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Evaluation of Yields and Chemical Composition of Unhairing Concentrate (UC) from Cowhide Unhairing Waste (CUW) Produced Using Different Process Methods

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Abstract

Unhairing concentrate (UC) is one of the processed products from cowhide unhairing waste (CUW) which can be done through hydrolysis and fermentation processes. UC has the potential to be used as a protein source. CUW is obtained from the cowhide cracker processing industry (CCPI) process. The CUW processing method affects the yields and chemical composition of UC products. This study aims to evaluate the yields and chemical composition of UC products produced from CUW through the application of different process methods. A total of 5 treatments were applied in this study, namely: A_0 = control; A_1 = CUW + F-Bs ; A_2 = CUW + CP + F-Bs; A_3 = CUW + I-NaOH + F-Bs +; A_4 = CUW + CP + I-NaOH + F-Bs, where CUW = Cowhide Unhairing Waste; F-Bs = Fermentation using Bacillus subtilis FNCC 0060; CP = Cooking Pressure using 21 Psi for 10 hours; I-NaOH = Immersion in NaOH 5% solution (1.25 M). The research design used CRD, 5 treatments with 3 repetitions. The final result shows that the yields value of UC is influenced by different processing methods. The difference in the process lowers the yield. Differences in the processing process at CUW can reduce fiber content and water content in UC products. UC products produced from CUW have the potential to be developed as substitute feed ingredients, especially for poultry. The A_3 treatment gave better results than other treatments based on the results of both quantitative and qualitative studies.

Keywords: Unhairing Concentrate; Cowhide Unhairing Waste; Method Process; Yields; Chemical Composition.

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1. Introduction

The production of livestock waste and by-products has increased significantly every year. One of the by-products produced from the slaughterhouse is cowhide. The hide is an intermediate product that can be further processed into a snack product in the form of hide crackers. The cowhide cracker processing industry (CCPI) is one of the industrial business units that has developed, especially in Indonesia. In the production process, this business produces waste in the form of cowhide unhairing waste (CUW). Most of the unhairing waste produced still contains hide tissue (epidermal layer) and remains of meat. Until now, this waste has not been utilized and most of it is still disposed of around industrial areas. The results of the initial study show that the potential for CUW from the CCPI is quite significant. The percentage of unharing waste from an animal can reach 3% of body weight [1]. Every day, this industry processes 10 pieces of cowhide with an average live weight of 250 kg. Based on this value, the potential for unhairing waste produced reaches 10 x 250 kg x 3% = 75 kg/day or 2,250 kg/month or ≈ 2.3 tons/month. The huge potential of CUW is a threat to the environment and the people living around the industrial area. Therefore, solutions and efforts are needed to utilize the CUW optimally. The CUW can be processed into a product that has economic value and is environmentally friendly at the same time. Based on its chemical composition, CUW can be used as a source of protein in animal feed. Efforts to utilize by-products from the livestock industry are growing rapidly. The feather/hair organ in livestock is in the epidermal structure with an amount of about 6% of the live weight of livestock. Feathers basically have a very complex structure in vertebrate animals. Structurally, feathers are formed as a result of a controlled breeding process. The breeding in question comes from the activity of biological cells of the epidermal tissue or the outermost layer of the body [2]. Based on its composition, hair/feathers have a high protein content. Protein from hair/ feathers is a protein of the fibrous type in the form of keratin. This protein is dominated by disulfide bonds in its amino acid chain. Its amino acid composition is dominated by the amino acid cysteine. As a result, the type of protein keratin has a very low digestibility. Feather applications that have not undergone processing have very low nutritional value [3]. Based on the results of the study, it is certainly necessary to make efforts to maximize the level of digestibility. Efforts that can be made are to process CUW into unhairing concentrate (UC). The process that can be applied is to combine the hydrolysis process with fermentation. The result of a production process is related to the process method used to produce the product [4]. This study aims to evaluate the yields value and chemical composition of UC products from CUW through the application of different production process methods.

2. Materials and Methods

2.1. Materials

This study uses raw materials from cowhide unhairing waste (CUW). The CUW were obtained from the Tamangapa Slaughterhouse, Antang, Makassar, Indonesia. The CUW was waste from cowhide cracker processing industry (CCPI) in the area of the Tamangapa Slaughterhouse. The fermenter used the bacterium *Bacillus subtillis FNCC 0060* from the Center for Food and Nutrition Studies, Gajah Mada University, Yogyakarta, Indonesia. The research supporting material was NaOH 5% (1.25 M) from the Animal Feed Chemistry Laboratory, Faculty of Animal Science, Hasanuddin University, Makassar, Indonesia.

2.2. Research methods

2.2.1. Research design

The study was carried out using a completely randomized design (CRD) with a unidirectional pattern. A total of 5 treatments with 3 replications were applied in this study. The research treatments consisted of A_0 = CUW sample without treatment (control); A_1 = CUW + F-Bs ; A_2 = CUW + CP + F-Bs; A_3 = CUW + I-NaOH + F-Bs +; A_4 = CUW + CP + I-NaOH + F-Bs, where CUW = Cowhide Unhairing Waste; F-Bs = Fermentation using *Bacillus subtilis FNCC 0060*; CP = Cooking Pressure using 21 Psi for 10 hours; I-NaOH = Immersion in NaOH 5% solution (1.25 M).

2.2.2. Pre-processing of CUW

First of all, the cowhide washed with running water for 10 minutes. The cowhide cooked at 80^{o}C for 15 minutes while stirring. The epidermis of the cowhide was removed using a modified tool made of serrated iron. The epidermis that has been separated from cowhide produced by CUW products as research samples. The CUW samples then washed thoroughly using running water for 5 minutes. The CUW samples then dried using an oven at 40^{o}C for 48 hours. The dried CUW was then used as a research sample.

2.2.3. Research implementation

The treatment in this research was to combine the hydrolysis process with the fermentation process. The fermentation stage uses *Bacillus subtilis* FNCC 0060 as a fermenter (F-Bs) while the hydrolysis stage carried out physically using cooking pressure (CP) process on the 21 Psi for 10 hours and immersion in 5% NaOH solution (1.25 M) (I-NaOH). A total of four sterile bottles prepared for the implementation of four types of treatment (A_1, A_2, A_3 and A_4), while the A_0 treatment (control) was not put into the sample bottle and sample immediately tested. Each bottle was filled with 50 g of CUW sample. In treatment (A_1), the sample were inoculated with the bacterial isolate *Bacillus subtilis FNCC 0060* (F-Bs). Treatment A_2, CUW samples cooked with a cooking pressure of 21 Psi for 10 hours (CP). Furthermore, it was inoculated with the bacterial isolate *Bacillus subtilis FNCC 0060* (F-Bs). In treatment A_3, CUW samples were immersed in 5% NaOH solution (1.25 M) for 48 hours (I-NaOH). The next step, was to inoculate with the bacterial isolate *Bacillus subtilis FNCC 0060* (F-Bs). Treatment A_4, CUW samples were cooked with a cooking pressure of 21 Psi for 10 hours (CP). The CUW sample was then immersed in 5% NaOH solution (1.25 M) for 48 hours (I-NaOH). Furthermore, *Bacillus subtilis FNCC 0060* (F-Bs) bacteria were inoculated on CUW samples. All bottles (four treatment) containing samples fermented for 21 days at room temperature.

2.2.4. Parameters and data analysis

Several parameters observed in the study: 1) yields value; 2 water content and 3) fiber content. ANOVA used as a tool for data analysis of research results. The results of the test showed a significant effect were then further tested with Duncan's Multiple Range Test (DMRT) [5].

3. Results and Discussion

3.1. Yields

Yields in principle were the amount of reaction product resulting from a chemical reaction [6]. Yields were very important to predict the amount of product that can be harvested from a number of processed raw materials. The yields also related to the efficiency value of a production process. The higher yields indicates that the production process will be more efficient. According to [7] that the yields influenced by the on-going process. Larger results indicate that the production process becomes more efficient. The results of the comparison of UC yields values produced from CUW using several different process methods presented in Figure 1.

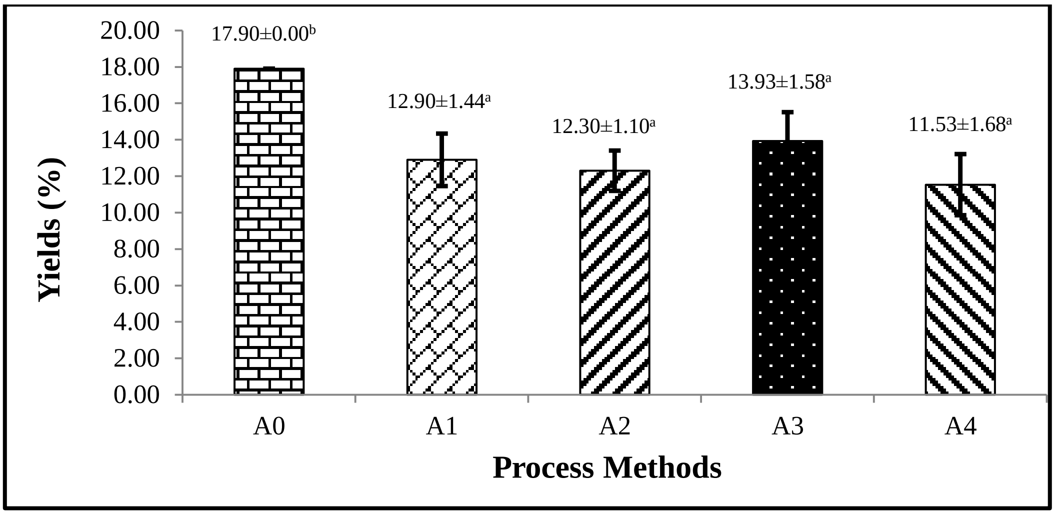

Figure 1: comparison of the yields (%) value of unhairing concentrate (UC) from cattle unhairing waste (CUW) processed using different process methods; ^{a,b} Different superscripts in each treatment showed significant differences (p<0.05); A_0=CUW sample without treatment (control); A_1=CUW+F-Bs; A_2=CUW+CP+F-Bs; A_3=CUW+I-NaOH+F-Bs; A_4=CUW+CP+I-NaOH+F-Bs, where CUW= Cattle Unhairing Waste; F-Bs=Fermentation using *Bacillus subtilis FNCC 0060*; CP = Cooking Pressure using 21 Psi for 10 hours; I-NaOH=Immersion in 5% NaOH solution (1.25 M)

Based on the results of ANOVA (Figure 1), it was shown that the difference in the process method had a significant effect p<0.05) on the yields value of UC. Based on the data, it can be seen that the process method causes a decrease in the yield value. The yield value for untreated CUW (A_0) (control) was 17.90% higher than the other treatments (A_1, A_2, A_3 and A4). The yield value from other treatments was in the range of 11.53-13.93%. This can be caused because the process method will affect the structure of the constituent proteins in CUW. The yield value shows the amount of extract product obtained after the extraction process is carried out [8]. The amount of yield obtained is influenced by the extraction process carried out [9].

3.2. Water content

The availability of water in a material is a very important factor and affects the fermentation process. Feed quality related to the amount of water in the material. Water content determines the shelf life of feed ingredients so special attention is needed. The water content values of UC produced using different process methods are completely presented in Figure 2.

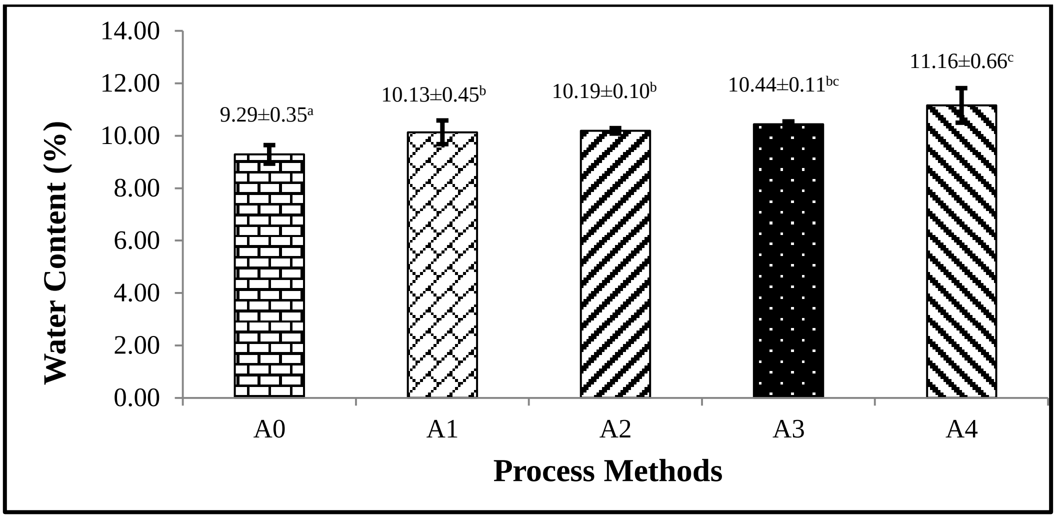

Figure 2: comparison of the water content (%) value of unhairing concentrate (UC) from cattle unhairing waste (CUW) processed using different process methods; [a,b,c] Different superscripts in each treatment showed significant differences (p<0.05); A_0=CUW sample without treatment (control); A_1=CUW+F-Bs; A_2=CUW+CP+F-Bs; A_3=CUW+I-NaOH+F-Bs; A_4=CUW+CP+I-NaOH+F-Bs, where CUW= Cattle Unhairing Waste; F-Bs=Fermentation using *Bacillus subtilis FNCC 0060*; CP = Cooking Pressure using 21 Psi for 10 hours; I-NaOH=Immersion in 5% NaOH solution (1.25 M)

Based on the data (Figure 2), it shows that the difference in the process method in the CUW processing has a very significant effect (p<0,01) on the value of the water content of the UC product. Based on the data, it can be seen that the process methods (hydrolysis and fermentation) (A_1, A_2, A_3 and A_4) significantly increased the water content of the UC product compared to the control treatment (A_0) (29%), while the application of process methods (A_1, A_2, A_3 and A_4) were 10.13%; 10.19%; 10.44% and 11.16% respectively. In the distribution process and animal feed business, the water content in a feed will greatly affect the quality. This quality is related to the storage process [10]. Feed ingredients that have a water content that is too high have the potential to be a good medium for the growth of microorganisms. When compared with UC water content with other feather concentrate products, the water content value is still lower (12.33%) [11].

3.3. Fiber content

The level of digestibility and absorption of feed ingredients, especially in poultry feed, is influenced by the value of fiber content. Poultry that have a single stomach have limitations in digesting a feed ingredient. UC products are one of the types of feed ingredients that have the potential to be used as poultry feed ingredients. The treatment of the process method affects the fiber content of UC products. Comparison of the value of fiber content of UC from each process method in full was presented in Figure 3. The results of ANOVA on the data (Figure 3) showed that the different processing methods applied to CUW had a significant effect (p<0.05) on the fiber content of UC products. It can be seen in Figure 3 that the process method treatment significantly reduced the fiber content in UC to below 1%. In the control treatment (A_0), the fiber content of UC obtained a value of 1.44%, but in the application of the process method (A_1, A_2, A_3 and A_4), the value of the fiber content can be reduced by their respective values (0.80%; 1.08%; 0.48% and 1.04%). These results indicate that the application of the process method in the CUW processing turned out to have a very significant effect in improving the quality of UC products. This value is even below the fiber content of chicken feather waste from the research of [11] which is 2.15%. The results of this fiber content test are still general in nature and cannot fully explain the condition of the specific fiber type. Fibers that are difficult to digest are known as neutral detergent fiber (NDF) and acid detergent fiber (ADF). ADF and NDF are a group of fibers that are difficult to digest, however, these fibers have a direct influence on the digestive process of livestock [12]. Fiber that is difficult to digest is actually mostly derived from plants, including in the form of cellulose, cellulose and lignin [13].

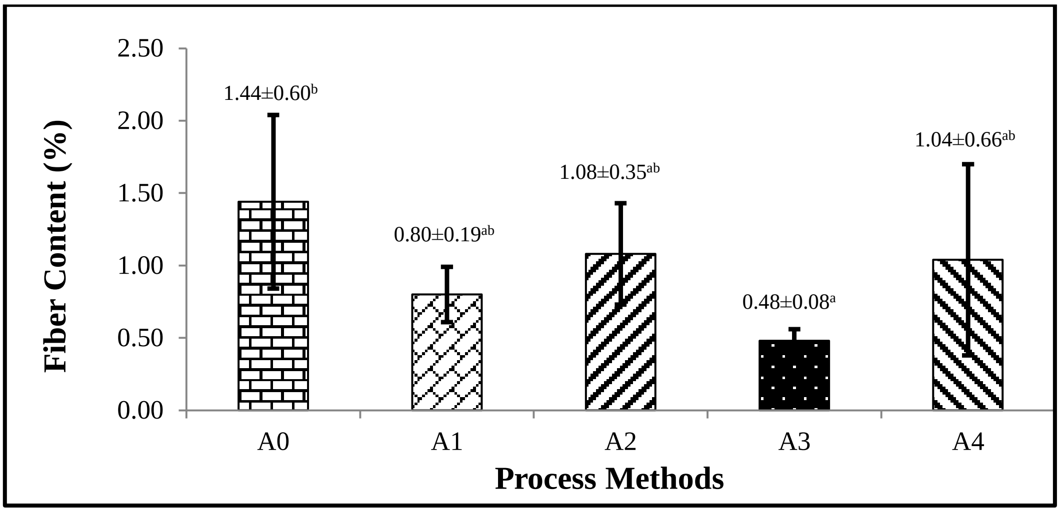

Figure 3: comparison of the fiber content (%) value of unhairing concentrate (UC) from cattle unhairing waste (CUW) processed using different process methods; [a,b] Different superscripts in each treatment showed significant differences (p<0.05); A_0=CUW sample without treatment (control); A_1=CUW+F-Bs; A_2=CUW+CP+F-Bs; A_3=CUW+I-NaOH+F-Bs; A_4=CUW+CP+I-NaOH+F-Bs, where CUW= Cattle Unhairing Waste; F-Bs=Fermentation using *Bacillus subtilis FNCC 0060*; CP = Cooking Pressure using 21 Psi for 10 hours; I-NaOH=Immersion in 5% NaOH solution (1.25 M)

4. Conclusion

The difference in the CUW processing method reduces the yield value of UC products by (11.53-13.93%) compared to without the process method (control) (17.93%). Likewise, the fiber content of UC also significantly decreased to the level (0.48-1.08%). On the other hand, the application of the processing method increases the water content of UC products to the level of 9.29-11.16%. UC products have the potential to be used as raw material for poultry feed in substituting feed ingredients for other protein sources. Based on the quantity assessment, the A_3 treatment gave better results than other treatments without reducing the quality based on its chemical composition.

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