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Physico-chemical properties and sensory acceptance of retorted chicken curry packed in different types of pouches

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Abstract

Chicken curry was prepared according to a standardised recipe. The dish was packed in RcPP/Nylon/Al/PET (Al) and Nylon/RcPP (T) and processed in the retort at 121 °C with the corresponding F_0 values of 6, 8 and 10. All samples were analysed for physico-chemical, microbiological and sensory evaluation. The chicken curry gravy showed a decreasing trend for total soluble solids (TSS) and colour (a* value). Still, an increasing trend was observed for pH, colour (L* and b* value) and viscosity. The absence of aerobic and anaerobic bacteria, as well as yeast and mould, *coliform/E. coli* and *Salmonella spp.* indicated that retorted chicken curry was safe to be consumed. Overall, the sensory evaluation results indicated that the chicken curry retorted at different F_0 values and packed with different types of pouches are generally acceptable in terms of colour, odour, taste, texture, viscosity and overall acceptability (sensory scores > 4.84). However, further improvement can be made in terms of odour, taste, texture (chicken) and specific pouch types for certain F_0 values. The overall acceptability of chicken curry retorted at 121 °C with F_0 6 was the most preferred, with a sensory score of 5.68 for chicken curry packed with an Al pouch.

Keywords: *chicken curry, retort pouches, quality evaluation, sensory acceptance*

Introduction

Chicken curry is a popular dish in Malaysian cuisine. The dish typically consists of vegetables such as potatoes, tomatoes and carrots, cooked in a spicy curry gravy made with a blend of aromatic spices such as turmeric, cumin, coriander, chilli, garlic, ginger, lemongrass and coconut milk. The level of spiciness can also vary depending on the individual recipe or personal preferences. The meat is usually cooked in the curry gravy for an extended period to allow the flavours to develop and the meat to become tender. It is often served with rice or bread.

Retorting is a thermal processing technology commonly used in the food industry for the production of shelf stable, ready to eat foods such as canned foods, pouches and other flexible containers. Retorting involves the process of heating food to a high temperature for a specified period in a steam chamber (Suleman et al. 2020). The purpose is to destroy any pathogenic microorganisms and enzymes that could spoil the food (Byun and Whiteside, 2007). Retorting technology has several advantages over other food preservation methods, including the ability to preserve food without the need for refrigeration, to preserve the nutritional value of the food, and the convenience of having a shelf stable, ready to eat meal that can be stored for an extended period. However, the retorting process can also affect the texture, flavour and appearance of the food, which can be addressed through recipe formulation and the selection of appropriate packaging materials (Lee et al. 2014 a, b).

A retort pouch is a type of flexible packaging made from multiple layers of materials that can withstand high temperatures and pressures during the retorting process. Retort pouches mostly consist of a combination of polyester, aluminium foil and polypropylene (Griffin 1987), which make the pouches durable, flexible and resistant to punctures and leaks. In addition, ready-to-eat foods in retort pouches are more acceptable to consumers compared to food packed in glass or metal containers due to lighter weight, more appealing and convenient end use (Al-Baali and Farid, 2006; Mohan et al. 2006). By using the retort pouch, cooking time will be shorter due to its

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high ratio of surface area to volume, thus improving nutritional value as well as reducing moisture loss when compared with other materials (Trevino 2009).

The F_0 value is a measure of the lethality or sterilising effect of a retort process. It is a measurement unit used to indicate the amount of time required to achieve a specific level of microbial destruction in a particular food product at a specific temperature. The F_0 value is an important parameter in the retort process, as it ensures that the product is commercially sterile and safe for consumption (Shirtz 2008). It is also used to determine the minimum processing time and temperature required to achieve a specific level of microbial destruction, which can help to optimise the retort process and minimise the impact on the sensory and nutritional quality of the food. Retort packaging has been used in various kinds of food products such as pepper chicken (Nalini et al. 2018; Shah et al. 2017), freshwater prawn curry (Majumdar et al. 2017), soy peas curry (Abhishek et al. 2014), goat meat curry (Rajkumar et al. 2010) and others. Although several researchers have studied the retort processing of chicken curry, (Lee and Shin, 2023; Vismitha Shree et al. 2022;) the information related to physicochemical, microbiological and sensory evaluation of chicken curry with different F_0 value and type of pouches were still scarce. Hence, the present study was conducted with the objective of evaluating the physico-chemical properties and sensory acceptance of retorted chicken curry packed in different types of pouches.

Materials and method

Preparation of chicken curry

The chicken curry was supplied by Saudagar Rasa Sdn. Bhd. in Selangor, Malaysia. The chicken was cut into uniform chunks before being boiled in water for 10 minutes. The broth was drained and the chicken chunks were separated. The ingredients of curry gravy include fresh onion, garlic, curry chicken spices, ginger, coconut milk, tamarind, rustle, chicken stock, salt and sugar. The recipe for chicken curry has been standardised.

Retort processing

Retort processing was performed using a horizontal water immersion clutch retort (Model H60, Type C50, Japan). A total of 180 g of product (60 g of half-cooked chicken and 120 g of curry gravy) was manually filled into a different type of retort pouches (12 x 16.5 cm) which were RcPP/ Nylon/Al/PET (Al) and Nylon/RcPP (T). All pouches were sealed by an impulse sealing machine (Automatic Impulse Sealer, Japan) after residual air was removed. The hermetically sealed pouches were put on a tray and loaded in the retort machine. To check the adequacy of the thermal process, a sample pouch was fixed with thermocouple glands through which the thermocouple was inserted into meat pieces for recording the core temperature during heat processing. The filled and sealed pouches (along with sample pouch) were subjected to thermal processing at 121 °C with different F_0 values of 6, 8 and 10. The F_0 meter probe was mounted with the system of the sample and pouch in its slowest heating zone (SHZ). The vessel was then turned on together with the data logger. The F_0 result was then printed on thermo-paper. The pressure was maintained at 15 psi throughout the process before rapidly dropping to 55 °C during the cool down. After the sterilisation process, the products were incubated for two weeks to ensure the product's stability in achieving commercially sterile. The processed retort pouches were stored in a cool and dry place for further analysis at ambient temperature (35 ± 2 °C), and the samples were taken for further analysis.

pH value

The pH value of chicken curry gravy was determined using a pH meter (Metler Toledo, Switzerland). The analysis was performed in triplicates, and the average weight was reported.

Total soluble solids (TSS)

The total soluble solids of chicken curry gravy was measured with a digital refractometer (Model HI 96801, Hanna Instrument, USA). The analysis was performed in triplicates, and the average weight was reported.

Water activity (a_w)

The water activity of retorted chicken curry gravy was determined using a water activity meter (LabMaster-aw, Novasina, Switzerland) according to the manufacturer's instructions. Values were taken after constant readings were obtained. The analysis was performed in triplicate and the average weight was reported.

Viscosity

The viscosity of the chicken curry gravy was determined with a viscometer (Brookfield, USA) using a spindle LV3 with 50 rpm. The analysis was performed in triplicate, and the average weight was reported.

Colour

The colour of chicken curry gravy was evaluated using a Chroma meter (Model CR-400/410, Konica Minolta, Japan) by measuring the colour parameters of the gravy: L* = 0 indicates black and L* = 100 white), + a* indicates red and –a* = green, and + b* indicates yellow and – b* = blue was determined for the surface of each sample. The analysis was performed in triplicate and the average weight was reported.

Microbiological quality assessment

a) Total plate count, yeast and mould, coliform/E. coli and anaerobic bacteria

Chicken chunks in the curry were cut using a sterile knife and mixed with the gravy. Ten gram sample of the mixture was aseptically weighed and homogenised with 90 mL of Ringer's solution (Oxoid, Hampshire, England) using a stomacher lab-blender (Seward Model 400, London, UK) for 60 seconds. Serial dilutions were prepared with the same diluent and duplicate counting plates were prepared using appropriate dilutions. For pour plating, 1 mL of the appropriate dilutions were mixed with molten (45 °C) media and poured into plates. The inoculum was evenly mixed by gently swirling the plates 6 times in each direction (6 clockwise, 6 anti-clockwise). Then, the agar with inoculum in the plate was allowed to solidify. Total mesophilic aerobic bacteria and total anaerobic bacteria were counted by plating samples on plate count agar (PCA) (Difco, USA).Yeast and mould counts were cultivated on potato dextrose agar (PDA) (Difco, USA). Microbial colonies were counted after 72 hours incubation at 31 ± 1 °C for both PCA and PDA (ICMSF, 1978). The total anaerobic bacteria were incubated in an anaerobic jar with the presence of a gas pack pouch to create the anaerobic condition. *E. coli and coliform* were determined by using compact dry EC (Nissui, Pharmaceutical, Japan) and incubated at 37 °C for 48 hours according to the manufacturer's instructions. All microbial enumeration results were expressed in log colony-forming units, CFU/g

b) Salmonella spp.

Chicken chunks in the curry were cut using a sterile knife and mixed with the gravy. The ISO 6579 enrichment procedure was used for the recovery of *Salmonella* from foods. Twenty five gram samples of the mixture were aseptically weighed and homogenised with 225 mL of buffered peptone water (Oxoid, Hampshire, England) using a stomacher lab-blender (Seward Model 400, London, UK) for 60 seconds. The samples were then incubated at 37 °C for 16 to 20 hours. After pre-enrichment, the samples were gently shaken and transferred to a) 0.1 mL into 10 mL *Rapport-Vassiliadis Soya* (RVS) broth (Oxoid, Hampshire, England) and (b) 1.0 mL into 10 mL Selenite Cystine (SC) broth (Oxoid, Hampshire, England). Cultures were vortex and mixed well before being incubated at 41.5 ± 1 °C for 24 ± 3 hours and at 37 ± 1 °C for 24 ± 3 hours for both RVS and SC broth, respectively. 3 mm loopful of each enriched samples were streaked on differential mediums, Xylose Lysine Deoxycholate (XLD) agar (Oxoid, Hampshire, England) and Brilliance Salmonella agar (Oxoid, Hampshire, England). Plates were then incubated at 37 ± 1 °C for 24 ± 3 hours. The appearance of typical *Salmonella* colonies were observed on both agars. Suspected colonies were identified biochemically. If growth is slight or if no typical colonies of *Salmonella* are present, the plates were re-incubated for an additional 24 hours and re-examined for typical colonies of *Salmonella*. The *Salmonella spp.* is considered present when the purple coloured colony is formed on the Brilliance Salmonella Agar and the red colonies with the formation of a black centre on the XLD, respectively.

Sensory evaluation of retorted chicken curry

Two sets (3 samples/set) of coded samples of retorted chicken curry packed with Al and T pouch were served together with gravy and were evaluated by 35 semi-trained panellists. The samples were warmed before serving. The panellists were asked to evaluate the product for the colour, odour, taste, texture (chicken), viscosity (gravy) and overall acceptability using a 7-point hedonic scale. The scale point were: 1 = dislike very much, 2 = dislike moderately, 3 = dislike, 4 = neither like nor dislike, 5 = like, 6 = like moderately, 7 = like very much). Drinking water was provided for cleaning the palate after testing each sample.

Statistical analysis

The statistical software Minitab 19 (Minitab Inc., State College, PA, USA) was used to perform a two-way analysis of variance (ANOVA; Tukey test; p <0.05) for differences among treatments.

Results and discussion

F_0 value

The specific F_0 values and processing times used in a study depend on various factors such as the type of product, packaging materials and processing equipment. It is essential to choose appropriate F_0 values and processing parameters to ensure the safety and quality of retorted food products. In this study, F_0 values of 6, 8, and 10 were used for both Al (20, 26 and 30 min) and T (21, 24 and 26 min) pouches respectively. These values were selected based on the recommended F_0 value for meat products, which is between 5 and 20 min (Frott and Lewis, 1994). Additionally, to ensure that the products were botulinum-treated, the internal temperature needed to reach 121 °C for 20 min, as suggested by Buncic (2006). Similarly, Manzoor et al. (2017) processed Rogan Josh, a traditional meat product in a retort at 121 °C using F_0 values ranging from 7 – 11.

Physico-chemical properties evaluation

The pH level of the chicken curry can also affect its quality during the retort process. The pH values of chicken curry gravy (*Table 1*) were slightly increased (p <0.05) from 5.74 to 5.77, with an increase in F_0 values from 6 to 10 when packed with a T pouch. However, there was no change in the pH value of chicken curry packed with the Al pouch, which indicates that the Al pouch is capable of maintaining the chicken curry's flavour and texture while minimising the risk of microbial growth and spoilage. Additionally, the pH value of chicken curry in the T pouch was higher when compared with the Al pouch for F_0 8 and 10. This might be due to the difference in the permeability of the packaging materials towards oxygen and water vapour. The T pouch is typically more porous towards oxygen and water vapour than the Al pouch, which can lead to changes in the pH level of the chicken curry during the retort process. In addition, the pH changes may also be attributed to the breakdown of proteins and the liberation of free amino acids in the chicken curry, which can affect the acidity of the product (Girish et al. 2018).

The total soluble solids (TSS) is an important quality parameter of the chicken curry, as it is a measure of the total amount of dissolved solids in the gravy. Changes in TSS can impact the flavour, texture and overall quality of the product. The total soluble solids (TSS) of chicken curry packed with the T pouch significantly decreased (p <0.05) from 6.43 to 5.83 for gravy samples processed at F_0 6 to 10 (*Table 1*). The chicken curry packed with the Al pouch had a higher TSS when compared with the T pouch, with values of 6.10 and 5.83, respectively, which may be due to the difference in the permeability of the packaging materials towards moisture and oxygen. The Al pouch is typically less permeable to moisture and oxygen than the T pouch, which can help to retain the TSS of the chicken curry during the retorting process. The decrease in TSS observed in chicken curry gravy packed with T pouch may be attributed to the loss of moisture during the heating process, which can lead to the soluble solids content changes in the chicken curry.

Water activity is an important parameter to consider during the retorting process, as it can affect the growth of microorganisms and the shelf life of the product. Higher water activity levels can increase the risk of microbial growth and spoilage, while lower levels can help to extend the shelf life of the product. The water activity of chicken curry gravy increased from 0.96 to 0.99 (p <0.05) with an increase in F_0 value from 6 to 8 (*Table 1*). Furthermore, the water activity of chicken curry gravy packed with an Al pouch was higher than that of a T pouch for samples processed at F_0 8. The increase in water activity observed with higher F_0 values may be due to the release of water from the chicken curry and the breakdown of compounds during heating, which indirectly increases the amount of free water in the product.

There was no significant difference (p >0.05) in the viscosity of chicken curry gravy with different F_0 values for both pouches. However, the viscosity increased significantly (p <0.05) for both Al and T pouches from 10.67 to 12.27 and from 10.30 to 11.80, respectively (*Table 1*). This finding indicates the retorting process can have an impact on the viscosity of chicken curry. The increase in viscosity observed with higher F_0 values may be due to the breakdown of organic compounds in the chicken curry during heating, indirectly causing the formation of new compounds and changing the product texture. Therefore, viscosity is an important quality parameter of the chicken curry gravy, as it measures the thickness and consistency of the gravy. Changes in viscosity can affect the texture and mouthfeel of the product, as well as its overall quality.

Table 1. Effect of different F_0 value on the physical properties of retorted chicken curry

Physical analysis	Type of pouch	F_0 value		
		6	8	10
pH	Al	5.73 ± 0.00^{a}A	5.62 ± 0.03^{b}B	5.72 ± 0.01^{a}B
	T	5.74 ± 0.01^{b}A	5.69 ± 0.01^{c}A	5.77 ± 0.02^{a}A
Total soluble solids (TSS)	Al	6.27 ± 0.15^{b}A	6.63 ± 0.06^{a}A	6.10 ± 0.00^{b}A
	T	6.43 ± 0.06^{a}A	6.57 ± 0.12^{a}A	5.83 ± 0.06^{b}B
Water activity (a_w)	Al	0.96 ± 0.01^{b}A	0.99 ± 0.00^{a}A	0.97 ± 0.00^{b}A
	T	0.97 ± 0.00^{a}A	0.97 ± 0.00^{a}B	0.97 ± 0.00^{a}A
Viscosity	Al	10.67 ± 0.06^{c}A	15.03 ± 0.80^{a}A	12.27 ± 0.25^{b}A
	T	10.30 ± 0.26^{c}A	13.63 ± 0.51^{a}A	11.80 ± 0.17^{b}A
Colour L*	Al	29.24 ± 0.03^{c}A	32.58 ± 0.05^{a}A	31.62 ± 0.80^{b}A
	T	28.23 ± 0.13^{b}B	27.03 ± 0.25^{c}B	28.67 ± 0.03^{a}B
a*	Al	12.79 ± 0.05^{a}A	12.31 ± 0.03^{b}A	12.43 ± 0.17^{b}A
	T	12.48 ± 0.20^{a}B	9.99 ± 0.22^{c}B	10.81 ± 0.04^{b}B
b*	Al	32.64 ± 0.09^{c}A	35.15 ± 0.08^{b}A	37.56 ± 0.85^{a}A
	T	33.25 ± 0.72^{a}A	29.99 ± 0.81^{b}B	32.23 ± 0.08^{a}B

Values are expressed as mean ± standard deviation.
Different lowercase (superscript) in the same row are significant differences (p <0.05)
Different uppercase letters in the same column are significant differences (p <0.05)
Al = RcPP/Nylon/Al/PET; T = Nylon/RcPP

The colour of the chicken curry is an important quality parameter, as it can affect the appearance and consumer acceptability of the product. The colour of chicken curry under different F_0 values is presented in *Table 1*. The L* values of chicken curry packed with Al and T pouches increased significantly (p <0.05) with an increment in F_0 values. This is due to the pH value, as it can impact the colour of the chicken curry. Higher pH levels will cause a darker colour in the product. However, the L* values of *Rogan Josh* decreased with an increase in F_0 values from 7 – 11, as reported by (Shah et al. 2017). This might be due to longer exposure to higher temperatures during the retorting process. Besides, Muhlisin et al. (2013) also mentioned that, the L* values of *Chuncheon Dakgalbi* (Korean dish) packed with a retort pouch were decreased with an increase in the cooking time from 10 – 30 min. The redness (a*) was found to be slightly reduced when F_0 values increased. On the other hand, the yellowness (b*) of chicken curry packed with the Al pouch increased from 32.64 to 37.56 when the F_0 values increased. The increase in L* values and the decrease in a* values observed at higher F_0 values may be due to the Maillard reaction between sugar and amino acid, which can lead to changes in product colour (Bindu et al. 2007). The increase in yellowness (b*) observed at the Al pouch may be due to the specific properties of the packaging material, as well as the effect of heating on the colour of the product. Therefore, it is important to monitor and control the colour of the chicken curry gravy carefully during the retorting process to ensure the desired appearance and quality of the end product.

Microbiological quality assessment

The absence of microbial growth in the retorted chicken curry samples is a critical indicator of the effectiveness of the retort process in achieving commercial sterilisation. This is an essential aspect of food safety and quality, as any surviving microorganisms could cause spoilage or pose a health risk to consumers. The total plate count, yeast and mould, *coliform/E.coli*, anaerobic plate count, and *Salmonella spp* were analysed after the retort processing. No microbial growth was observed in any sample with different F_0 values (*Table 2*). This finding indicated that the recommended thermal processing parameter had achieved commercial sterilisation of the processed chicken curry in different types of retort pouches. In addition, the microbial counts of chicken curry before the thermal process were 4.98 x 10^7, 4.64 x 10^6 and 6.1 x 10^6 cfu/g for total plate count, yeast and mould and anaerobic plate count, respectively. The absence of microbial counts observed after the retort process of chicken curry confirmed the effectiveness of the retort process in reducing the microbial load of the product. Similar to pork curry samples were retorted at 121 °C and F_0 11.81 did not reveal any growth of total plate counts, including *E.coli*, *Salmonella* spp, *Clostridium* spp and *Staphylococci* spp during the storage period (Girish et al. 2018). Shah et al. (2017) also reported that, no microorganisms were detected after processing *Rogan Josh* in a retort pouch with a temperature of 121 °C and F_0 7 to 11. Therefore, it can be concluded that the retorted chicken curry using different F_0 values and packaging materials is safe for consumption and meets the standards for commercial sterilisation.

Sensory evaluation

Sensory evaluation is subjective and can vary depending on individual preferences. Therefore, it is crucial to gather feedback from a diverse group of panellists to ensure the results are representative of the general population. The sensory evaluation results of chicken curry packed with Al and T pouches are presented in *Table 3*. There were no significant differences (p >0.05) in the sensory scores of colour and viscosity of chicken curry processed with different F_0 values and types of pouches. However, the sensory score of odour showed a significant decline (p <0.05) from 6.13 to 5.50 with an increment of F_0 value (from 6 to 10) for chicken curry packed using an Al pouch. On the other hand, the viscosity (gravy) score was significantly higher (p <0.05), increasing from 5.06 to 5.69 for chicken curry packed with a T pouch when compared with an Al pouch. Interestingly, the panellists detected a significant difference in the odour (score 6.13 vs score 5.32) and taste (score 5.58 vs score 4.84) of chicken curry as well as the chicken texture (score 5.79 vs score 4.87) packed with Al and T pouches at F_0 6 respectively. The overall acceptability of chicken curry retorted at F_0 6 was the most preferred, with a sensory score of 5.68 for chicken curry packed with an Al pouch when compared to the other samples.

The impact on texture is due to the degradation of proteins and oxidative changes in the product (Rajan et al. 2014). The type of packaging used can also have a significant impact on the quality of retorted chicken curry. Flexible packaging materials such as laminated films can help to retain the flavour and texture of the chicken. At the same time, metal cans may result in a metallic taste or texture of the chicken, which can be undesirable for many consumers. The affected texture can vary depending on the type of food product. For example, the green beans retorted in pouches had better flavour, texture and overall acceptability compared to those processed in a can (Chen and George, 1981). Additionally, Chia et al (1983) found that, fishery products processed in pouches were firmer in texture and lighter in colour. These findings suggest that the use of pouches for processing can have positive effects on the quality attributes of these food products. Therefore, the choice of packaging material can affect the rate of heat transfer during the retort process, which can impact the overall quality of the product.

Table 2. Effect of different F_0 value on the microbiological analysis before and after retorted chicken curry

Treatment	F_0 value	Packaging material	Total plate count (cfu/g)	Yeast and mould (cfu/g)	Coliform/*E.coli* (cfu/g)	Anaerobic plate count (cfu/g)	*Salmonella spp.* (cfu/g)
Before retort			4.98×10^7	4.64×10^6	N.D	6.1×10^6	N.D
After retort	6	Al	N.D	N.D	N.D	N.D	N.D
		T	N.D	N.D	N.D	N.D	N.D
	8	Al	N.D	N.D	N.D	N.D	N.D
		T	N.D	N.D	N.D	N.D	N.D
	10	Al	N.D	N.D	N.D	N.D	N.D
		T	N.D	N.D	N.D	N.D	N.D

Result written as N.D means no growth detected.
Detection of *Salmonella* in food product by the ISO 6579 *Salmonella* culture procedure
Al = RcPP/Nylon/Al/PET; T = Nylon/RcPP

Table 3. Effect of different F_0 value on the quality acceptance of retorted chicken curry with different type of pouches

Sensory attributes	Type of pouch	F0 value		
		6	8	10
Colour	Al	5.92 ± 0.88^{a}A	6.03 ± 0.79^{a}A	5.74 ± 0.98^{a}A
	T	5.61 ± 1.10^{a}A	5.84 ± 0.89^{a}A	5.87 ± 0.93^{a}A
Odour	Al	6.13 ± 0.91^{a}A	5.74 ± 1.03^{ab}A	5.50 ± 1.11^{b}A
	T	5.32 ± 1.14^{a}B	5.29 ± 1.21^{a}A	5.55 ± 1.01^{a}A
Taste	Al	5.58 ± 1.20^{a}A	5.53 ± 1.16^{a}A	5.29 ± 1.21^{a}A
	T	4.84 ± 1.46^{a}B	5.08 ± 1.15^{a}A	5.45 ± 1.13^{a}A
Texture (chicken)	Al	5.79 ± 0.99^{a}A	5.53 ± 0.92^{a}A	5.45 ± 1.27^{a}A
	T	4.87 ± 1.42^{a}B	5.03 ± 1.26^{a}A	5.26 ± 1.22^{a}A
Viscosity (gravy)	Al	5.54 ± 1.24^{a}A	5.49 ± 1.20^{a}A	5.40 ± 1.26^{a}A
	T	5.06 ± 0.91^{b}A	5.29 ± 0.93^{ab}A	5.69 ± 0.90^{a}A
Overall acceptability	Al	5.68 ± 1.14^{a}A	5.58 ± 1.06^{a}A	5.32 ± 1.23^{a}A
	T	4.89 ± 1.16^{a}B	5.00 ± 1.19^{a}B	5.50 ± 1.18^{a}A

Values are expressed as mean ± standard deviation.
Different lowercase letters in the same row are significant differences (p <0.05)
Different uppercase letters in the same column are significant differences (p <0.05)
Al = RcPP/Nylon/Al/PET; T = Nylon/RcPP

Conclusion

In summary, the quality of retorted chicken curry can be influenced by several factors, including temperature, time, pressure, type of packaging and pH level. To ensure the best possible quality, it is important to consider these factors carefully when designing the retort process and selecting the appropriate packaging materials. The chicken curry processed with an F_0 value of 6 will be selected for the next storage study based on the quality acceptance from panellists.

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