

## **Acceptance Test and Iron Content Test *Churros* Formulation of RALE Flour (Red Beans and Soybeans) as an Alternative Snack to Prevent Anemia for Teenage Girls**

**Ayunis Naba'ur Rhodiyah<sup>1</sup>, Juliana Christyaningsih<sup>2</sup>, Erlyna Jayeng Wijayanti<sup>3</sup>, Ani Intiyati<sup>4</sup>**

<sup>1,2,3,4</sup>Department of Nutrition, Politeknik Kesehatan Kemenkes Surabaya, Surabaya, Indonesia

Email: [juliana\\_analis@yahoo.co.id](mailto:juliana_analis@yahoo.co.id)

---

### **ARTICLE INFO**

#### **Article History:**

Received August, 11<sup>th</sup>, 2023

Accepted August, 20<sup>th</sup>, 2023

Published online November, 30<sup>th</sup>, 2023

#### **Keywords:**

*Anemia;*

*Iron;*

*Red bean flour;*

*Soybean flour;*

*Churros;*

### **ABSTRACT**

Conditions in which the amount of hemoglobin in the blood is below normal limits is called anemia. Iron deficiency is one of the causes of anemia which is still common in pregnant women and adolescents. The aim of this study was to determine the acceptability and levels of iron in *churros* formulated by RALE (red bean and soybean flour) as a snack to prevent anemia for girls. The research method is an experiment on 3 formulations of adding many flours: red bean: soybean with the formulations CP 1 (85:5:10), CP 2 (75:10:15), and CK 3 (100:0:0), using organoleptic tests in the form of likes and dislikes for color, taste, aroma, texture which were presented to 25 panelists. Test for iron content using ICP-OES method for the best organoleptic formulation and test results (CK 3). The results showed the CP 1 formulation were the most preferred with an average score of 4.32 which was included in the like category. The conclusion of this study showed organoleptic properties, the formulation favored by the panelists was the CP 1 formulation with a ratio of flour: red bean flour: soybean flour of 85:5:10, having an iron content of 3.86 mg/100 grams *churros*.

---

### **INTRODUCTION**

One of the common health issues in Indonesia is anemia, which can affect various age groups, including toddlers, adolescents, pregnant women, and adults.<sup>1</sup> Anemia occurs when the hemoglobin levels within red blood cells fall below normal levels.<sup>2</sup> For adolescent girls, anemia is defined when the hemoglobin level is less than 12 g/dL.<sup>3</sup> According to data from Basic Health Research in 2018 survey, the prevalence of anemia increased to 48.9%, whereas previously in 2013, the prevalence of anemia was 37.1%.<sup>4</sup> Deficiency of iron intake is one of the conditions that can lead to the occurrence of anemia.<sup>5</sup>

Red beans and soybeans are plant-based foods that are high in protein and iron.<sup>6</sup> Through a survey of 100 different types of foods, researchers at the United States Department of Agriculture conducted a study and found that red beans have higher levels of iron and antioxidants compared to other fruits and vegetables such as spinach, blueberries, cranberries, and cherries. Red beans have superior qualities of iron and antioxidants. Iron itself is crucial for preventing anemia in adolescent girls.<sup>7</sup>

---

Churros are a traditional dessert from Spain that is quite popular in Indonesia.<sup>8</sup> Churros have a sweet flavor with a crispy texture on the outside and a soft interior.<sup>9</sup> Therefore, it is highly favored by consumers of all ages, including children, teenagers, and adults. The high iron content in red beans and soybeans can be utilized in the making of these churros. Therefore, researchers are interested in creating churros using a substitution of red bean and soybean flour, which is anticipated to help prevent anemia in adolescent girls. The aim of this research is to determine the acceptance and iron content of churros made from RALE flour (red beans and soybeans) as an alternative snack for preventing anemia in adolescent girls.

## MATERIALS AND METHODS

This research applies the experimental method, in which the studied samples are subjected to specific treatments with the aim of observing and understanding the effects that arise as a result of the treatment or experiment.<sup>10</sup> The organoleptic test for RALE churros was conducted at the Sensory Evaluation Laboratory (UCR) of the Nutrition Department, Health Polytechnic Ministry of Health in Surabaya, located at 24B South Pucang Jajar Street, while the iron content test was carried out at the Saraswanti Indo Genetech Laboratory, located at 1 Duku Menanggal Street, Gayungan District, Surabaya. The research was conducted from October 2022 to June 2023. The samples designated for this study were RALE churros with three formulations. Organoleptic tests for the three formulations were conducted with 25 panelists, and the selected formulation from the acceptance test along with the control formulation would undergo iron content analysis.

## RESULTS

### Characteristics of RALE Churros

In RALE churros, the difference in composition lies in the use of wheat flour, red bean flour, and soybean flour. The variation in three formulations aims to determine the differences in the organoleptic characteristics of each RALE churros formulation as shown in Table 1:

**Table 1. Characteristics of RALE Churros Formulations**

Indicator	CP 1 (Wheat Flour: Red Bean Flour: Soybean Flour = 85 : 5 : 10)	CP 2 (Wheat Flour: Red Bean Flour: Soybean Flour = 75 : 10 : 15)	CK 3 (Wheat Flour: Red Bean Flour: Soybean Flour = 100 : : 0)
Color	Golden yellow, slightly brownish	Slightly brownish	Golden yellow
Aroma	Buttery with a hint of nutty	Aroma Nutty aroma with a slight buttery scent	Buttery aroma
Taste	Sweet, buttery flavor with a hint of nuttiness Sweet	Nutty flavor	Sweet buttery flavor
Texture	Soft	Soft	Soft

Source: Primary Data, 2023

## Average Acceptance Test Results of RALE Churros

In this study, the acceptance test results were obtained using the hedonic scale test to determine the level of preference of panelists for RALE churros. The average values of organoleptic tests are as follows:

**Table 2. Average Organoleptic Test Results of RALE Churros**

NO	Indicator	Formulation		
		CP 1	CP 2	CK 3
1	Color	4.36	3.72	4.4
2	Aroma	4.28	4.00	4.16
3	Taste	4.32	3.52	4.28
4	Texture	4.32	4.04	4.2
	Average	4.32	3.82	4.26

Source: Primary Data, 2023

## Kruskal Wallis Non-Parametric Test

The non-parametric Kruskal-Wallis test was applied to test for significant differences based on color, aroma, taste, and texture indicators in RALE Churros. This test was conducted to evaluate whether there were significant differences between RALE Churros formulations in terms of these indicators. The Kruskal-Wallis test results can be seen in Table 3 below:

**Table 3. Kruskal-Wallis Test Results for RALE Churros**

NO	Indicator	Kruskal-Wallis Test Value
1	Color	0.005
2	Aroma	0.414
3	Taste	0.001
4	Texture	0.297

Source: Primary Data, 2023

Following Table 2, the Kruskal-Wallis test results show that there are significant differences between churros formulations (RALE) in terms of color and taste parameters, with a p-value < 0.05. However, for aroma and texture indicators, the Kruskal-Wallis test results indicate that there are no significant or relevant differences between churros formulations with  $p > 0.05$ .

## Mann Whitney Post Hoc Test

Differences were found in the color and taste indicators, thus requiring a post hoc test, the Mann Whitney test, to observe whether the hypothesis is accepted or not.

**Table 4. Mann Whitney Test Results for RALE Churros**

No	Indicator	Mann Whitney Test Value		
		CP 1 : CP 2	CP 1 : CK 3	CP 2 : CK 3
1	Color	0.009	0.864	0.003
2	Taste	0.001	0.983	0.003

Source: Primary Data, 2023

Based on Table 3, the Mann Whitney test results for the color parameter of CP 1: CP 2 and CP 2: CK 3 formulations, indicated by  $p < 0.05$ . This indicates that the hypothesis is accepted, meaning there is a significant difference in color between these formulations. Additionally, for the taste indicator, in formulations CP 1: CP 2 and CP 2: CK 3, which also showed  $p < 0.05$ , the hypothesis is accepted, indicating a significant difference in taste between these formulations. For the color and taste indicators in the CP 1: CK 3 formulation, the p-value is  $> 0.005$ , meaning the hypothesis is rejected, or there is no difference in this formulation.

### Iron Content Test of RALE Churros

The iron content analysis results of RALE churros per 100 grams can be seen in Table 5:

**Table 5. Iron Content of Churros per 100 grams**

Formulation	Weight	Iron Content of RALE Churros
CP 1	100 grams	3.86 mg
CK 3 (control)	100 grams	3.05 mg

Source: Primary Data, 2023

Laboratory examination results showed that in 100 grams of churros, the CP 1 formulation contained 3.86 mg of iron, while the CK 3 (control) formulation contained 3.05 mg/100 grams.

## DISCUSSION

### Organoleptic Characteristics of RALE Churros

Organoleptic testing using the hedonic method (preference test)<sup>11</sup>, was conducted at the Sensory Evaluation Laboratory (UCR) of the Nutrition Department, Health Polytechnic Ministry of Health in Surabaya. A total of 25 moderately trained panelists were involved in this study. Sensory testing can be used to evaluate consumer preferences or responses to a product.<sup>12</sup> Panelists were asked to provide personal responses or preferences regarding the level of liking<sup>13</sup> for various formulations of RALE Churros. In this study, the tested indicators included color, aroma, texture, and taste.<sup>14</sup>

#### 1. Color

One crucial indicator in the appearance of food is its color. A food product with an appealing color enhances eating enjoyment and creates a distinct impression on panelists.<sup>15</sup> According to organoleptic testing, the highest average color index score was demonstrated by formulation CK 3 at 4.4, exhibiting a golden yellow color. Following this, the second preferred formulation was CP 1 with a score of 4.36, displaying a golden yellow color with a slight brown tint. Meanwhile, the lowest average score was obtained by formulation CP 2 at 3.72, featuring a somewhat brownish color. The slightly brownish color of CP 2 is attributed to the increased addition of red bean flour, resulting in a darker and less appealing hue. Kruskal-Wallis's test results for the color index yielded a P value of  $(0.005) < 0.05$ , indicating an effect on the three churros formulations. Subsequently, Mann Whitney

---

tests were conducted for formulations CP 1: CP 2 and CP 2: CK 3, revealing a significant difference in color with a P value < 0.05. However, the CP 1: CK 3 formulation had a P value > 0.05, indicating no color discrepancy in this formulation.

Dark coloration in churros can be attributed to the protein content present in red bean and soybean flour.<sup>16</sup> During the frying process, these proteins interact in the Maillard reaction, resulting in dark coloration in churros, providing them with a brownish hue.<sup>17</sup> One method to mitigate dark coloration in churros is by using red bean flour that has undergone soaking for 24 hours and boiling for 90 minutes, regardless of whether it is with or without the skin, as it can reduce brightness levels. During soaking, the brightness level of red beans may decrease as the color pigments dissolve. Meanwhile, during boiling, the brightness of the flour may also decrease due to intense heat exposure during the heating process.<sup>18</sup>

## 2. Aroma

Aroma is a critical element in the taste experience of food, evaluated through the sense of smell. Changes in food aroma can influence its taste. The aroma of food often reflects the enjoyment derived from a food item.<sup>19</sup> Based on organoleptic testing, the highest average score for aroma was found in formulation CP 1, with a score of 4.28, exhibiting a distinctive buttery aroma with a slight nutty scent. Following this, the second preferred formulation was CK 3, with an average score of 4.16, featuring a buttery aroma. Meanwhile, the lowest average score was obtained by formulation CP 2, scoring 4.00, with a nutty aroma. With slight differences observed from the organoleptic results, it can be concluded that there was no significant effect. The Kruskal-Wallis test results for the aroma index yielded a P value of (0.414) > 0.05, indicating no effect on the three churros formulations.

## 3. Taste

Overall taste perception plays a crucial role in controlling consumer acceptance of a food product.<sup>20</sup> Based on organoleptic testing, the highest average score for the taste parameter was found in formulation 1 (CP 1), scoring 4.32, with a buttery taste with a hint of nuts. Conversely, the lowest average score was found in formulation CP 2, scoring 3.52, with a nutty taste. From the research findings, it can be determined that the significant addition of red bean and soybean flour significantly decreased the liking or preference level of panelists for the product's taste. The Kruskal-Wallis's test results for the taste parameter yielded a P value of (0.001) < 0.05, indicating an effect on the three churros formulations. Subsequently, Mann Whitney tests were conducted for formulations CP 1: CP 2 and CP 2: CK 3, revealing a significant difference in taste with a P value < 0.05.

Conversely, the CP 1: CK 3 formulation had a P value > 0.05, indicating no taste discrepancy in this formulation.

#### 4. Texture

Texture characteristics have the potential to influence consumer preferences for a food product.<sup>21</sup> Texture is observed through the mouth during biting, chewing, and swallowing. Freshly made churros have a crisp texture on the outside and a soft texture on the inside. From organoleptic testing, the highest average score for the texture index was found in formulation 1, with a score of 4.32. Conversely, the lowest average score was found in formulation 2, scoring 4.04. The Kruskal-Wallis's test results for the texture index yielded a P value of (0.297) > 0.05, indicating no effect on the three churros formulations. Prolonged cooling after frying can cause the crispy texture of churros to diminish. Therefore, a crispifier ingredient is needed to maintain the crispiness of churros for a longer duration.

One of the crispifying agents that can be added is sodium bicarbonate or baking soda. Baking soda is one of the few leavening and crisping agents used in baking and frying. When baking soda is mixed into the batter, it produces CO<sup>2</sup> gas. This gas plays a role in forming pores in the batter, allowing it to expand. Besides baking soda, rice flour can also make the texture of fried foods crispier. Rice flour is one of the main ingredients used in baking processes and also as a coating for frying.<sup>23</sup>

#### **Energy and Iron Content in 1 Serving of Churros RALE**

According to Ministerial Regulation No. 28 of 2019 on Adequate Nutritional Intake, for adolescent girls aged 10-18 years, the average daily energy requirement is 2017 kcal, and the daily iron requirement is 13 mg. For snacks, which account for 10% of a single meal, the energy for snacks is = 2017 x 10% = 202 kcal and the iron for snacks is = 13 x 10% = 1.3 mg.

In one recipe, churros yield 25 pieces, with a weight of 12 grams per piece, resulting in a total weight of 300 grams, containing 1164.7 kcal of energy. The energy requirement for snacks is 202 kcal per serving, so we get:

$$\text{Number of churros in a serving} = \frac{202}{1164,7 \text{ kcal}} \times 25 \text{ pieces} = 4,3 \sim 5 \text{ pieces.}$$

In 1 serving of churros (60 grams), it contains 232.9 kcal of energy (Based on the TKPI calculation) and contains 2.3 mg of iron (Based on the iron content lab test). In 1 serving, it already meets the energy and iron requirements.

---

## CONCLUSION

Based on organoleptic properties, the churros highly favored by the panelists are those with code CP 1 with a formulation of wheat flour: red bean flour: soybean flour in the ratio of 85:5:10. The iron content of RALE churros most preferred is in formulation CP 1 at 3.86 mg/100 grams. The organoleptic test results for churros formulations were conducted using the Kruskal-Wallis's test; if the value has  $P < 0.05$ , then it will be further tested using Mann Whitney, specifically for color and taste.

## SUGGESTION

1. Using skinless red bean flour which has gone through a soaking process for 24 hours and boiling for 90 minutes to reduce the color pigment in the red beans so that the final product produced can have a better color.
2. Analyze the nutritional content of protein, to determine the relationship related to the absorption of iron and protein.
3. Add crunching ingredients (baking soda, rice flour) so that the crunchiness of the churros lasts longer.

## REFERENCES

1. RI KK. Pedoman Pencegahan dan Penanggulangan Anemia Pada Remaja Putri dan Wanita Usia Subur (WUS). Published online 2018. <https://www.ptonline.com/articles/how-to-get-better-mfi-results>
2. Rahayu A, Yulidasari F, Putri AO, Anggraini L. Metode Orkes-ku (Raport Kesehatanku) Dalam Mengidentifikasi Potensi Kejadian Anemia Gizi Pada Remaja Putri. 2019.
3. Kemenkes RI. Pedoman pemberian Tablet Tambah DARAH (TTD) bagi remaja putri pada masa pandemi COVID-19. Kementerian Kesehat RI. Published online 2020:22.<http://appx.alus.co/direktoratgiziweb/katalog/ttd-rematri-ok2.pdf>
4. Kemenkes RI. Hasil Riset Kesehatan Dasar Tahun 2018. Kementerian Kesehatan RI. 2018;53(9):1689-1699.
5. Amir N, Djokosujono K. Faktor-Faktor yang Berhubungan dengan Konsumsi Tablet Tambah Darah (TTD) pada Remaja Putri di Indonesia: Literatur Review. J Kedokt dan Kesehat.2019;15(2):119. Doi:10.24853/jkk.15.2.119-129
6. Astuti D, Kulsum U. Pola Menstruasi Dengan Terjadinya Anemia Pada Remaja Putri. J Ilmu Keperawatan dan Kebidanan. 2020;11(2). doi:10.26751/jikk.v11i2.883
7. St Umrah A, Kasrida Dahlan A. Pengaruh Konsumsi Kacang Merah Terhadap Pengobatan Anemia Pada Ibu Hamil Di Puskesmas Sendana Kota Palopo Effect of Red Beans

- 
- Consumption on Anemia Treatment of Pregnant Woman in Puskesmas Sendana Kota Palopo.2018;08(01):688-695.
8. Rochmah MM, Sofa AD, Oktaviys EE, Muflihati I, Affandi AR. Karakteristik Sifat Kimia dan Organoleptik Churros Tersubstitusi Tepung Beras dengan Tepung Ubi, Chemical Characteristic and Organoleptic ChurrosSubstituted with Rice Flour with Sweet Potato Flour. *J Pangan dan Gizi*. 2019;9(1):74. doi:10.26714/jpg.9.1.2019.74-82
  9. Mukti AB, Devi Widayanti<sup>1</sup> A, Prasastono N. Pengaruh Penggunaan Sari Buah Strawberry Terhadap Penampilan, Tekstur, Aroma, Warna Dan Rasa Sebagai Pengganti Air Mineral Dalam Pembuatan Churros. *J Pariwisata Indones*. 2021;17(1):1-10. doi:10.53691/jpi.v17i1.137
  10. Dr. Sandu Siyoto, SKM. MK. Dasar Metodologi Penelitian.;2015.
  11. Muntikah dan Razak Maryam. Bahan Ajar Gizi Ilmu Teknologi Pangan.;2017.
  12. Pudjirahaju A. Pengawasan Mutu Pangan.;2018.
  13. Gusnadi D, Taufiq R, Baharta E. Uji Organoleptik dan Daya Terima pada Produk Mousse Berbasis Tapai Singkong sebagai Komoditi UMKM si Kabupaten Bandung. *J Inov Penelit*.2021;1(12):2883-2888.
  14. Anonim. Modul Penanganan Mutu Fisis (Organoleptik). Univ Muhammadiyah Semarang. Published online 2013:31.
  15. Negara JK, Sio AK, Arifin M, Oktaviana AY, S Wihansah RR, Yusuf M. Microbiologist Aspects and Sensory (Flavor, Color, Texture, Aroma) In Two Different Presentation Soft Chesese. *J Ilmu Produksi dan Teknol Has Peternak*. 2016;4(2):286-290.
  16. Nurina Rahmawati ACI. Pengaruh Penambahan Tepung Kacang Merah Terhadap Mutu Organoleptik, Fisik, Dan Kimia Nugget Ayam Kampung. 2021;6(1).
  17. Nurhayatun Ra, Sari Fk, Pibriyanti K. Nugget Tempe Dengan Substitusi Tepung Kacang Merah Sebagai Pangan Kaya Zat Besi. *J Sagu*. 2020;19(1). doi:10.31258/sagu.v19i1.7874
  18. Pangastuti HA, Affandi DR, Ishartani D. Available online at [www.ilmupangan.fp.uns.ac.id](http://www.ilmupangan.fp.uns.ac.id). Karakteristik Sifat Fis dan Kim Tepung Kacang Merah (*Phaseolus Vulgaris L*) Dengan Beberapa Perlakuan Pendahuluan. 2013;2(1):20-29.
  19. Rahmayuni, Pato U, Johan VS, Solihin MA. Substitusi Tepung Terigu Dengan Pati Sagu Dalam Proses Pembuatan Cake. :1-13.
  20. Bambang Surahman dan Wiwen Winarti. Analisis Pengaruh Cita Rasa Terhadap Kepuasan Pelanggan. Published online 2021.
  21. Hariyadi P. Tekstur : Tantangan Reformulasi Pangan Olahan. 2022;(August).
  22. Firdanansi A. No Title. Eval Karakteristik Sensorik Cookies Yang Menggunakan Tepung Kuning Telur Pada Lama Pengocokan Yang Berbeda. Published online 2022.



23. Veronika R, Bosowa P, Sartika N, Politeknik A. Substitusi Tepung Beras Sorgum (*Sorghum Bicoar L. Moench*) Sebagai Bahan Baku Pembuatan Kue Tradisional Khas Bugis-Makassar.2023;5(1):23-37
24. Indonesia MKR. PMK Republik Indonesia Nomor 28 Tahun 2019 tentang Angka Kecukupan Gizi yang Dianjurkan untuk Masyarakat Indonesia. Published online 2019.
25. Direktorat Jenderal Kesehatan Masyarakat Direktorat Gizi Masyarakat. Tabel Komposisi Pangan Indonesia. Vol 2.;2017. doi:10.29103/averrous.v2i2.412