and paste ($P = 0.463$). The results indicate that the five attributes for these products were equally liked by the consumers. However, a statistical analysis revealed that significant differences exist within the attributes of cured cold-smoked fish ($P = 0.03$). There was a statistically significant higher degree of liking for appearance for cured cold-smoked tilapia compared to the other attributes ($P < 0.005$). Haard (1992) argued that overall appearance is particularly important in the market acceptability of fishery products. The higher boundary of attribute intensities for the given hedonic scale was set as 'like extremely (= 1) to like moderately (= 3)' to represent the acceptance of the attributes. Sensory attributes such as colour, aroma, flavour and texture play important roles in consumer decisions in the purchase and consumption of a food product (Sulaeman et al. 2002).

In the current study, appearance, odour, flavour, taste and texture were rated as good for all the four products. For brined cold-smoked tilapia, the majority of the consumers rated odour (86%), flavour (83%), taste (82%) and texture (86%) as good, while 75% rated appearance as good. Similar trends were also noticed for cured cold-smoked tilapia, surimi and paste, indicating that appearance of these products was the least important for consumer panelists when compared to odour, flavour, taste and texture. However, the differences in the sensory attributes among the four products are not significant ($P > 0.05$) which indicates that these value-added tilapia products are acceptable by consumers in Samoa.

A limited number of females participated in the sensory evaluation event, thus representation on gender was generally poor for comparison purposes. The results in Figure 3 show that the preferred product for the male respondents (32%) was brined cold-smoked, followed by paste (28%), surimi (21%) and cured cold-smoked (19%). For the female respondents, paste was the preferred product (30%), followed by brined cold-smoked (26%), while cured cold-smoked (22%) and surimi (22%) shared similar ratings. Gender-based differences were not significant.

Table 4 shows preference in relation to respondents' education level. About 2% of the 1–8 years of education category preferred brined cold-smoked; for the 9–13 years category, 10% preferred brined cold-smoked; while for the 14+ years category, 12% preferred brine cold-smoked. These findings are significantly different ($P \leq 0.05$). When Bonferroni's test was conducted, results revealed that people with higher education (14+ years) tended to accept new tastes better than people with less education. Similarly, the results show that the younger generation seems to prefer smoked products and surimi while the older generation prefers the paste; here again these differences are significantly different ($P \leq 0.05$). Bonferroni's test indicated that people aged 46 years and above prefer tilapia value-added products than people of other ages. A study by Corredor et al. (2010) also showed that acceptance and purchase intent are affected by education/profession.

Table 5 shows value-added product taste evaluation in relation to ethnic background. The majority of the participants were Samoans (79%), the remaining being European (9%), mixed ethnicity (8%), Japanese (3%) and people of other origins (2%). Results indicate that most Samoans preferred brined-smoked tilapia (24%) while most Europeans preferred the paste (4%), mixed ethnicity participants preferred brined-smoked and paste (3% each), Japanese preferred brined-smoked, surimi and paste at 1% each, while people from other origins preferred the paste (2%). There is a significant preference for brined cold-smoked tilapia among the Samoan respondents ($P < 0.05$).

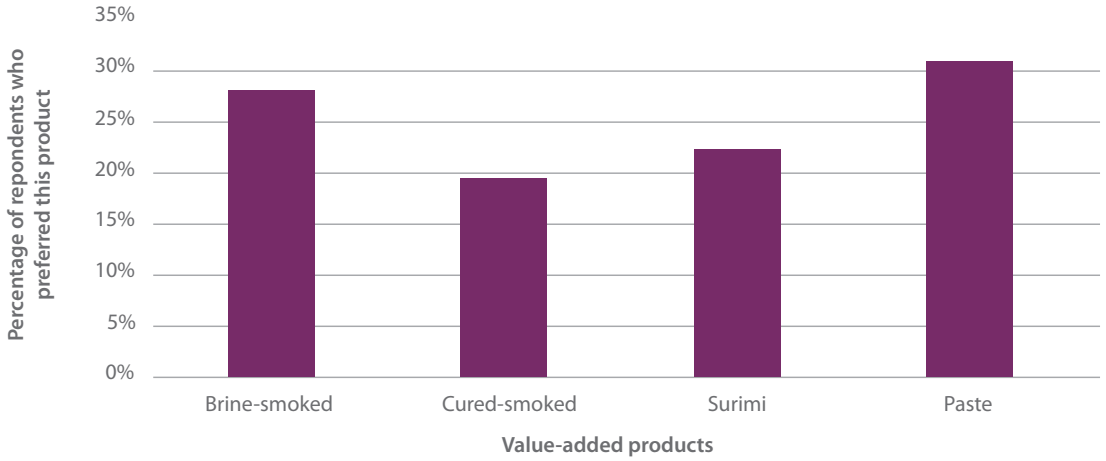

Figure 2. Consumer ranking of the four tilapia products.

Table 3. Mean scores and inter-quartile range of tilapia products using Friedman test.

Attribute	Mean rank	Inter-quartile range			*P*-value
		Highest score	Median score	Lowest score	
Brined, cold-smoked tilapia					
Appearance	3.3	1	3	6	
Odour	2.7	1	2	8	
Flavour	3.0	1	2	6	0.19
Taste	3.1	1	2	7	
Texture	3.0	1	2	7	
Cured, cold-smoked tilapia					
Appearance	3.4	1	3	6	
Odour	2.9	1	2	5	
Flavour	2.9	1	2	8	0.03
Taste	2.8	1	2	4	
Texture	2.9	1	2	6	
Surimi					
Appearance	3.1	1	2	8	
Odour	2.9	1	2	7	
Flavour	3.0	1	2	7	0.745
Taste	3.0	1	2	8	
Texture	3.0	1	2	9	
Paste					
Appearance	3.0	1	2	7	
Odour	2.9	1	1	5	
Flavour	3.0	1	1	7	0.463
Taste	3.2	1	2	4	
Texture	2.9	1	1	5	

1 = like extremely, 2 = like very much, 3 = like moderately, 4 = like slightly, 5 = neither like or dislike, 6 = dislike slightly, 7 = dislike moderately, 8 = dislike very much, 9 = dislike extremely.

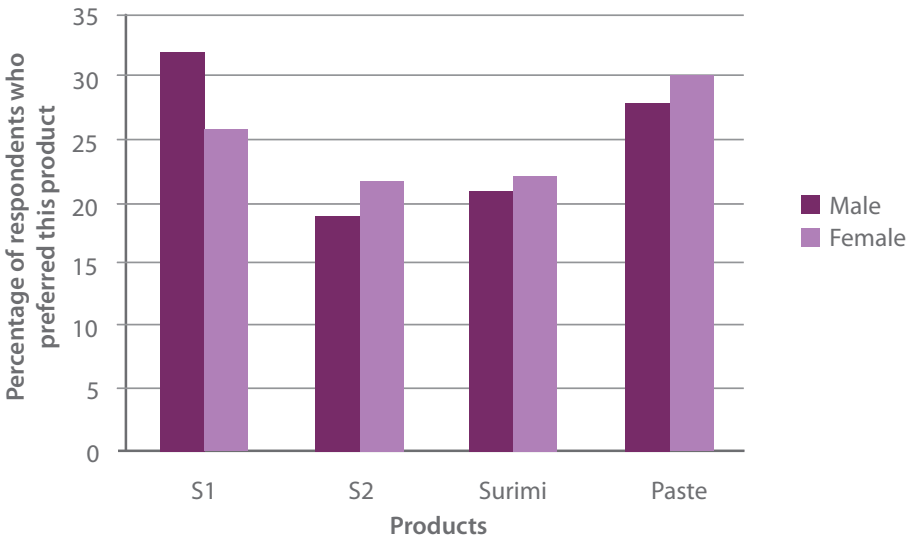

Figure 3. Preferences for the tilapia products by gender.
S1 = brined, cold-smoked tilapia; S2 = cured, cold-smoked tilapia.

The overall taste evaluation of tilapia value-added products (Table 6) showed that paste was the preferred product, followed closely by brined cold-smoked fish, surimi and cured cold-smoked fish. Differences, however, were not significant ($P = 0.185$).

While value-added products from tilapia are shown to be acceptable by consumers in Samoa, 42% of the respondents still preferred to buy live tilapia and 20% prefer fresh, untreated tilapia as shown in Figure 4. It appears that there is little scope for the sale of frozen tilapia, however value-added products such as fried-salted, smoked, surimi, paste and other products received 5%, 10%, 8%, 9%, 4% popularity, respectively. Given the outcome of the current sensory evaluation of Nile tilapia, commercial food processing of this fish species may provide further marketing opportunities. This study suggests that commercial processing of tilapia could be a viable venture in Samoa, and could contribute to food security through better utilisation of a currently underutilised fish species. This may also help divert fishing pressure from the already overexploited nearshore and offshore fisheries.

Conclusion

Farmed Nile tilapia value-added products have been well accepted in Samoa. Various opportunities for income generation exist through increased participation in farming and product development of similar underutilised fish species, which will also contribute to national food security.

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Table 4. Preferences for the tilapia products by respondents' level of education.

Number of years of education	Percentage of respondents who preferred this product*					P-value
	None	Brined, cold-smoked	Cured, cold-smoked	Surimi	Paste	
1–8	0	2	1	3	1	
9–13	0	10	6	6	9	0.916
14+	1	12	6	7	9	
Total	**1**	**24**	**7**	**16**	**19**	

* Consumers were allowed to choose more than one category, so category percentages do not add up to 100.

Table 5. Preferences for the tilapia products by respondents' ethnicity.

Product	Samoa	European	Mixed ethnicity	Japanese	Others
Brine-smoked	24	2	3	1	1
Cured-smoked	17	1	2	0	0
Surimi	19	2	0	1	0
Paste	19	4	3	1	2

Table 6. Overall preference for tilapia value-added products (respondents could have several equally preferred products).

Product	Number of consumers	Percentage of consumers*	P- value
Paste	33	51	0.185
Brined cold-smoked	30	46	
Surimi	24	37	
Cured cold-smoked	21	32	

* Consumers were allowed to choose more than one category, so category percentages do not add up to 100.

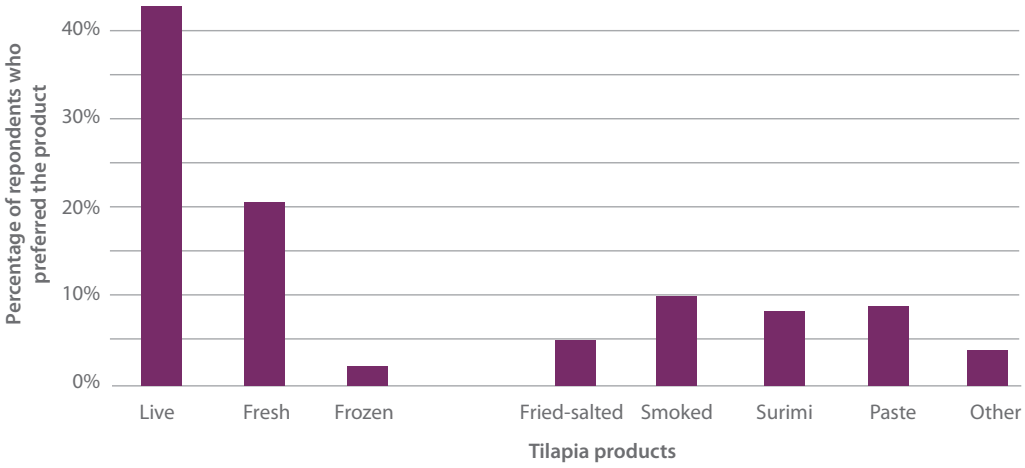

Figure 4. Preference for different types of tilapia products.

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