
January 2022

THE SECOND INTERNATIONAL CONFERENCE ON GENETIC RESOURCES AND BIOTECHNOLOGY: Harnessing Technology for Conservation and Sustainable Use of Genetic Resources for Food and Agriculture

# Committees: The Second International Conference on Genetic Resources and Biotechnology

Cite as: AIP Conference Proceedings **2462**, 010002 (2022); https://doi.org/10.1063/12.0008934
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# Preface: The Second International Conference on Genetic Resources and Biotechnology

The Second International Conference on Genetic Resources and Biotechnology, which is the continuation of the first event held in 2018, focuses on topics related to advances in biotechnology to create more opportunities for effective conservation and sustainable utilization of genetic resources for food and agriculture. This year conference's theme is Harnessing Technology for Conservation and Sustainable Use of Genetic Resources for Food and Agriculture. The conference was organized by Indonesian Agency for Agricultural Research and Development (IAARD), Ministry of Agriculture, Indonesia, in collaboration with Indonesian Biotechnology Consortium and held on 24$^{th}$-25$^{th}$ of May 2021virtually due to the pandemic of COVID-19.

The conference aims to share and exchange current scientific information and technological developments on biotechnology and their applications for conservation and sustainable use of genetic, to encourage and promote quality, efficiency, and modernization of management and utilization of genetic resources, and to facilitate national and international collaboration among participants. There are five scopes discussed in this conference. They are effective management of conservation and sustainable use of genetic resources for food and agriculture, application of genomics and molecular markers for genetic resource conservation and crop adaptation to climate change, application of innovative crop improvement techniques for conservation and sustainable use of plant genetic resources for food and agriculture, plant cell and tissue culture for conservation and effective utilization of genetic resources, and the use of microbial genetic resources as biological control agents of agricultural pests and diseases, and for soil bioremediation.

Five speakers from the United States of America, Japan, India and Indonesia were invited to discuss about their expertise and knowledge on relevant subjects in the plenary sessions. This conference was attended by more than 100 participants including 75 presenters and 44 listeners worldwide. They came from diverse governmental, private, or academic institutions and also scientific communities. The presented materials have undergone peer review processes and only qualified papers were selected. Furthermore, all papers were subjected to double blind peer-review and expected to meet the scientific criteria of significance and academic excellence to be published in a conference proceedings indexed in a well-known, reputable service.

We would like to express our sincere gratitude to our speakers, presenters and all participants for their contributions in this conference. We would also like to express our appreciation for the generosity of our sponsors that support this conference: PT CropLife, PT ITS Science Indonesia, PT Fajar Mas Murni and PT Prima Instrument Analitika. Lastly, special thanks to all committee members for their exceptional work and contributions in the conference and publication.

Chair of Organizing Committee

Dr. Toto Hadiarto

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# Physicochemical characteristics of yoghurt from various beans and cereals

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**Heny Herawati, Diana Nur Afifah, Eni Kusumaningtyas, et al.**

# Physicochemical Characteristics of Yoghurt from Various Beans and Cereals

Heny Herawati[1, a)], Diana Nur Afifah[2], Eni Kusumaningtyas[3], Sri Usmiati[1], Agus S. Soemantri[1], Miskiyah[1], Elmi Kamsiati[1] and Muchamad Bachtiar[4]

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**Abstract.** Indonesia has abundant beans and cereals as potential raw materials for yoghurt production. However, for commercialization, it should be characterized, such as physicochemical analysis. So far, yoghurt is processed from fresh milk as raw material. The purpose of this research was to analyze the physicochemical characteristics of yoghurt produced from various beans and cereals. The research was conducted using 2 microbial starters of yoghurt and 2 starters of lactic acid bacteria with raw materials, such as soybean, mung bean, sorghum, and *hanjeli*. The study was conducted using a completely randomized design with two replications. The results showed that the difference in raw materials affects the proximate characteristics of the yoghurt produced. Soybean yoghurt showed the highest viscosity and total dissolved solids of 1842.05 cP and 16.10°Brix, respectively. *Hanjeli* flour yoghurt had the highest pH value at 4.80, while mung bean yoghurt had the lowest pH at 3.90.

## INTRODUCTION

Indonesia has a great enormous local raw main based fermented product materials, that have potential to be developed into functional food. Several potential sources of beans and cereals are very prospective to be developed into alternative processed products and increase the added value products through the technology of making yoghurt.

So far, yoghurt is processed from fresh cow's milk as raw material. However, several technologies have been implemented to be able to process yoghurt from plant raw material sources such as soybean juice that contain high enough protein. Some studies reported processed yoghurt from soybean [1–7]. Some studies have added other ingredients in order to produce optimal quality [8–10]. In order to increase the functional value of the yoghurt produced, yoghurt can also be processed from mung bean [11–13] and green bean sprouts.

In addition to various beans that can be used to process yoghurt, there are raw materials from cereal sources that contain a high protein content composition, namely *hanjeli* and sorghum [14]. Other vegetable sources have also begun to be widely researched in order to produce yoghurt apart from animal milk [15]. To produce yoghurt from several sources of vegetable raw materials, the characteristics of its physicochemical qualities must also be analyzed and characterized [16], so that are acceptable to consumers, has optimal functional value, and can be further commercialized.

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In this research, several sources of raw materials and types of raw materials, such as flour and seeds, were used and their effects were characterized on both physical and chemical characteristics. The purpose of this research was to analyze the physicochemical characteristics of yoghurt produced from various beans and cereals.

## MATERIALS AND METHODS

The raw materials used to produce yoghurt include *hanjeli* obtained from Sumedang Regency, sorghum from Bogor, soybeans and mung beans obtained from the commercial market in Bogor, while other additives such as sugar and skim milk were also obtained from the commercial market in Bogor.

Yoghurt processing technology included immersion stages, mixing all dry ingredients with the addition of water, crushing using a blender, filtering, heating to boiling, temperature regulation, cooling, adding yoghurt culture and lactic acid bacteria (LAB), and conditioning until it forms yoghurt. The research was conducted using 2 microbial starters of yoghurt and 2 starters of LAB. The study was conducted using a completely randomized design with two replications.

The yoghurt obtained was then analyzed on both physical and chemical analyses. Physical analysis was carried out to the variable of color (L, a, b, C, and hue), viscosity, total dissolved solid (TDS), and pH. Meanwhile, chemical analysis included analysis of water content, ash content, fat content, protein content, carbohydrate, and energy levels.

Macro elements in the form of protein content was analyzed following the AOAC method [17], while the determination of functional characteristics (flavonoid levels and antioxidant capacity) was carried out with IC50 analysis. In addition, analysis of moisture, ash, fat, and carbohydrate content was also carried out for several samples. The results of the calculations are used for the energy analysis of the product. The analysis results obtained were analyzed using analysis of variance (ANOVA) and further tested by Duncan's test using SPSS 2.1 software.

## RESULTS AND DISCUSSIONS

The yoghurt products obtained were analyzed, both physically and chemically, in relation to the characteristics of the resulting product. Physical characteristics are very important to know the appearance and formation of yoghurt properly that affects the resulting color. The color of yoghurt is generally white, however with the use of soybeans (yellow) and mung beans, it became pale white when compared to whole milk yoghurt. Viscosity was strongly influenced the viscosity level, and pH is an indication of the acidity level due to the fermentation process.

### Physical Characteristics

The color characteristics were obtained as shown in Table 1. Based on color analysis, it shows that there are differences between flour, beans, and cereals resulting in different color qualities by indicators of L, a, b, C, and hue values. The ANOVA and Duncan's test to all treatments showed significantly different results at the 95% confidence interval (Table 1).

**TABLE 1.** Color characteristics of yoghurt sample produced from various beans and cereals.

| No. | Yoghurt sample | L | a | b | C | Hue |
|---|---|---|---|---|---|---|
| 1 | Mung bean | 77.67 b | -5.85 f | 9.62 d | 11.26 b | 121.31 a |
| 2 | Soybean | 87.85 a | 0.99 a | 11.49 a | 11.53 a | 85.05 f |
| 3 | *Hanjeli* bean | 75.91 d | -2.35 b | 10.73 b | 10.98 c | 102.54 e |
| 4 | Sorghum bean | 77.64 b | -2.95 c | 10.12 c | 10.58 d | 106.28 d |
| 5 | *Hanjeli* flour | 77.69 c | -4.28 e | 7.43 f | 8.58 f | 119.93 b |
| 6 | Sorghum flour | 79.64 b | -3.09 d | 8.19 c | 8.75 e | 110.68 c |

Numbers followed by different letters show significantly different levels of 95% confidence interval. L, a, b, C, and hue are notification of color parameters on the indicator of the chromameter tool.

The difference in color indicators is also indicated by differences in the types of raw materials, namely flour and grains. The shape of the raw material affects the color of the yoghurt produced. The highest L, a, b, and C values

were found in soybean yoghurt. While, the lowest value is found in yoghurt produced from *hanjeli* for L value and variations for other types of yoghurt.

Viscosity was analyzed to determine the thickness of the yoghurt produced, while TDS was used to determine the solid fraction of the resulting yoghurt. Meanwhile, pH is to determine the acidity level of the yoghurt, produced as a form of fermentation by the microbes used. Result of physical quality analysis in the form of viscosity, TDS, and pH was shown in Table 2.

**TABLE 2.** Viscosity, TDS, and pH of yoghurt sample produced from various beans and cereals.

| No. | Yoghurt sample | Viscocity (Cp) | TDS (°Brix) | pH |
|---|---|---|---|---|
| 1 | Mung bean | 1438.45 b | 13.40 c | 3.90 c |
| 2 | Soybean | 1842.05 a | 16.10 a | 4.06 c |
| 3 | *Hanjeli* bean | 1006.60 c | 14.90 b | 3.90 c |
| 4 | Sorghum bean | 1486.90 b | 13.40 c | 4.31 b |
| 5 | *Hanjeli* flour | 1111.50 bc | 15.10 b | 4.80 a |
| 6 | Sorghum flour | 419.00 d | 13.00 c | 4.73 a |

Numbers followed by different letters show significantly different levels of 95% confidence interval. TDS = total dissolved solid.

Statistical analysis shows that the use of types of beans and cereals and the shape of seeds and flour affects the results of the analysis of viscosity, TDS and pH, where all values are followed by different letters. The highest viscosity and total dissolved solids were soybean yoghurt (1842.05 cP and 16.10°Brix). The highest pH value was *hanjeli* flour yoghurt (4.80), while the lowest was mung bean yoghurt (3.90).

The highest viscosity is found in soy yoghurt which is in accordance with the highest TDS results. The increasing of TDS will increase the viscosity. The amount of dissolved solids will affect the viscosity of the resulting liquid. Meanwhile, the highest acidity level was seen in the samples of mung bean yoghurt, soybean, and *hanjeli*. The three yoghurts shows the same result and the lowest pH value which means its more acidic.

## Chemical Characteristics

Chemical characteristics of yoghurt, consist of moisture, ash, fat, protein, carbohydrate, and energy content analysis,. The results of the proximate analysis of the resulting yoghurt samples is shown in Table 3. Based on the proximate analysis, it was found that the results were significantly different for the parameters of moisture, ash, fat, protein, carbohydrates, and anergy content. This shows that the treatment of the types of raw materials in the form of various beans and cereals and the form of both flour and seeds affects the proximate levels of the resulting yoghurt samples.

**TABLE 3.** Proximate analysis of yoghurt sample produced from various beans and cereals.

| No. | Yoghurt sample | Moisture content (%) | Ash content (%) | Fat content (%) | Protein content (%) | Carbohydrate content (%) | Energy (ccal) |
|---|---|---|---|---|---|---|---|
| 1 | Mung bean | 82.29 d | 0.42 cd | 1.90 b | 4.03 b | 11.36 c | 78.70 b |
| 2 | Soybean | 80.10 f | 0.75 a | 2.12 a | 5.65 a | 11.38 c | 87.17 a |
| 3 | *Hanjeli* bean | 84.02 a | 0.36 d | 1.67 c | 3.27 de | 10.69 d | 70.81 d |
| 4 | Sorghum bean | 83.06 c | 0.41 cd | 0.59 f | 3.09 e | 12.86 b | 69.11 e |
| 5 | *Hanjeli* flour | 81.45 e | 0.53 b | 0.76 e | 3.59 c | 13.68 a | 75.88 c |
| 6 | Sorghum flour | 83.71 b | 0.48 c | 1.16 d | 3.34 d | 11.31 c | 69.01 e |

Numbers followed by different letters show significantly different levels of 95% confidence interval.

The highest protein content was found in soy yoghurt samples compared to other types of yoghurt. It is possible that soybeans contain a high enough protein content compared to cereals, so that the yoghurt from various beans is obtained higher protein levels than from the cereal class. This of course also affects the energy produced which is directly generated higher energy than the others.

The analysis of flavonoid levels and antioxidant capacities of the yoghurt samples was shown in Table 4. The type and form of raw material treatment does not affect the levels of flavonoids produced (Table 4). Meanwhile, antioxidant capacity were significantly different for the 95% confidence interval.

**TABLE 4.** Flavonoids and antioxidants content of yoghurt sample produced from various beans and cereals.

| No. | Yoghurt sample | Flavonoid content (ppm) | Antioxidant capacity IC50 (ppm) |
|---|---|---|---|
| 1 | Mung bean | 26.80 a | 67.01 c |
| 2 | Soybean | 37.09 a | 131.99 b |
| 3 | *Hanjeli* bean | 23.98 a | 93.27 c |
| 4 | Sorghum bean | 24.23 a | 315.01 a |
| 5 | *Hanjeli* flour | 21.51 a | 130.84 b |
| 6 | Sorghum flour | 35.89 a | 89.72 c |

Numbers followed by different letters show significantly different levels of 95% confidence interval.

There is a statistical difference for flavonoid levels and antioxidant capacity, possibly because the constituent components of antioxidants are not only from the flavonoid group, but also it is possible from other components such as polyphenols. To find out the capacity of the yoghurt in relation to other active components, it is very feasible to carry out further analysis for the various yoghurts. The largest antioxidant capacity was found in sorghum seed yoghurt at 315.01 ppm, therefore, sorghum is prospectively processed into fermented food, as yoghurt drink.

## CONCLUSION

Yoghurt produced from various beans and cereals, both in the form of flour and seeds, has different characteristics for physical and chemical qualities, except for flavonoid levels. The highest protein content was found in soy yoghurt samples compared to other types of yoghurt. Soybeans contain a high enough protein content compared to cereals so that the yoghurt from various beans is obtained higher protein levels than from the cereal class. The highest viscosity and total dissolved solids of soybean yoghurt, was 1842.05 cP and 16.10°Brix. The highest pH value was *hanjeli* flour yoghurt at 4.80 and the lowest was mung bean yoghurt at 3.90. The largest antioxidant capacity was found in sorghum seed yoghurt (315.01 ppm). Thus, sorghum is prospectively processed into functional yoghurt drink.

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