Influence of Peanut Flour Addition on Rasi Process Production

H Herawati¹*, E Kamsiati¹, Abubakar¹
Indonesia Center for Agricultural Post Harvest Research and Development
Jl. Tentara Pelajar No 12, Cimanggu-Bogor

*Email: herawati_heny@yahoo.com

Abstract. Rasi is a cassava flour made from grains resembling rice granules. In general, rasi is processed by using cassava flour took tapioca and manual granulation after that dried. One of the disadvantages of rasi traditional process production is the form of granules that are not uniform and easily destroyed also has low protein and fat levels. Increasing the levels of fat and protein of rasi should be done the addition peanut flour. This study aimed to characterize the effect of adding peanut flour and improvement of granular formation method by using extrusion technology to physic chemical properties of the rasi product. There were three treatments of peanut flour addition, i.e 5, 10 and 15% that compared with control. The study was designed using a complete randomized design and the data obtained was analyzed using SPSS 2.1 software. Based on the result of the research, there was an increase of fat and protein content of rasi sample which added peanut flour. Peanut flour added constants have higher lightness and WI (Whiteness Index) values than controls. The amorphous phase of the constituents added with peanut flour was higher than the control, while the crystalline phase shows the opposite value. This was evident from the microstructural profile, where the constituents of peanut flour have starch granules that have started to break apart from the controls.

1. Introduction

Rasi is a cassava flour made from grains resembling rice granules. In general, rasi is processed by using cassava flour took tapioca and manual granulation after that dried. Rasi is produced and becomes the staple food of the Cireundeu community in Cimahi city. One of the disadvantages of rasi traditional process production is the form of granules that are not uniform and easily destroyed also have low protein and fat levels. Several methods are used to improve the shape of artificial rice granules produced. [1] and [2] used the granulation method. Some other researchers use hot and cold extruder to produce artificial rice [3-7].

One of the efforts to improve the quality of rasi is by processing it into relatively more uniform granules resembling the form of rice from rice. Research on rice processing technology analogous to using extruder machines was carried out [7-9] by using raw materials in the form of corn flour added with tapioca. Several other studies have used the main source of my ingredients from various types of flour such as sago starch with kidney beans [10]; from arrowroot [11]; taro flour, seaweed and fish bone collagen [12]; modified cassava starch, corn, Canavalia ensiformis, and Dioscorea esculenta [13].

The use of several types of flour and food additives is intended to improve the quality of artificial rice produced. As Noviasari et al. [14] which conducted artificial rice processing research to improve
the nutrition of artificial rice that it produces. Sadek et al. [15] conducted research on artificial rice production to prevent the onset of degenerative diseases. While Budijanto and Yuliana [16] used artificial rice as a vehicle in order to develop the concept of food diversification. Some of these artificial rice processing technologies are closely related to the purpose of using the main raw material sources, increasing certain functional value or increasing the added value of others.

The opportunity to use other local flour is cassava flour for making analogue rice. [17] formulated using mocaf added with corn starch, Carboxy Methyl Cellulose (CMC) and tofu flour. Jannah et al [18] conducted the addition of shrimp flour in making analogue rice with the main raw material in the form of cassava flour. Increasing the levels of fat and protein of rasi should be done addition peanut flour. Increasing of protein and fat level in rasi will increase nutrition value of product for consumers. Peanuts were chosen because it’s easy to obtain and have high protein content. This study aimed to characterize the effect of adding peanut flour and improvement of granular formation method by using extrusion technology to physico chemical properties of the rasi product.

2. Methods
The research activity was conducted from January to July 2018 at the Postharvest R & D Laboratory and Rasi processing unit, Kampung Cirendeu-Cimahi, West Java. The ingredients used include: cassava flour, peanut flour, and chemicals for analysis. The equipments used included mixer, steamer, extruder, oven, sealer, soxhlet, destilator, RVA (Rapid Visco Analyzer), XRD (X-Ray Diffraction) and SEM (Scanning Electron Microscope).

The stages of the research process included mixing cassava flour with water 25 % v/w, steaming for 30 minutes, extruding granules and drying with an oven for 3 hours. The study was designed using a completely randomized design that includes genetics and correlation of the use of peanut flour (5, 10 and 15%) with three replicates. The analysis included colour analysis, texture, proximate content, RVA profile, crystallinity profile and microstructure analyzed using SEM tools.

The study was designed using a complete randomized design and the data obtained was analyzed using SPSS 2.1 software. The data obtained were then analyzed by ANOVA and if it showed significantly different results at intervals of 95%, further test analysis was carried out with Duncan.

3. Result and discussion
3.1. Colour analysis
The constituent characteristics added to peanut flour are relatively similar to the controls without the addition of peanut flour. In making artificial rice or rice can be derived from cereals or tubers which are sources of carbohydrates as the main raw material [7]. Meanwhile, to increase the protein [2] added soybean flour to artificial rice making from cassava flour as raw material. Color characteristics of rasi produced as shown in the table below.

| Treatments  | Color analysis of raw Rasi | Color Analysis of cooked rasi |
|-------------|----------------------------|-------------------------------|
|             | L  | a  | b  | WI | L  | a  | b  | WI  |
| Control     | 74.60<sup>a</sup> | 1.95<sup>d</sup> | 11.91<sup>b</sup> | 96.20<sup>a</sup> | 58.20<sup>a</sup> | 2.14<sup>c</sup> | 11.11<sup>b</sup> | 95.49<sup>b</sup> |
| KC 5%       | 76.14<sup>b</sup> | 2.49<sup>b</sup> | 12.00<sup>b</sup> | 96.27<sup>b</sup> | 59.39<sup>a</sup> | 2.81<sup>b</sup> | 13.26<sup>a</sup> | 95.51<sup>b</sup> |
| KC 10%      | 77.95<sup>a</sup> | 2.28<sup>c</sup> | 11.87<sup>b</sup> | 96.37<sup>a</sup> | 60.97<sup>b</sup> | 2.89<sup>b</sup> | 14.34<sup>a</sup> | 95.55<sup>a</sup> |
| KC 15%      | 73.49<sup>a</sup> | 2.87<sup>a</sup> | 12.77<sup>a</sup> | 96.13<sup>d</sup> | 61.16<sup>a</sup> | 3.40<sup>a</sup> | 15.11<sup>a</sup> | 95.55<sup>a</sup> |

Remarks: numbers followed by the same letter show significantly different levels of 95% confidence interval

Based on the results of statistical analysis, the addition of peanut flour resulted in a different whiteness index between treatments. The whiteness index value showed the brightness level of the rasi produced. The mature characteristics of rasis with the addition of peanut flour showed that the results of the statistical analysis were significantly different compared to the controls for the parameter values
L, a, b and whiteness index. The addition of peanut flour will increase the whiteness index of raw and cooked rasi. This happens because peanut flour has a white colour that will increase the whiteness of rasi.

3.2. Proximate analysis

Characteristics of constituents produced can be finalized water, ash, fat, protein and carbohydrate content based on proximate analysis results. The results of the proximate analysis of the control of rasi were compared with the constituents added with peanut flour as listed in the table below.

| Treatments    | Moisture (%) | Ash (%) | Fat (%) | Protein (%) | Carbohydrate (%) | Energy (Kcal) |
|---------------|--------------|---------|---------|-------------|------------------|---------------|
| Control       | 11.647<sup>a</sup> | 0.64<sup>a</sup> | 0.42<sup>a</sup> | 0.78<sup>a</sup> | 86.51<sup>c</sup> | 352.94<sup>a</sup> |
| KC 5%         | 5.427<sup>b,c</sup> | 0.77<sup>b</sup> | 2.98<sup>b</sup> | 2.90<sup>b</sup> | 87.59<sup>d</sup> | 388.75<sup>b</sup> |
| KC 10%        | 5.663<sup>b</sup> | 0.71<sup>b</sup> | 3.80<sup>b</sup> | 3.49<sup>c</sup> | 86.33<sup>b</sup> | 393.50<sup>c</sup> |
| KC 15%        | 4.993<sup>c</sup> | 0.68<sup>ab</sup> | 5.14<sup>d</sup> | 5.29<sup>d</sup> | 83.90<sup>c</sup> | 402.98<sup>d</sup> |

Remarks: numbers followed by the same letter show significantly different levels of 95% confidence interval

Based on the results of proximate level analysis, with the addition of peanut flour, the protein and fat content of rasi produced increased. The results of statistical analysis showed that protein and fat values were significantly different between treatments for the addition of peanut flour 5, 10 and 15%. Increasing levels of fat and protein increase the levels of constituent energy produced. The addition of various peanuts as a source of protein had previously been done by adding soybeans, green beans, cowpea and koro beans to the preparation of analog rice from oyek. Protein levels obtained ranged from 6.35-10.17%.[19]

3.3. Texture Analysis

The results of the texture analysis are carried out using a texture analyzer. Texture analysis includes parameters of hardness, adhesiveness, cohesiveness, gumminess and chewiness. Based on the results of texture analysis, the results obtained are listed in the table below.

| Treatments | Hardness (N) | Adhesiveness (mJ) | Cohesiveness (N) | Guminess (N) | Chewiness (mJ) |
|------------|--------------|-------------------|------------------|--------------|----------------|
| Control    | 27.612<sup>ab</sup> | 0.177<sup>ab</sup> | 0.527<sup>a</sup> | 14.211<sup>ab</sup> | 41.690<sup>bc</sup> |
| KC 5%      | 32.141<sup>a</sup> | 0.103<sup>b</sup> | 0.543<sup>a</sup> | 17.446<sup>d</sup> | 61.220<sup>a</sup> |
| KC 10%     | 23.539<sup>ab</sup> | 0.363<sup>a</sup> | 0.560<sup>a</sup> | 13.027<sup>ab</sup> | 53.710<sup>ab</sup> |
| KC 15%     | 15.076<sup>c</sup> | 0.073<sup>b</sup> | 0.563<sup>a</sup> | 8.464<sup>b</sup> | 37.120<sup>c</sup> |

Remarks: numbers followed by the same letter show significantly different levels of 95% confidence interval

Based on the results of texture analysis, the results of hardness, adhesiveness, gumminess, and chewiness showed that the results of statistical analysis were significantly different. Whereas based on the results of statistical analysis cohesiveness shows results that are not significantly different. Cooked rasi are expected to have a texture that remains compact and not sticky. The value of texture compactness can be seen from the value of cohesiveness. While the value of stickyness can be seen from the adhesiveness value. The higher the adhesiveness value showed the higher adhesiveness. The addition of peanut flour will reduce the stickyness due to the presence of fat from peanuts.
3.4. Viscosity Analysis

Analysis of RVA (Rapid Visco Analyzer) Profile was carried out in order to determine viscosity capacity and paste formation of rasi. Based on the results of RVA’s analysis of the rasi samples with the addition of peanut flour compared to the controls as listed in the table below.

| Parameters                  | Control | 5%   | 10%  | 15%  |
|-----------------------------|---------|------|------|------|
| Viskositas puncak (cp)      | 2512.5  | 2648.0 | 3265.0 | 3365.5 |
| Hot paste viscosity (cp)    | 1710.5  | 1791.5 | 2026.5 | 2117.5 |
| Cold paste viscosity (cp)   | 2699.0  | 2975.0 | 3045.5 | 3048.0 |
| Viscosity end plateau (cp)  | 1760.5  | 1839.5 | 2106.5 | 2216.0 |
| Breakdown (cp)              | 802.0   | 856.5 | 1238.5 | 1248.0 |

Based on results, RVA profile analysis obtained results from the peak of viscosity of the constituent samples with the peanut flour propagation, with the increasing concentration of added peanut flour, increasing the peak viscosity. Likewise with the breakdown value produced, indicating that with more and more peanut flour added, it will also increase the breakdown value. Increasing the value of peak viscosity and hot paste viscosity shows the ability of starch granules to maintain themselves during the heating process.[20]

3.5. Crystallinity Profile

To find out the crystalline and amorphous profile, the control rasi samples compared with rasi with the addition of peanut flour obtained the results as shown in the Figures and Tables below.

![Figure 1](image1.png)  
![Figure 2](image2.png)

**Figure 1.** Results of analysis of crystallinity profile of various rasi (control, KC 5%, KC 10%, KC 15%)  

Based on the results of the crystallinity profile analysis and the amorphous phase of rasi added peanut flour has a crystalline phase which decreases with increasing concentration of added peanut flour. The levels of peanut flour 5, 10 and 15% respectively resulted in a crystalline phase of 35%, 33.9% and 33.1% compared to controls which had a crystalline phase of 37%. This is inversely proportional to the amorphous phase, with increasing concentration of added peanut flour increasing the amorphous phase.
Sequentially the amorphous rasi were added with peanut flour of 5, 10 and 15%, namely 65.0, 66.1 and 66.9%, compared to controls that had an amorphous phase of 63%.

3.6. Microstructure analysis
The cross-sectional microstructure of rasi depicts porosity and starch granules which can be identified using SEM (Scanning Electron Microscope). Based on this cross section, granules can be identified that begin to undergo gelatinization processes and join one another. The microstructure profile of the rasi control was compared with rasi with the addition of peanut flour as shown in the figure below.

![Figure 2](image)

**Figure 2.** Control microstructure profile and addition of peanut flour (0, 5, 10, 15%)

The rasi microstructure profile with the addition of peanut flour showed that the control had starch granule microstructure which was relatively more intact compared to the rasi with added peanut flour. This is as a result of the XRD profile which shows that with the increasing concentration of added peanut flour, it will increase the amorphous phase of the constituents produced.

4. Conclusion
The addition of peanut flour in making constellations affects the proximate level of the constituents produced. The resulting fat and constituent protein content increased with the addition of peanut flour. The peak viscosity of the constellations added was increased by the addition of the concentration of peanut flour. The hardness of the constituents added with peanut flour decreases with an increase in the concentration of added peanut flour. The crystallinity phase of constellations added with peanut flour decreases with the increase of peanut flour. This was very much related to the constituent microstructure which has the form of starch granules that start to break a lot compared to the constituents without the addition of peanut flour. The use of 5-10% peanut flour in rasi production can be done to improve the nutritional value of rasi and produce rasi with good physical characteristics. The constituent characteristics were feasible to be developed further for the wider commercialization of constellations.
5. References

[1] Herawati H and Widowati S 2009 *Buletin Teknologi Pascapanen Pertanian* 5(I) 39-48
[2] Herawati H, Arif A, Oktaviani K and Widowati S 2011 Karakteristik beras artifisial berbasis ubikayu dan kedelai. Disampaikan pada Seminar Nasional Teknologi Pascapanen 2011, Bogor.
[3] Moretti D, Lee TC, Zimmermann MB, Nuessli J and Hurrell RF 2005 *Journal Food Science* 70 330-336
[4] Zhuang H 2010 *Journal of Food Processing and Preservation* 34 1080-1102
[5] Mishra A, Mishra HN and Rao PS 2012 *International Journal Food Science Technology* 47 (9) 1789-1797.
[6] Budijanto S and Yuliyanti 2012 *Jurnal Teknologi Pertanian* 13 (3) 177-186.
[7] Herawati H, Kusnandar F, Adawiyah DR and Budijanto S 2013 *Pangan* 22 (4) 317-327 ISSN:0852-0607
[8] Herawati H, Kusnandar F, Adawiyah DR, Budijanto S and Rahman MS 2014 *Thermochimica Acta* 593 50–57
[9] Herawati H, Kusnandar F, Adawiyah DR and Budijanto S 2014 *J. Litbang Pert.* 33 (3) September 2014: 87-94.
[10] Wahjuningsih SB, Marsono, Praseptiangga D and Haryanto B 2016 *International Conference on Agricultural and Food Engineering* (Cafei 2016) 23 – 25
[11] Caesarina I and Estiati T 2016 *Jurnal Pangan dan Agroindustri* 4 (2) 498-504
[12] Darmanto YS, Riyadi PH and usanti S 2017 *Journal of Engineering and Applied Sciences* 12 (12) 3055-3060. ISSN: 1816-949X
[13] Sumardiono S, Pudjiastuti I, Handayani NA and Kusumayanti H 2018 E3S Web of Conferences 31, 06005
[14] Noviasari S, Widara SS and Slamet Budijanto S 2017 *Jurnal Kesehatan Masyarakat* 13 (1) 19-27
[15] Sadek NF, Yuliana ND, Prangdimurti E, Priyosoeryanto BP and Budijanto S 2016 *Pangan* 25 (1) 61 – 70.
[16] Budijanto S and Yuliana ND 2015 *Journal of Developments in Sustainable Agriculture* 10 7-14
[17] Yuwono SS and Zulfiyah AA 2015 *Jurnal Pangan dan Agroindustri* 3 (4) 1465-1472.
[18] Jannah M, Tamrin, Sugianti C and Warji 2015 *Jurnal Teknik Pertanian Lampung* 4 (1) 51-56
[19] Kanetro B, D. Pujimulyani, S. Luwihana and A. Sahrah 2017 *AGRITECH* 37 (3), Agustus 2017. Hal. 256-262 DOI: http://doi.org/10.22146/agritech.31538
[20] Subekah NW, P. Sari and A. Subagio 2016 *Jurnal Agroteknologi* 10 (1) 12-24