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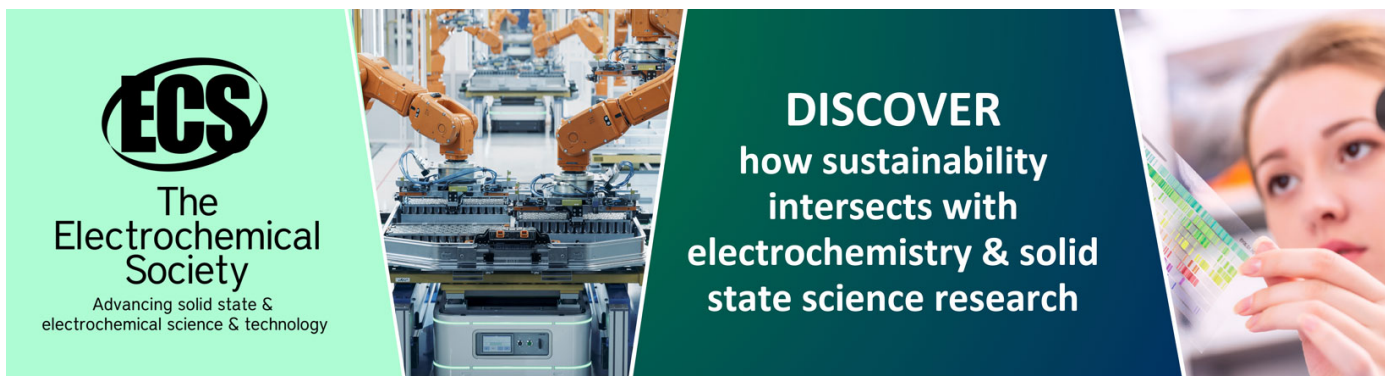
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The flavonoid levels in substituted noodles of tempe flour and carrot extract

S Maryam

Departemen of Chemistry, Faculty of Mathematic and Nartural Sciences, Universitas Pendidikan Ganesha, Bali, Indonesia

Abstract. Noodles are foods made from wheat flour, so it contain high carbohydrates, because of that it is necessary to substitute tempe flour and carrot extract, so that the noodles contain bioactive components and become functional food. The aims of study is to determine the levels of flavonoids in substituted noodles of tempe flour and carrot extract. This research is a developing research on noodle making process. There are four types of noodles made, namely standard/control noodles, and noodles made with a ratio of wheat flour : tempe flour and carrot extract are (50 : 30 : 20)/noodles 1; (50 : 25 : 25)/noodles 2 and (50 : 20 : 30)/noodles 3. The results of the three replications stated that the substitution affected the flavonoid component of noodles. There was an increase in flavonoid levels insubstituted noodles of tempe flour and carrot extract compared with control noodles. Flavonoid levels in control noodles were 2.69 mg/100 g and in noodles 1, 2 and 3 at 18.90 mg/100 gr; 16.77 mg/100 g and 21.93 mg/100 g or an increase of 7; 6.23 and 8.15 times of control noodles. Subtituted noodles of tempe flour and carrot extract are functional foods.

1. Introduction

Noodles are food that is relatively cheap, making it affordable to all levels of society. The high carbohydrate content in noodles is due to the basic ingredients of noodles in the form of wheat flour which are rich in carbohydrates, so that in the wide community noodles are often used as a substitute for rice which also has the main component of carbohydrates.^[1]

Noodles are one of the foods that are very popular with the wider community, including groups of children. The types of noodles are very diverse, but the initial stage of making noodles is the same, namely through the stirring stage of wheat flour as the basic ingredient of noodles by adding water so that it will produce evenly and loamy dough because it will form gluten, followed by printing the dough so that the dough will be thin sheets and cuts from the sheet-shaped dough so that small pieces will be produced.^[2] This small piece or raw noodle will later become the forerunner of noodles, whether it be dry noodles or wet noodles.^[3]

In the current era, where the people are busy with various kinds of activities, so it requires an effort to provide food also followed the pattern of practicality, that is easy and fast. This situation causes a condition where noodles are often used in providing family food. Noodles are used instead of rice because they are rich in carbohydrates.

The basic ingredients for making noodles are wheat flour, wheat flour with carbohydrate content of 77.3%; protein 9.6%; 12.3% fat. During this time the noodles that are usually consumed only contain macro nutrients, namely carbohydrates, proteins and fats, and very little or even do not contain other nutrients such as vitamins and minerals. So it is expected that with the addition of tempe and carrots can improve the nutrient content of wet noodles which in tempe and carrots are rich in vitamins and



minerals and also can reduce dependence on wheat flour which is imported and occupy the largest portion in making wet noodles. So that people who consider noodles as a snack, not only to fill the stomach but also increase their nutritional intake.

Tempe is one of the traditional food products that are produced from generation to generation. These foods can be made through a fermentation process from soybeans or other nuts in a certain time using *Rhizopus sp.*^[4] As an original Indonesian product since time immemorial and also in an effort to improve the nutrition of the large community, it was felt necessary to develop and promote soybean tempe widely, considering that tempe has many advantages compared to other foodstuffs, including high nutrition, antioxidant isoflavones namely genestein at 112.33 µg/gram, daizein at 723 µg/gram, and 8 hydroxy daizein at 823 µg/gram; SOD (Super Oxide Dismutase) is 1.26 µMol/gr/hour and vitamin E is 1127 IU/gram sample.^[5] Have a good taste and a relatively cheap price so that it has a great opportunity to be utilized in the framework of fulfilling family nutrition.

Another benefit of tempe are to increase the total antioxidant capacity of the blood and reduce DNA damage in wistar rats due to exposure to ultraviolet rays.^[6] Tempe can also reduce levels of MDA (Malondialdehyde) in wistar rats that are irradiated with ultraviolet light by 47,453%.^[7] Besides that tempe can also reduce SGOT and SGPT levels of liver of mice that experience oxidative stress by 17%.^[8] As a result there is no doubt that tempe is one of the functional foods, namely foods that, if eaten or consumed, not only fill but can also improve the health.^[9,10,11]

Tempe flour is a product of tempe. This flour is made by cutting tempe into thin portions and drying it at a temperature of 60°C for 8 hours. After drying, the tempe is smoothed to 250 mesh. This product is tempe flour which will then be used as a substitute in the process of making noodles. Tempe flour is a food ingredient that contains high protein and antioxidants, which is a component that if consumed will have a positive impact on the health of the human body, because it can reduce free radicals in the human body.^[12]

The use of tempe flour which is a mixture in making noodles can improve the nutritional value of the noodles themselves because tempe contains antioxidants so that ultimately is a functional noodle.^[1] Likewise, the provision of more varied food consumption for the wide community and encourage diversification of community food and fulfillment of nutritional needs and produce noodles with added value in the form of functional food, caused by the presence of antioxidant components found in tempe as an additional ingredient when making noodles.

The use of tempe flour in the process of making noodles will have a positive impact on the resulting noodle products, which will produce noodles with a slightly yellow color compared to the noodles from wheat flour only.

Carrots are vegetables that are orange in color and are rich in beta carotene. This compound is an active substance which is currently widely used as an antioxidant. An active component that can reduce oxidants. The presence of oxidants in the human body will have a negative impact that is damaging the body's cells and will ultimately have an impact on cell death and changes in cell function.^[13]

The addition of tempe flour and carrots in the process of making noodles will have a positive impact, which is caused by the addition of nutritional components and also antioxidants which in the end the addition of these two ingredients in the process of making noodles will produce a condition that will increase the nutrition value from noodles and will also have a positive impact on the sale value of noodles because of the public's attention to the use of food ingredients which are dual functions, namely food that is filling and can also be a media towards the formation of body health.^[14]

The flavonoid components found in tempe and also in carrot extract added when making noodles can cause flavonoids in noodles. The further impact of the addition of tempe flour and carrot extract is the production of quality noodles, which are caused by the presence of antioxidants in noodles. Continued consumption will cause functional food to be produced.

2. Method

The design of the study refers to the development of making dry substituted noodles with various tempe flour and carrots. Formulation between wheat flour : tempe flour : carrot extract is for control noodles/only flour; Mie II (50:30:20); Mie III (50:25:25) and Mie IV (50:20:30). The study was carried out with three replications.

2.1. Materials and tools

The ingredients used include noodle flour, methanol, butanol, acetic acid, HCl, distilled water, whatman paper no. 1, and ammonia. While the tools used include oven, porcelain mortar, dry blender, analytical balance sheet, centrifuge, ependorf tube, chromatographic vessel, UV lamp (300 nm), hair dryer, thermometer, glass tool, hot plate, magnetic stirrer, and micro pipette.

2.2. Fractionation of flavonoid compounds

Fractionation was carried out using a two-way paper chromatography technique. Extraction extracts were tried as much as 30, 40 and 50 μ l on whatman paper no. 1 and dried using a hair dryer. After drying the sample plate is then developed with an eluent that suitable for flavonoid analysis. Eluents used include BAA (Butanol : Acetic acid : Aquades = 4:1:5) and Acetic acid 15%. The resulting noodle flour is then macerated with ethanol 70% 1: 5, heat for 10 minutes. The resulting extract is then filtered using filter paper

2.3. The process of making noodles

There are four kinds of noodles that made, including: Noodle I (standard), made from 100% wheat flour (without the addition of tempe flour and carrot extract); Mie II (made from wheat flour : tempe : carrot with a ratio of 50:30:20); Mie III (made from wheat flour : tempe : carrot in a ratio of 50:25:25) and Mie IV (made from wheat flour : tempe : carrots in a ratio of 50:20:30).

These four kinds of noodles are made with the following stages:

1. Wheat flour, tapioca, tempe flour and carrot extract (according to the type of noodles) are stirred together, so the flour becomes homogeneous.
2. Add the eggs, coconut oil, salt and water, put it in the flour mixture, then knead it to clay.
3. After clay, thin sheets are made using noodle molds.
4. Followed by making small pieces and cut it
5. Molded into small noodles
6. Dried in the sun
7. The dried noodles are blended to form noodle powder

3. Result and Discussion

From the research, it was found that flavonoid levels in dry noodles were substituted with tempe flour and carrot extract three times as follows:

Table 1. The flavonoid levels in substituted noodles of tempe flour and carrot extract

No	Types of Noodle	Flavonoid Level (mg/100 gr QE)
1	Noodle 1	2,69
2	Noodle 2	18,90
3	Noodle 3	16,77
4	Noodle 4	21,93

Flavonoid levels in various noodles can be displayed as shown below:

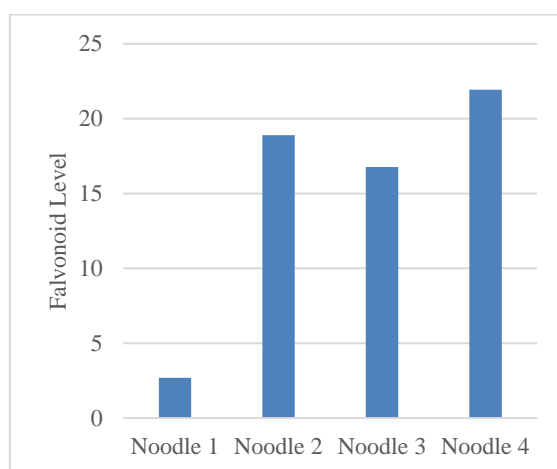


Figure 1. The flavonoid levels in substituted noodles of tempe flour and carrot extract.

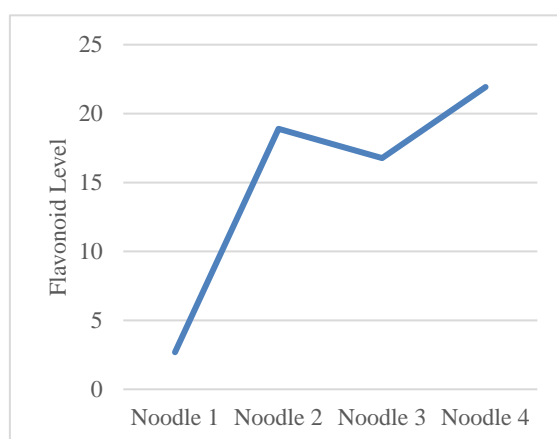


Figure 2. Increased levels of flavonoid in substituted noodles of tempe flour and carrot extract

Flavonoids are derivatives of phenols. In general, flavonoids are organic compounds consisting of 15 carbon atoms with two aromatic rings connected by three carbons that can form a third ring. The hydroxyl group found in flavonoids is the place where various sugars can stick to which can increase the solubility of flavonoids in water

Flavonoids are synthesized by the same precursor (phenylalanine, which is an aromatic amino acid) through a typical cyclic acid biosynthesis pathway found only in plants.

In this study, obtained levels of flavonoids in substituted noodles of tempe flour and carrot flour, seen more the amount of carrot extract that used (Noodles 2, 3 and 4) then the levels of flavonoids will also be higher. In this study obtained flavonoid levels in Noodles 1 (standard), Noodles 2, Noodles 3 and Noodles 4 in a row at 2.69 mg/100 g; 18.90 mg/100 gr; 16.77 mg/100 g and 21.93 mg/100 g. Increased flavonoid levels are caused by the addition of more carrot extracts. From this data can be explained that, the increase in flavonoid levels of 7, 6.23 and 8.15 times the standard noodles (without tempe and carrots).

Carrots are vegetables that contain antioxidant compounds in the form of flavonoids in addition to beta carotene. The higher the level of beta carotene, the more red the color will be.

4. Conclusion

From the research conducted, it can be concluded that:

1. The addition of tempe flour and carrot extract will increase the levels of flavonoids in noodles
2. The more carrot extract is added, the flavonoid levels will also increase.

5. Suggestion

Based on the results of the research, it is recommended to examine the levels of other antioxidants available and the antioxidant capacity and IC₅₀ in the substitution noodles of tempe flour and carrot extract.

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