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DIFFERENT PERCENTAGES OF BASIL SEEDS (*Ocimum basilicium* L.) AS HYDROCOLLOID IN BATTER COATING SYSTEM: EFFECT ON THE PHYSICOCHEMICAL AND SENSORY PROPERTIES OF BREADED FISH FILLETS

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ABSTRACT

Basil seed (*Ocimum basilicium* L.) has the potential to improve the characteristics of food products when added to the batter for coating but the amount could result in different qualities. This study investigates the physicochemical and sensory properties of tilapia fish fillets coated with batter added with different percentages of basil seeds (0%, 3%, 6% & 9%). The viscosity, coating adhesion, cooking yield, frying loss, moisture and fat contents, colour, texture and sensory properties were analyzed. As the basil seeds percentages added increased, the viscosity was improved and strongly correlated with the coating adhesion, cooking yield, frying loss and moisture content. The hardness, chewiness and fracturability of the fish fillet were also improved. The treated samples were darker and redder, which contributed to the golden colour. Panellists rated the crispness and overall acceptability of the treated samples higher than the control (0% of basil seed), while other parameters such as colour, appearance, fishy smell level, taste and juiciness were not different between the control and the treated samples. In conclusion, the quality of the coated fish fillet with added 3% of basil seed to the batter was not much different compared to the control (0%), while, the 9% had negatively influenced the oil adsorption and sensory characteristics of the samples. Therefore, 6% is suggested as the most suitable percentage to be used in the batter.

Key words: Breaded, coating materials, hydrocolloid, mucilage, tilapia fillet

INTRODUCTION

Processed fish products such as fish fillets, fish nuggets, and fish fingers are usually coated with batter or/and breadcrumbs to prevent the disintegration of the products during storage and cooking (da Silva *et al*., 2021). These battered and breaded products are examples of ready-to-cook products, which only need to apply a final cooking procedure such as the deep-fat frying method before consumption (Rozzamri *et al*., 2020). Batters and breading serve many functions as food coatings. The coating of the food products can produce a crunchy texture, and golden yellow colour, and can act as a barrier against the loss of moisture, hence, the product becomes tender with a juicy interior and crispier outer crust (Fiszman & Salvador, 2003). There are three steps of the battering and breading procedure which involve pre-dusting, battering, and breading. Each step has its function to produce a good quality battered and breaded product (Bandre *et al*., 2018). Lack of adhesion at the interface and increase in oil absorption, which affects consumer acceptance are among the problems related to the battered and breaded products, therefore, improvements are needed by manipulating the battering system (Fiszman & Salvador, 2003; Kılınççeker, 2011).

The use of edible films or coatings with the incorporation of hydrocolloids such as polysaccharides or gums may extend the shelf life and improve the quality of fresh, frozen, and manufactured food products (Varela & Fiszman, 2011). Some coatings, particularly those based on hydrophilic polymers, are a good barrier to retaining the moisture of food material and could hinder the absorption of the oil during frying coated food pieces (Balasubramaniam *et al*., 1997). Hydrocolloids are used to improve batter performance and assist the suspension of different solids by controlling the viscosity and water-binding capacity. Examples of hydrocolloids that have been

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tested to improve the batter's quality of the fish product were sodium alginate, carrageenan, hydroxyl propyl methylcellulose, xanthan gum, and chitosan (Talab & Abou-Taleb, 2021). Most of these hydrocolloids could control the amount of batter adhered to the fish by increasing the batter's viscosity and lowering its overflow during the process. They also could retain the moisture that is directly related to the available free water, form films, improve freeze-thaw stability, and infuse with mild surfactant properties thus improving the battered products during frying (Chen *et al*., 2008).

Basil seed (*Ocimum basilicum* L.) is a popular aromatic and white-purple flowering herb grown in India and Iran. The basil seed was reported to exude a clear mucilaginous gel when in contact with water and can be used as a food stabilizer similar to the characteristics of the flaxseed and chia seed (Coorey *et al*., 2014). According to Varela and Fiszman (2011), the formation of mucilage from the seeds could potentially increase the batter's viscosity. As a consequence, the adhesion of batter to the food material and cooking yield could increase, while reducing the frying loss, thus improving the quality of battered fried food products. Zameni *et al*. (2015) stated that the thermal and freezing treatments did not negatively affect the basil seed gum but on the other hand, improved the rheological and texture properties, and preserved gel integrity thus making it suitable for food processing. Among studies related to the basil seed gum was the application in myofibrillar protein gel which increased the water-binding and gel strength (Lee & Chin, 2020), and the development of active edible coating for shrimp (Khazaei *et al*., 2016). Although there were several studies on the effect of many types of commercial polysaccharides as hydrocolloids for food batter, limited studies were found on the effect of basil seed in the batter formulation to coat fish fillet. The percentages of basil seed used may also affect the final quality characteristics of the batter and fried coated fish fillet. Therefore, this study aimed to evaluate the effect of different percentages (0, 3%, 6% & 9%) of basil seed added in the batter formulation to be used for coating tilapia fish fillets. The results are expected to discover the basil seed's potential further, by determining the suitable percentages to be used to improve the coating processing methods.

MATERIALS AND METHODS

Preparation of the tilapia fish fillets

Tilapia fillets were acquired from a local store (Seri Kembangan, Selangor) with a weight of 150–180 g each. The fish fillets were cleaned and cut into approximately 3–4 cm^2. Then, the fish fillet was washed under running tap water and dripped dried for 10 min before the battering process.

Fillet coating

Basil seed, wheat flour, cornflour, salt, black pepper, Japanese breadcrumb, and palm oil were purchased from the local supermarket (Seri Kembangan, Serdang, Malaysia). The basil seed was ground into powder form by using a blender (Panasonic MX-801S, Japan). Wheat flour was used as the pre-dust. The formulation of batter was prepared with slight modifications according to Bakar *et al*. (2010), which consists of wheat flour, cornflour, salt, and black pepper. Three different percentages (3%, 6%, & 9%) of basil seed were used to replace the wheat flour in the batter (Table 1). Dry ingredients and water were mixed at the ratio of 1:1.4 dry ingredients to the water. Batter prepared without the addition of basil seed was considered as control. The surface of the fish fillets was dabbed with paper towels before dipping the fillets into the pre-dust. Then, the pre-dusted fish fillets were immersed in the batter for each formulation and the excess batter was dripped off for 30 s. The battered fillet was then coated with Japanese bread crumbs before being deep-fried in palm oil using a 3.5 L capacity deep-fryer (FDF 1038, Faber) at 180 °C for 3 min based on the method by Ismail-Fitry *et al*. (2008).

Viscosity of batter

The viscosity of batter containing different percentages of seeds was measured by using a rheometer (RheolabQC Anton Paar, USA). The analysis was carried out in triplicates.

Coating material performance

Yield parameters were determined by measuring the weight of the raw fish fillet (x), the weight of the coated fish fillet before cooking (y) and the weight of the coated fish fillet after cooking (z) according to Kılınççeker & Hepsag (2011). Calculations of the

Table 1. Formulation of batter with different percentages of basil seeds for coating of tilapia fish fillet

Coating batter	Wheat flour (%)	Corn flour (%)	Basil seed (%)	Salt (%)	Black pepper (%)	Total (%)*
0% (control)	82	15	0	2	1	100
3%	79	15	3	2	1	100
6%	76	15	6	2	1	100
9%	73	15	9	2	1	100

*The dry ingredients were later mixed with water at the ratio of 1:1.4 dry ingredients to the water.

yield parameters were as follows:

Coating adhesion

The adhesion degree was calculated according to the following Equation 1:

$$\text{Adhesion degree} = \frac{y - x}{y} \times 100\%$$

Cooking yield

The yield parameters were determined according to the following Equation 2:

$$\text{Cooking yield} = \frac{z}{x} \times 100\%$$

Frying loss

The frying loss parameters were determined according to the following Equation 3:

$$\text{Frying loss} = \frac{y - z}{y} \times 100\%$$

Moisture content

The moisture content of battered and breaded tilapia fish fillets and raw tilapia fish fillets was determined by using the oven drying method according to AOAC (2005). The samples (3-5 g) were dried at 105±1 °C until they reached a constant weight. The analysis was carried out in triplicates for each sample. The moisture content was calculated according to the formula below (Equation 4):

$$\text{Moisture content (\%)} = \frac{\text{original sample weight} - \text{dried sample weight}}{\text{original sample weight}} \times 100\%$$

Fat content

The fat content of the breaded tilapia fish fillet and raw tilapia fish fillet were determined using the Soxhlet method according to AOAC (2005). Five grams of sample were placed in the thimble and inserted into the Soxhlet apparatus. The round bottom flask was weighed, and 200 mL of petroleum ether was poured. Soxhlet was connected to the reflux and round bottom flask continuously for about 8 hr. Then, petroleum ether from the round bottom flask was evaporated using a rotary evaporator. The fat content was calculated based on the formula below (Equation 5):

$$\text{Oil in the sample (\%)} = \frac{(\text{weight of flask} + \text{oil}) - (\text{weight of flask})}{\text{weight of sample used}} \times 100\%$$

Colour measurement

A Minolta chromameter (CR-300 Minolta, Japan) was used to measure the colour of the samples. The colour readings were expressed by CIE ($L^*a^*b^*$) system. L^*, a^*, and b^* indicate whiteness/darkness, redness/greenness and blueness/yellowness, respectively. A battered and breaded tilapia fish fillet was used for each treatment and the $L^*a^*b^*$ values were measured directly on three different positions on both sides of the fillet (Bakar *et al*., 2010).

Texture profile analysis (TPA)

Texture profile analysis was carried out to measure the texture properties (hardness, fracturability, cohesiveness, springiness, and chewiness) of battered and breaded tilapia fish fillet by using a texture analyser (Stable Microsystem TA.XT2i, United Kingdom). The samples were subjected to compression using a knife blade probe HDP/BSK with a pre-test speed of 1.00 mm/s, test speed of 5.00 mm/s, post-test speed of 10.00 mm/s, and 5 g of trigger force.

Sensory analysis

The sensory evaluation of battered and breaded tilapia fish fillet was carried out with 40 untrained panellists to rate the colour, appearance, taste, crispness, juiciness, oiliness level, fishy smell and overall acceptance. All the panellists were informed and explained the sensory analysis procedures and samples involved and received their consent to participate before the sensory evaluation session. The panellist rated the liking of the products on a 7-point hedonic scale with 1 = dislike extremely and 7 = like extremely.

Statistical analysis

Both One-way Analysis of Variance (ANOVA) and Pearson's Correlation were performed by using Minitab 19 for statistical analysis. The Tukey's test was used for mean comparison if a significant ($p<0.05$) variation was found.

RESULTS AND DISCUSSION

The viscosity of the batter

Table 2 shows the effect of different percentages of basil seed used in the batter on the viscosity of the batter, coating adhesion, cooking yield, frying loss, moisture content, and fat content of the fish fillet. There was a constant significant increase ($p<0.05$) of viscosity when the percentage of basil seeds increased in the batter. Table 3 shows the viscosity was significantly correlated ($p<0.05$) to the increase of the basil seed percentage. A similar result was observed by Karimi and Kenari (2016) on the functionality of basil seed gum where the viscosity increased as the concentration increased from 0.5 to 2% w/v. The increasing of batters' viscosity with the addition of basil seeds could be due to the mucilage formed when contacted with water. Mucilage is a type of hydrocolloid with a long chain of high molecular weight polysaccharides and proteins which is hydrophilic and acts as gum (Hong & Ibrahim, 2012). According to Mirhosseini and Amid (2012), plant gums are either water-soluble or have the percentages of a hydrophilic fraction with a greater affinity for absorbing water to form a gel. The hydration properties are influenced by the swelling capacity, solubility, and water-holding capacity.

Coating adhesion

Coating adhesion is also known as coating pick-up, is an important physical property since it influences the quality parameter of fried products. Coating adhesion is used to indicate the amount of batter that is adhered to the piece of food on which the yield and quality of the final product depend (Albert *et al*., 2009). Basil seed at 9% added to the batter showed a significant increase ($p<0.05$) in coating adhesion on tilapia fish fillet compared to the control and 3% seed. The coating adhesion was significantly correlated ($p<0.05$) to the increase of the basil seed percentage and positively correlated ($p<0.05$) to the viscosity of the batter (Table 3). The coating adhesion is generally associated with the batter viscosity, which as viscosity increases, more batter remains on the food substrate, thus increasing the percentage of coating adhesion (Dogan, 2005). The viscosity of a batter is a key characteristic of the quality of the coating as it affects the pickup and quality of batter that adheres, the handling characteristic of the battered product, its appearance and final texture (Fiszman & Salvador, 2003). Karimi and Kenari (2016) reported that the higher viscosity of hydrocolloid suspensions has a significant role in the coating functionality and performance such as the product yield, appearance, crispness, moisture and oil barrier properties.

Cooking yield and frying loss

The cooking yield for batter added with basil seed at 6% and 9% resulted in a significant increase ($p<0.05$) compared to the 3% treatment and control. The cooking yield also had positive correlations ($p<0.05$) with the viscosity of the batter and coating adhesion (Table 3). The increase in cooking yield could be due to the water retention capacity of the mucilage of the seed, which is responsible to hinder water vaporization and consequently lead to a higher cooking yield (Karimi & Kenari, 2016). The frying loss resulted in a significant reduction ($p<0.05$) with a 9% addition of basil seed (Table 2). In addition, strong negative correlations of the frying loss against the basil seed percentage, viscosity of the batter, coating adhesion and cooking yield were identified (Table 3). Kilinççeker (2011) reported that methylcellulose (MC) had high viscosity and binding ability and when added to the batter to produce chicken nugget, increased the adhesion degree and cooking yield while lowering the coating loss and frying loss of the sample. Sahin *et al*. (2005) stated that the addition of xanthan gum, guar gum and hydroxypropyl methylcellulose (HPMC) in the batter was significantly effective for batter pick-up. While, Yusnita *et al*. (2007) concluded that higher batter viscosity resulted in a higher coating pick-up, cooking yield and low frying loss of fried battered products in their study.

Moisture content

A significant increase ($p<0.05$) of the fish fillet moisture content for all percentages of basil seeds added to the batter against the control was observed. The addition of 9% of basil seed in the batter formulation showed a higher moisture content compared to other percentages. This may be due to the characteristic of basil seed that has higher water holding capacity which makes the moisture retained in the fish fillets. The development of gel could act as a physical barrier and make the surface stronger, with fewer small pores, decreasing vaporization and trapping moisture inside (Liberty *et al*., 2019), thus the fish fillet with high moisture content was produced. Zameni *et al*. (2015) reported that the basil seed gum had the maximum moisture content at the end of the frying process, which might be due to the effect of high-water binding capacity and film-forming ability. Péroval *et al*. (2002) also stated that the hydrophilic characteristic and high water-binding capacities of gums play a significant role in defining the moisture control of the samples.

Fat content

The fat contents were recorded to be lowered significantly ($p<0.05$) for basil seeds at 3% and 6% compared to the control. However, the fat content of batter with 9% basil seed showed no significant difference ($p>0.05$) compared to the 0% (control), 3% and 6% of basil seeds. The effectiveness of using basil seed as a barrier to fat/oil intake and moisture loss in comparison to the control can be seen. Karimi and Kenari (2016) reported that coatings with salep and basil seed gum for deep-fried potato strips showed that the concentration of 0.5% of basil seed gum reduced more oil as compared to the 1.0% and 1.5% of concentration. This could be due to the rough coating due to higher viscosity that led to a large amount of oil absorption. More free volume or non-uniformity in films allows water molecules to easily transfer and enhance the permeability of the coating to moisture and consequently oil intake. Edible films made from a low concentration of gum showed lower permeability than a film made from a higher concentration (Karimi & Kenari, 2016).

Colour properties

Table 4 shows the effect of different percentages of basil seeds on the lightness (L^*), redness (a^*) and yellowness (b^*) of the breaded tilapia fish fillet. The L^* values of samples with basil seeds at 6% and 9% were significantly reduced ($p<0.05$) compared to the control. Meanwhile, the a^* values at 6% and 9% basil seeds were increased significantly ($p<0.05$) compared to the control and 3% samples. A strong negative correlation between the L^* value and the percentages of basil seed, and a strong positive correlation between the a^* value and the percentages of basil seed were observed (Table 3). The *b** value, on the other hand, showed no significant difference (p>0.05) between the treatments and control. In general, the breaded tilapia fish fillets showed a darker colour, and more redness and remained yellow when basil seed was added especially with the increased percentages. A breaded product can be considered to become progressively more golden brown with the increasing redness and yellowness while decreasing the lightness value (Barbut, 2013). The development of colour is the result of the chemical browning reactions of reducing sugar and protein sources and could be influenced by frying oil absorption and the batter coating density and thickness (Loewe, 1993). According to Albert *et al*. (2009), Maillard's reaction and caramelization of sugars in the higher temperature frying treatment also cause the appearance of the golden colour of the fried foods.

Table 2. Effect of different percentages of basil seeds incorporated into the batter as coating materials on the properties of the batter and coated tilapia fish fillet

Analyses	Basil seeds percentages			
	0%	3%	6%	9%
Batter viscosity (mPa)	844.00 ± 92.50^{d}	1346.60 ± 58.60^{c}	2231.00 ± 161.30^{b}	3264.70 ± 214.70^{a}
Coating adhesion (%)	48.58 ± 0.31^{b}	48.70 ± 1.12^{b}	50.28 ± 0.49^{ab}	51.60 ± 0.49^{a}
Cooking yield (%)	180.72 ± 0.69^{c}	181.01 ± 1.19^{c}	188.04 ± 1.32^{b}	198.29 ± 1.69^{a}
Frying loss (%)	7.02 ± 0.25^{a}	7.17 ± 0.66^{a}	6.51 ± 0.28^{a}	4.03 ± 0.52^{b}
Moisture content (%)	48.96 ± 1.57^{c}	55.01 ± 0.98^{ab}	54.15 ± 1.00^{b}	57.76 ± 1.62^{a}
Fat content (%)	13.62 ± 0.51^{a}	11.54 ± 0.55^{b}	11.20 ± 0.41^{b}	12.22 ± 0.89^{ab}

Different letters in a row show significant differences (p<0.05) between the control and different percentage of seeds

Table 3. The Pearson correlation between the parameters measured for the tilapia fish fillets quality coated with batters added with basil seed

	Basil (%)	Viscosity	Coating adhesion	Cooking yield	Frying loss	Moisture	Fat	*L**	*a**	*b**	Hardness	Fracturability	Cohesiveness	Springiness
Viscosity	0.989#													
Coating adhesion	0.958#	0.987#												
Cooking yield	0.936	0.977#	0.989#											
Frying loss	-0.850	-0.913	-0.926	-0.971										
Moisture	0.897	0.848	0.751	0.750	-0.698									
Fat	-0.547	-0.420	-0.315	-0.218	0.036	-0.669								
*L**	-0.881	-0.933	-0.932	-0.975	0.996	-0.758	0.111							
*a**	0.846	0.816	0.828	0.736	-0.554	0.612	-0.638	-0.574						
*b**	-0.674	-0.691	-0.614	-0.699	0.790	-0.816	0.148	0.823	-0.177					
Hardness	0.986#	0.956#	0.899	0.876	-0.790	0.954	-0.640	-0.834	0.804	-0.711				
Fracturability	0.898	0.824	0.748	0.685	-0.540	0.907	-0.859	-0.600	0.842	-0.504	0.941			
Cohesiveness	0.632	0.736	0.826	0.856	-0.876	0.305	0.259	-0.834	0.520	-0.426	0.506	0.245		
Springiness	0.865	0.827	0.728	0.747	-0.726	0.991	-0.581	-0.783	0.521	-0.884	0.924	0.844	0.320	
Chewiness	0.991#	0.973#	0.923	0.912	-0.843	0.946	-0.566	-0.882	0.778	-0.752	0.996	0.905	0.568	0.926

0 indicates no linear relationship; 0 to 0.3 (0 to −0.3) indicate a weak positive (negative) linear relationship; 0.3 to 0.7 (0.3 to −0.7) indicate a moderate positive (negative) linear relationship; and 0.7 to 1.0 (−0.7 to −1.0) indicate a strong positive (negative) linear relationship. Values with (#) is significantly correlated (p<0.05).

Table 4. Effect of different percentages of seeds incorporated into the batter for coating on the colour and texture of tilapia fish fillet

Analyses		Basil seeds percentages			
		0%	3%	6%	9%
Colour	*L**	45.98 ± 1.98^{a}	45.63 ± 0.36^{ab}	44.47 ± 0.80^{bc}	39.15 ± 2.37^{c}
	*a**	8.23 ± 0.65^{b}	9.00 ± 0.45^{b}	13.22 ± 0.34^{a}	12.04 ± 0.44^{a}
	*b**	24.83 ± 1.83^{a}	23.52 ± 0.37^{a}	24.83 ± 0.28^{a}	22.21 ± 2.11^{a}
Texture	Hardness (g)	952.3 ± 71.00^{c}	1291.1 ± 46.80^{b}	1435.00 ± 87.50^{b}	1657.20 ± 89.10^{a}
	Fracturability (g)	963.3 ± 54.20^{a}	1138.8 ± 167.40^{a}	1207.10 ± 201.30^{a}	1207.9 ± 100.00^{a}
	Cohesiveness	0.33 ± 0.01^{a}	0.32 ± 0.01^{a}	0.33 ± 0.01^{a}	0.34 ± 0.01^{a}
	Springiness (mm)	0.808 ± 0.01^{a}	0.849 ± 0.02^{a}	0.837 ± 0.04^{a}	0.869 ± 0.03^{a}
	Chewiness (g.mm)	254.97 ± 16.70^{c}	354.13 ± 14.00^{b}	398.43 ± 31.33^{b}	490.26 ± 54.96^{a}

Different letters in a row show significant differences (p<0.05) between the control and different percentage of seeds

Texture profiles

The influence of basil seeds on the texture of the tilapia fish fillet is shown in Table 4. The results showed that basil seed significantly ($p<0.05$) increased the hardness and chewiness of samples as compared to the control, with 9% of seeds having the highest values. These results can be related to the thickening properties, high water retention capacity and high fibre content of the mucilage (Câmara *et al*, 2020). Positive significant correlations ($p<0.05$) were observed for the hardness and chewiness against the basil seed percentage and viscosity (Table 3). The springiness and cohesiveness showed no significant changes ($p>0.05$) between the treatments. Although the fracturability had higher values by the increment of basil seed percentage, the results were statistically insignificant ($p>0.05$). Fracturability values could be explained by the thermo-gelling effect and cross-linking properties of gums (Ballard, 2006). The ability of the edible coating to limit moisture transfer could be the key to the production of crispier breaded fried products. The interactions between proteins, polysaccharides, and water have been suggested to play an important role in the crispness of some products (Mohamed *et al*., 1998). Hardness and fracturability are the parameters that most indicated the crispness of the samples.

Sensory evaluation

The results of the sensory evaluation (colour, appearance, taste, crispness, juiciness, oiliness level, fishy smell, and overall acceptability) of the breaded fish fillet are presented in Figure 1. No significant differences ($p>0.05$) in colour, appearance, fishy smell level, taste and juiciness were recorded between all the treated samples and the control. This was in agreement with the study by Khazaei *et al*. (2016), where no significant difference was observed in shrimp samples coated with basil seed gum and thymol against the control. However, samples with 6% basil seed had a significantly higher preference ($p<0.05$) for the crispness as compared to other samples. The panellists also rated the oiliness level for the sample added with 6% basil seed significantly higher ($p<0.05$) compared to 9%, although it was not significant ($p>0.05$) against the 3% and control samples. This could be related to the low fat and high moisture detected for the sample with 6% basil seed as reported in Table 2. A similar result was reported in a study by Jouki & Khazaei (2021), where panellists preferred chicken nugget coated with batter added with quince seed gum due to its lower oil uptake and high moisture content. The crispness and oiliness level might influence the overall acceptability of the samples, where it can be seen that with 6% basil seed added to the batter, better preferences by the panellists were obtained compared to other samples. The panellists were also asked through a questionnaire about their preference for freshwater fish. Twenty per cent of the panellists did not prefer freshwater fish due to its fishy smell or muddy taste, but with a good taste and texture of coating, they can accept this type of food product.

CONCLUSION

It can be concluded that the basil seed added to the batter had improved the overall quality of the tilapia fish fillet. The coating adhesion, cooking yield, and frying loss results were better, which was related to the improvement of the batter viscosity. It also positively affected the moisture content and reduced

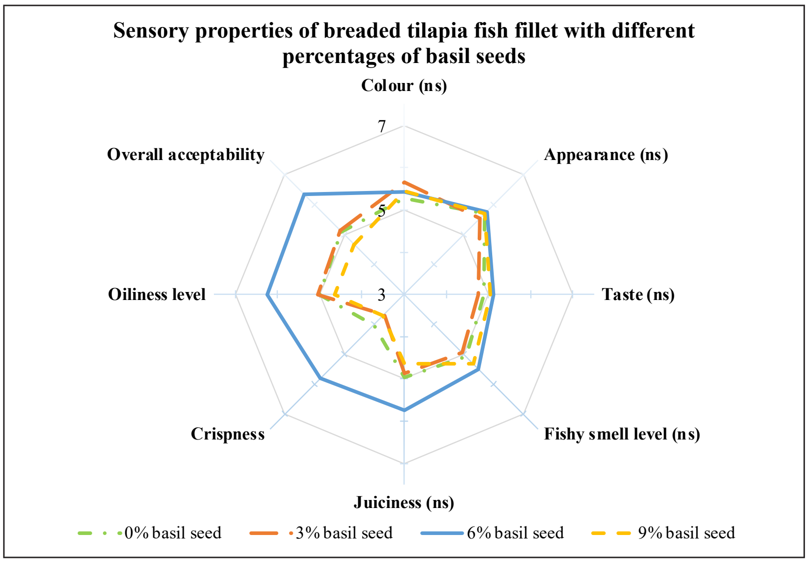

Fig. 1. Effect of different types and percentages of seeds incorporated into the batter for coating on the sensory properties of tilapia fish fillet based on a 7-point of hedonic scale (1= dislike extremely, 7= like extremely). Parameters with no significant results ($p>0.05$) are labelled with (ns)

oil absorption. The texture especially related to the hardness, chewiness and fracturability of the fish fillet was also improved. The sensory properties of the samples with added basil seed were more preferred, especially for the crispness and overall acceptability. The higher value of fracturability tested using TPA can be associated with the higher-rated crispness during sensory evaluation. The appearance of the treated samples showed minimum changes compared to the control but they were a little bit darker and redder, which contributed to the golden colour. The percentage used for the basil seed also showed a limitation where at 9% the quality of certain parameters especially related to the oil uptake and sensory analysis started to show a negative result. In the end, the batter prepared with 6% basil seed can be considered the most suitable coating material for the tilapia fish fillet, which can improve the physicochemical and sensory properties of the product.

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