Identification of Purine Content in Various Processed Foods of Chicken as Specialty Food of West Sumatra

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Abstract. The specialty food of West Sumatra generally contains high protein. Mostly high-protein foods also contain high purine. Consuming high purine foods will have an impact on the emergence of Hyperuricemia. The aim of this study was to examine the purine content of various foods made from chicken as specialty food of West Sumatra. Food samples were obtained from several restaurants in the city of Padang based on consideration of community choices. Food samples were obtained from several restaurants in Padang City. Purine contents were determined by using HPLC (High Performance Liquid Chromatography) method. The results showed that the type of processed food made from chicken as specialty food of West Sumatra affects the levels of purines.

1. Introduction
Purine is a molecule found in cells in the form of nucleotides. The best known nucleotides are purine and pyrimidine as monomeric precursors of ribonucleic acid (RNA) and deoxyribonucleic acid (DNA). Purine compounds consist of adenine and guanine. Whereas hypoxanthine and xanthine are purine-derived natural compounds which are rarely found as bases in DNA and RNA, but often act as important intermediates in the process of breaking down nucleotides [1,2].

According to Ref. [3], purines in food are the main constituents of nucleic acids, nucleotides and free bases. The final product of purine metabolism is gout and increased levels of uric acid in blood serum causing gout or hyperuricemia [4]. The accumulation of uric acid crystals (monosodium crystal urate) with soft tissue in the body causes inflammatory pain in arthritis. Gout can also lead to complications of diabetes and cardiovascular disease, where these diseases have increased and evenly distributed throughout the world lately [5].

West Sumatra is one area that has a variety of specialty foods. Specialty foods of West Sumatra in general contain high protein. One of specialty food of West Sumatera is processed foods made from chicken. Chicken is the most widely consumed type of poultry. Based on the Indonesian Food Composition Table [6] chicken meat has a high protein content compared to other animal meat which is 18.2g / 100g of material. High protein foods in particular have high purine content.

Gout can be controlled by limiting the amount of consuming purine, it is important to have an understanding of which foods have higher purine content. The purpose of this study was to identify the purine content (adenine, guanine, hypoxanthine and xanthine) in various types of processed foods made from chicken as specialty food of West Sumatra using HPLC. The purine yield is calculated based on the weight consumed (mg / 100g of material).

2. Materials and methods
Various processed foods made from chicken are obtained from restaurants in the city of Padang. Purines standard, Adenine A 8626, Guanine G 11950, Hipoxhantine H 9377, Xanthine X 4002 and Ammonium
hydroxide obtained from Sigma-Aldrich (St. Louis, MO, USA), aquabidest, perchloric acid 25% obtained from PT.Smart-Lab Indonesia.

2.1. Sample preparation
The food to be analysed is crushed first then freeze dried, the fat is extracted with hexane and dried. This dry, fat-free material is mashed up and ready for further analysis.

2.2. Purine extraction and separation
The purine contents were determined by high performance liquid chromatography (Shimadzu, Tokyo, Japan) according to the method of Brulé, D., et al [7], with some modifications. A total of 100 mg of the sample was hydrolysed with 4 ml of 11.6 N HClO4 at 105°C for 6 hours. The hydrolyzed sample was then neutralized with 25% NH4OH. The solution was transferred to a 50 mL volumetric flask and then adjusted with aquadest. Samples were filtered using 0.45 μm millipore paper.

Standard solutions of the purine and pyrimidine bases (Sigma Chemical Co.) were prepared in a solution of 1.2 N perchloric acid (adjusted to pH 4.0) at a final concentration of each base of 20 mg/liter. The bases were separated isocratically using a HPLC system with a reverse-phase Waters C-18 column. The mobile phase consisted of potassium phosphate buffer (KH2PO4) 0.1 M adjusted to pH 4.0 with phosphoric acid. The flow rate was 1.0 ml/min and the bases were detected by their absorbance at 254 nm.

3. Results and discussion
3.1. Water content
Water is an important component in food. All food ingredients contain water in different amounts - both animal and vegetable foods. Water content is the amount of water contained in a material expressed in percent. Determination of water content is the most important and most extensive analysis carried out in food processing and testing. Water content directly affects the stability and quality of food. The results of water content analysis can be seen in Table 1.

Table 1. Average value of water content in a variety of processed foods made from chicken as specialty food of West Sumatra.

| Sample            | Water content (%) ± SD |
|-------------------|------------------------|
| Raw chicken meat  | 70.34 ± 0.44           |
| Chicken rendang   | 43.23 ± 0.97           |
| Chicken curry     | 71.37 ± 0.65           |
| Chicken grilled   | 59.50 ± 0.42           |
| Chicken balado    | 45.68 ± 0.59           |
| Chicken seasoned  | 55.32 ± 0.15           |
| Chicken pop       | 67.78 ± 0.67           |

Chicken curry contains the highest water content when compared with the others that is equal to 71.37%. The lowest water content contained in chicken rendang is 43.23% (Table 1). Based on the results of the study, the water content of chicken rendang, chicken grilled, chicken balado, chicken seasoned and chicken pop decreased when compared with raw chicken meat. Percentage change of water content analysis can be seen in Table 2. Chicken curry contains the highest water content when compared with the others that is equal to 71.37%. The lowest water content contained in chicken rendang is 43.23% (Table 1).

Based on the results of the study, the water content of chicken rendang, chicken grilled, chicken balado, chicken seasoned and chicken pop decreased when compared with raw chicken meat. Percentage change of water content analysis can be seen in Table 2.
Table 2. Average value of water content in a variety of processed foods made from chicken as specialty food of West Sumatra

| Sample          | Percentage changes (%) |
|-----------------|------------------------|
| Chicken rendang | 38.54                  |
| Chicken grilled | 15.41                  |
| Chicken balado  | 35.06                  |
| Chicken seasoned| 21.35                  |
| Chicken pop     | 3.64                   |

The decrease of water content in chicken rendang was 38.54%, in chicken grilled was 15.41%, in chicken balado was 35.06%, in chicken seasoned was 21.35% and in chicken pop was 3.64%. Factors that influence the determination of the water content of a food ingredient are storing material, free water and bound water, wet and dry base water content, water activity, relative humidity and absolute humidity as well as the physical properties of the material.

Moist heat methods and dry heat methods when cooking a chicken have a similar effect on purine levels with increasing adenine and guanine slightly and with decreasing hypoxanthine in cooked products compared to their raw counterparts [8,9].

3.2. Purine content

The results of the analysis of purine base content in the various processed foods made from chicken as specialty food of West Sumatra shown in Table 3.

Table 3. Purine content in various type of processed foods made from chicken as specialty food of West Sumatra

| Sample           | Adenine          | Guanine | Xanthine | Hipoxanthine | Total     |
|------------------|------------------|---------|----------|--------------|-----------|
| Raw chicken meat | 74.11 ± 20.69    | -       | -        | 508.23 ± 90.61| 582.35    |
| Chicken rendang  | 50.67 ± 0.29     | -       | -        | 276.67 ± 4.91 | 327.33    |
| Chicken curry    | 158.17 ± 11.56   | 57.26 ± 15.84 | -    | 215.42      |
| Chicken grilled  | 92.17 ± 2.93     | -       | -        | -            | 92.17     |
| Chicken balado  | 43.11 ± 4.22     | -       | -        | 337.06 ± 25.09 | 380.17    |
| Chicken seasoned| 40.59 ± 2.72     | -       | -        | 378.21 ± 33.89 | 418.8     |
| Chicken pop      | 45.40 ± 7.16     | -       | -        | 317.05 ± 71.76 | 362.45    |

Reverse phase high pressure liquid chromatography (HPLC) has proven to be very efficient for analyzing nucleic acids [10], and has been commonly used to separate and measure purine bases [11]. To measure the amount of purines present, the peak area of the sample is compared to the peak area of a standard solution whose concentration is known, so that the amount of purine present in the sample can be measured.

Based on the Diet Guide, RSCM Nutrition Installation and the Indonesian Dietesien Association in 2011 [10], the purine content of foodstuffs can be divided into three groups: group 1: high purine containing 100-1000 mg of purine in 100 g of material; group 2, medium purines containing 9-100 mg of purine in 100 g of the ingredient; group 3, low purines.

Purine content in most types of processed foods made from chicken have a high purine content except chicken grilled which has a medium purine containing of 92.17 mg / 100g of material. Based on the results of the study, purine content of chicken rendang, chicken curry, chicken grilled, chicken balado, chicken seasoned and chicken pop decreased when compared to the purine levels of raw chicken meat. Percentage changes of purine content in processed foods made from chicken and can be seen in Table 4.
Table 4. Percentage change of purine content in processed food made from chicken as specialty food of West Sumatra

| Sample            | Percentage change (%) |
|-------------------|-----------------------|
| Chicken rendang   | 43.79                 |
| Chicken curry     | 63.01                 |
| Chicken grilled   | 84.17                 |
| Chicken balado    | 34.72                 |
| Chicken seasoned  | 28.08                 |
| Chicken pop       | 37.76                 |

Decrease in purine content in chicken rendang by 43.79%. in chicken curry 63.01%. in chicken grilled 84.17%. in chicken balado 34.72%. in chicken seasoned 28.08% and in pop chickens by 37.76%. The decrease is probably caused by differences in the type of processing and cooking spices used in the sample. Processing methods, such as boiling, fermenting and frying can reduce the purine content of food [13].

Based on data from the results of this research, most of the guanine and xanthine bases in the sample are difficult to detect. According to the Pratiwi [2], guanine and xanthine bases cannot dissolve in the mobile phase which has a pH of 4 whereas in this study using a mobile phase with a pH of 4.8 so that the levels of guanine and xanthine are difficult to be detected.

Research has shown that each purine base has a different uricogenic effect. Adenine and hypoxanthine are known to have more impact on the accumulation of uric acid in the body than the other two types of purine bases [14]. Nevertheless, while knowing the total purine content of foods is very beneficial, it is also helpful to know the levels of individual purine bases in foods so those with higher adenine and hypoxanthine can be avoided as much as possible [15,16].

Consumption of foods containing >200mg / 100g of purine, especially with a high hypoxanthine ratio is considered to be at high risk for hyperuricemia [4]. In the body, purine turnover occurs continuously along with the synthesis and breakdown of RNA and DNA, so that even though there is no intake of purines, uric acid is still formed in substantial amounts.

4. Conclusion

Based on the research, it can be concluded that there was a change in water content and purine content between raw chicken meat and processed foods made from chicken as specialty food of West Sumatra. Most processed foods made from chicken are high purine food categories. Foods that contain high purine levels should be avoided or reduced by hyperuricemia sufferers.

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