The preference and shelf life of crispy fried onions

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Abstract. Crispy fried onion is widely used on the food processing to improve food tasteful as additional part of the cuisine. This study aimed to understand the shelf life of crispy fried onions which packaged by using Polyethylene (PE) plastic, Polypropylene (PP) plastic and Aluminium Foil (AF), understand the consumer’s preference during storage and also the preference from external consumers. Sensory test to external consumers was carried out in Bangli, Tabanan, Buleleng Regency and Denpasar City as the centre production of onions in Bali. The estimation of crispy fried onions shelf life was determined by using Extended Storage Studies (ESS). Results showed that the utilization of AF packaging was the best packaging with the shelf life of crispy fried onions was 13 weeks following by 8.28% water content. PCA analysis result on the sensory test during storage concluded that the uses of AF packaging affected on the texture, colour, taste and overall. Additionally, consumer’s preference in Buleleng Regency was influenced by colour, consumer’s preference in Tabanan and Denpasar were influenced by texture and taste and consumer’s preference in Bangli was affected by flavour according to PCA analysis result to external consumers.

1. Introduction

Red onion was one of the horticulture commodities commonly required by Indonesia’s citizen as additional part for food processing and interested due to the taste and smell unique of red onion [1]. The production of red onion highly depends on season therefore overproduction was often occurred and the selling price of red onion was low in farmer level [2]. Red onion was damaged easily therefore it was necessary the effort to extend its shelf life through postharvest processing [1,3] such as converting the red onion become branding product with the long shelf life namely crispy fried onion. Reference [4] stated that crispy fried onions can improve the tasteful of cuisine and also aesthetic visual of cuisine. Crispy fried onion can be served as snack when enjoying the tea time.

The good food processing was required to extend the crispy fried onion’s shelf life and maintain the crispy texture due its characteristic was easily damaged therefore processing modification is required to solve this issue such as additional the starch and selection of packaging types capable to maintain the quality of crispy fried onions. The studies of crispy fried onions branding products were often carried out such as by Reference [5-8]. Meanwhile, the study about the utilization of crispy fried onion packaging was still limited in vacuum and non-vacuum packaging in line with the study by Reference [3] mainly only focus on the observation about the changes of fried onion during storage and not observed the fried onion’s shelf life.

In Bali Province, the red onions were commonly cultivated in Bangli Regency mainly at Kintamani District around the Batur Lake area with 1,200 hectare land, Tabanan Regency and Buleleng Regency.

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Most varieties cultivated were local variety and other varieties namely Bali Karet, Biru Lancor, Super Philip and Bima Brebes [9]. The red onions cultivation in this area have been developed from upstream to downstream and produced the processed products such as crispy fried onion. However, the processed product mentioned was still packaged by using Polyethylene (PE) plastic therefore its texture easily changes and impact on the reducing of sensory acceptance mainly in flavour. The utilization of packaging types easily obtained was one of the considerations in this study therefore Polyethylene (PE) plastic, Polypropylene (PP) plastic and Aluminium Foil (AF) were chosen due to these packagings were suitable with segmentation market related to suppress the selling price. Reference [10] described that the uses of packaging types was one of the efforts to inhibit the water vapor absorbed into products, avoid the damage, protect the materials from pollution and physically disturbances. The goals of this study were understanding the shelf life of crispy fried onions which packaged by using Polyethylene (PE) plastic, Polypropylene (PP) plastic and Aluminium Foil (AF), understanding the consumer’s preference during storage and also the preference from external consumers which conducted in the centre production of onions in Bali Province.

2. Materials and methods

2.1. Materials and instruments
The main materials used in this study were fresh red onions and additional materials consisted of salt and tapioca flour. The instruments for red onions processing consisted of knife, cutting board, basin, kitchen scales, pan, spatula, stove and three types packaging namely Polyethylene (PE) plastic, Polypropylene (PP) plastic and Aluminium Foil (AF). Water content was determined by using analytic scale and oven.

2.2. Location and time
Research was carried out at Laboratory of postharvest in Assessment Institute for Agricultural Technology (AIAT) Bali from November 2019 to February 2020. Water content analysis and sensory test during storage were conducted in AIAT Bali meanwhile sensory test to external consumers was done in the centre production of red onions located in Denpasar City, Tabanan, Buleleng and Bangli Regency.

2.3. Samples preparation
The red onions used for crispy fried onions were obtained from traditional market in Denpasar City. The fresh red onions were sorted to separate the dirt and damaged red onions. Then, the red onions were shelled, washed by using water flow and drained. The red onions were sliced by using knife with the thickness was ± 2 mm. The red onions have been sliced were added the 1 tablespoon salt for 1 kg the red onions and left for ± 15 minutes. In order to obtain the crispy texture of fried red onions, 1.5 tablespoon corn-starch was added and left for ± 15 minutes. Cooking oil was heated and then the red onions were fried by using abundant cooking oil until all of red onions were soaked in the cooking oil. Medium fire was used to prevent it from the burning. The fried processing was stopped when the colour has been changed to the yellowish due to the fried processing still run after lifting from the cooking oil. Packaging was done after the fried red onions have been cold and there was no cooking oil left in the fried red onions.

2.4. Research design
Research consisted of two studies namely 1) consumers preference to crispy fried onions by using 25 external consumers in Denpasar City, Tabanan, Buleleng and Bangli Regency and 2) the estimation of crispy fried onions shelf life by using three types packaging namely Polyethylene (PE) plastic, Polypropylene (PP) plastic and Aluminium Foil (AF). The parameters of quality reducing used to understand the shelf life were water content and sensory test.
The shelf life of crispy fried onions was determined by using Extended Storage Studies (ESS) method. ESS method was done by storage the crispy fried onions on normal daily temperature and observe the reducing quality until the products were not accepted based on organoleptic evaluation. Partially Staggered Design (PSD) was used to determine the shelf life of crispy fried onions due to the shelf life of this product was between 3 to 6 months. The expired time of crispy fried onions were determined according to water content and organoleptic evaluation to the texture with the rate were 3-4 (rather like-like).

Panellist used in ESS method were 15 beginner panellists. Before the storage processing, water content was measured and organoleptic evaluation was carried out. To understand the quality reducing of crispy fried onions during storage, the water content measuring was done every week and organoleptic evaluation was carried out every two weeks. Water content analysis by using oven method. Organoleptic evaluation to attributes of colour, texture, flavour and overall were conducted by using hedonic test sensory evaluation with the scale categories descriptive were 1 = dislike very much; 2 = dislike; 3 = like slightly; 4 = like and 5 = like very much.

2.5. Statistical analysis
PSD data analysis was done by using simple linear regression analysis in the Microsoft Excel. Principal Component Analysis (PCA) was carried out to determine the best treatment toward the sensory quality during storage. The, mapping the external consumers preference was conducted by using subjective test (sensory test result) analysed by using Sensomaker software shown in Biplot graphic.

3. Results and discussion
3.1. The estimation of crispy fried onions shelf life by ESS (Extended Storage Studies) method
The main components of crispy fried onions were carbohydrate (54.15%), following by fat (31.77%). The lowest percentage of crispy fried onions components were water content (5.87%), ash content (4.67%) and protein content (3.55%) (Figure 1). Fried onions were categorized as one of dried food products therefore it has the low of water content. The increasing of water content during storage could be used as indicator the decreasing of fried onions quality which marked by the disappearance of crispy texture.

The quality of crispy fried onions would decrease as far as the long of storage time. The shelf life was determined by water content and sensory test during storage period. The water content of crispy
fried onions which packaged by three packaging types (PE, PP and AF) increase during storage period as shown in Figure 2. The increasing of water content mentioned were 0.3157% (PE plastic), 0.3948 (PP plastic) and 0.2386% (AF) in every week, following by simple linear regression analysis result respectively were y = 0.3157x + 6.4792 with R² = 0.8093; y = 0.3948x + 4.8758 with R² = 0.8707; y = 0.2386x + 5.4554 with R² = 0.8054 respectively. The water content of crispy fried onions packaged by PE plastic was 5.99-11.28%, PP plastic was 5.37-10.47% and AF was 5.87-8.28%. Compared to the requirement for maximum water content in dried food product was 7% stated by Reference [11] and the water content of fried onions (1.40-1.78%) by Reference [8], this result was significantly lower due to the fried onions were processed without cooking oil drainer and addition of the corn starch.

The high of water content in PE plastic was caused by the packaging has thin layer therefore the permeability of water vapour was bigger therefore the diffusivity of water through the packaging becomes greater [3,12,13]. The increasing of water content during storage period can cause the changes of colour, flavour, texture, physical appearance, nutrition value and microbiology content [6,12,14]. The uses of corn starch also can cause the increasing of water content during storage period due to the corn starch contains high amylose led to the increasing of water absorption [15]. The higher water content of crispy fried onions, the lower crispy texture in fried onions.

3.2 The changes of organoleptic quality during storage period

The changes of organoleptic quality with using three packaging types observed during storage period consist of the attributes of colour, texture, flavour and overall. The organoleptic evaluation of fried onions during storage period showed the reducing of organoleptic quality to colour, texture, flavour, taste and overall. The uses of PE plastic showed the quality reducing was higher than PP plastic and AF (figure 3). The consumer’s acceptance was most influenced by texture attribute followed by colour and flavour. The crispy texture of fried onions also affected by water content. The lower water content, the crispier texture in fried onions [7]. The texture of fried onions also influenced by carbohydrate content contained in the fresh red onions [5]. During the fried processing, the polysaccharide would create the layer above the materials to prevent fat migration to materials and reduce the water loss from materials. The layer formed causes the crispy texture in fried onions [16].

PCA analysis result to sensory test during storage period as shown in Figure 4 described that the main component capable to describe the variance was 95.28% derived from first component was 88.99% and second component was 6.29%. The sensory attributes categorized into first component were texture, flavour and overall. Meanwhile, the second component consisted of colour and taste. Texture and overall attributes were not correlate with colour and taste texture due it formed 90 degree angle. The texture and overall attributes were close located and has the same direction therefore both of them were positively correlate. Colour and taste attributes formed the angle with same direction then it can be said that both of them positively correlate.

AF packaging closer located with the attributes of texture, flavour, taste and overall compared to PE and PP plastic therefore it can be assumed that AF packaging as the best treatment to maintain the fried onions quality due it still can be accepted based on sensory evaluation rather than PE and PP plastic (figure 4). The selection of AF packaging (AF on the 13th week) because it was close located with the quality attributes of texture, flavour and overall. The quality of fried onions was influenced by the attributes of texture, flavour and taste based on sensory perspective.

3.3 The external consumer’s preference of crispy fried onions

The sensory test of fried onions with using external consumers aimed to understand the consumers mapping to crispy fried onions. The external consumer’s preference was conducted in Denpasar City, Tabanan, Buleleng and Bangli Regency. Score plot graphic described the closeness relationship of each samples (figure 5). The samples close located into each other has identically characteristic, meanwhile the samples with contrast directed has difference characteristic [17]. According to consumers preference with using the attributes of colour, taste, texture, flavour and overall, it formed
three groups namely group 1 were Tabanan Regency and Denpasar City, group 2 was Bangli Regency and group 3 was Buleleng Regency.

Figure 3. The changes of sensory quality: colour (a), flavour (b), texture (c), taste (d) and overall (e) in crispy fried onions during storage period.

Loading plot as shown in figure 6 showed that texture positively correlate to taste. The flavour attribute positively correlates with overall attribute meanwhile the flavour was negatively correlate with the texture and taste attributes. Figure 7 informed that the main component (PC1) gives information the variance data was 67.65% and PC2 was 29.77%. The consumer’s preference in Buleleng Regency represented characteristic of colour attribute sensory meanwhile texture and taste were represented by consumers in Tabanan and Denpasar. The flavour attribute was represented by consumers in Bangli Regency.
Figure 4. Biplot of sensory test in crispy fried onions during storage period.

Figure 5. Score plot graphic of sensory attributes on crispy fried onions in Province Bali.

Figure 6. Loading plot described the closeness relationship between sensory variables with PC1 and PC2.

Figure 7. PC1 and PC2 biplot of crispy fried onions sensory variable in Bali Province.
4. Conclusions
The best packaging for crispy fried onions was AF packaging with the shelf life was 13 weeks (91 days). The water content in the end storage period was 8.28%. The AF packaging affected on the sensory attributes namely colour= 21.37%; flavour= 63.16%; texture= 18.76%; taste= 50.02% and overall= 50.02% with descriptive score rate were colour= 4.20; flavour= 4.00; texture= 3.80; taste= 4.00 and overall= 4.10. The AF packaging greatly affected on the attributes of texture, colour, taste and overall. The consumer’s preference in Buleleng Regency was determined by the attributes of colour, Tabanan Regency and Denpasar City were texture and taste and Bangli Regency was flavour.

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