Original Research Article

The Development Goat Patties using Red Onion Peel *(Allium cepa L.)* Powder as Fiber Agent

ABSTRACT

Aims: The purpose of this study is to determine, based on carbohydrate, fat, fiber, protein, color analysis, and total microorganisms, the best percentage of red onion peel powder to add to goat patties.
Study design: Laboratory research using a Completely Randomized Design (CRD).
Place and Duration of Study: This research was located in the Meat Processing Division, Faculty of Animal Husbandry, Brawijaya University, Malang. The research was conducted for 2 months.
Methodology: This study used 4 treatments and 6 replications. The treatments used were the addition of red onion skin powder as a control (T0), 2% (T1), 4% (T2) and 6% (T3).
Results : Goat patties treated differently by adding red onion peel powder had a very significant impact ($P<0.01$) on carbohydrate, fat, fiber, protein, color analysis and total microbial count. The levels of carbohydrate, fat, fiber, protein and color L, a, b* increased, while the total microorganisms decreased.
Conclusion: Red onion peel powder can be used as a natural fiber agent in goat patties. The best carbohydrate content, fat content, fiber content, protein content, color analysis and total microorganisms are found in the addition of 6% onion skin powder.

Keywords: Goat meat, patties, red onion peel, resctructured meat.

1. INTRODUCTION

The increase in market demand for goat meat is due to one type of red meat that has many advantages. Red meat, encompassing beef, pork, and mutton, is recognized as a nutritious food option and a tasty choice because of its rich protein levels and the essential amino acids that the body requires. Goat meat is lower saturated fat and cholesterol content and higher polyunsaturated fat content compared to beef or lamb gives it an advantage over other red meats. Goat meat has the potential to increase goat consumption in Indonesia because goats have high nutrients such as 78.38% water content, 19.30% protein, 1.90% fat and 1.28% ash content (Luasiri, et al., 2024). The disadvantages of goat meat are that it has a tough texture and an unpleasant odor. The solution that can be done to improve the quality of goat meat is to use restructured meat technology.

Using relatively small and irregular pieces of meat to create a product that resembles whole meat is the basic principle of restructured meat. Restructured meat aims to create meat products that have a taste, texture and appearance similar to real meat, and use cheaper ingredients to increase the added value of meat. An example of a restructured meat product is patties. Patties is one of the types of food that is very popular with a variety of different groups. The demand for food safety from the community is increasing so that processing related to dietary fiber content needs to be considered. The weakness of patty products on the market is the lack of fiber content. Previous studies have shown that the addition of fiber from natural ingredients can improve the quality of patties, including patties with the addition of date fruit fiber (Rasul, et al., 2024) and patties with the addition of purple eggplant flour (Bunmee, et al., 2022). An additional natural fiber ingredient that has never been used is red onion peel powder.

Red onion peel powder is an example of a natural fiber agent that can be used to help maintain digestive health. Red onion peel *(Allium cepa L.)* normally considered to be a waste product. Using the red onion peel as a fiber agent in patties not only increases the nutritional value of the product but can also help reduce agricultural waste. Although onion skin is classified as waste, this material has high nutritional content and value such as 1-3% protein, 0.5-1% fat, 7-10% water, 4-6% ash and 50-60% crude fiber (Muzhahir, et al., 2023). Onion peel contains isolated phenolic compounds and quercetin in concentrations 3-5 times higher and has an anti-fibrous activity also 3-5 times higher than the edible part of the onion. Previous research have stated that the addition of onion skin powder waste to patties has bioactive properties as anticancer, antioxidant and antimicrobial (Chadorshabi, et al., 2022). The objectives of this research are to obtain the best percentage of addition of red onion skin powder to dough, in terms of physicochemical properties and total microbial count.

2. MATERIAL AND METHODS

2.1 Materials

The following materials were used goat meat, the thigh part of the goat obtained from the Dr. Goat Farm, Batu City, tapioca flour, onions, garlic, egg white, pepper, and salt obtained from the Traditional Market, Malang City.

2.2 Methods

These studies were conducted in a lab using a completely randomized design (CRD) of four treatments and six replications. The treatments used were T0 (control), T1 (2%), T2 (4%) and T3 (6%).

2.3 Data Analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 23 software for tabulation. To detect highly significant differences ($P<0.01$). ANOVA analysis was used. Duncan's Multiple Range Test (DMRT) was used for further testing when differences existed.

2.4 Goat Meat Patties Production

The process of making red onion peel powder begins with washing with water then drying for 3 days. After that, the red onion peel powder is ground using a dry mill to a size of 100 mesh and the natural fiber agent is ready to use.
The process of making goat patties begins with grinding goat meat, salt and ice cubes using a meat grinder, then other ingredients such as tapioca flour, garlic, onions, egg whites and pepper are added. Then the patties are formed into flat circles and baked at a temperature of 180±2°C, turning every 1 minute. The patties are cooled until they reach a temperature of 25±2°C. The treatment of adding red onion peel powder to goat patties is as follows:
T0: without adding red onion peel powder
T1: adding red onion peel powder as much as 2%
T2: adding red onion peel powder as much as 4%
T3: adding red onion peel powder as much as 6%

2.5 Quality of Goat Meat Patties

2.5.1 Carbohydrate Content

Carbohydrate testing was performed using the Luff-Schoorl method (AOAC, 2005). The carbohydrate assay procedure begins by weighing the sample to ± 5 g and placing it into a volumetric flask of 500 ml capacity. Add 100 ml of HCL 0.1, connect to a condenser and boil for 3 hours. Test the pH and transfer the carbohydrate content to a graduated cup. Transfer the solution to a 200mL graduated decanter for dilution, homogenization and filtration. Filter the sample and take 1mL. Dilute the sample to 10 ml with distilled water. Add 15mL distilled water and 25ml Luff's solution to the specimen. Boil for 10 minutes and allow to cool. Add 15mL of the 20% KI solution and 25mL of the 25% KI solution.

H2SO3 solution to the sample. Titrate the mixture with thiosulfate solution until the color of the mixture is light yellow. Add 1-2 drops of starch solution and titrate with thiosulfate solution until the mixture is white.

2.5.2 Fat Content

Fat content testing using the Soxhlet method (AOAC, 2005). First, the filter paper and cotton are baked at 105°C for 12 hours. The filter paper and cotton are then placed in a desiccators for 15-30 minutes and weighed on an analytical balance. Then, 1g of the sample that you have checked for moisture is added and wrapped in filter paper and cotton to form a cylindrical shape. Extract samples by adding up to 40 ml top and 60 ml bottom petroleum ether (PE) or benzene solution for 2-3 hours. The samples were aerated and placed in an oven at 105°C for 24 hours after the extraction process was completed. The samples were then transferred to a desiccator for 15 to 30 minutes, the samples were reweighed with an analytical balance, and the results were calculated using the following equation:

$$\%\ Fat\ Content = \frac{FM\ (FPM - DI)}{DI}\ x\ 100\%$$

2.5.3 Fiber Content

Fiber content testing using the Gravimetric method (AOAC, 2005). Weighed the goat meat patties sample and extracted using soxhlet. Dried and put into a 500 ml measuring cup. Add 50 mL 1.25% H2SO4 solution and boil for 30 minutes with condenser. Add 50 ml 3.25% NaOH solution and boil again for 40 min. The solution was then filtered through a Buchner funnel with dried and weighed ashless filter paper. To remove any precipitate remaining on the filter paper, wash with 1.25% hot H2SO4 solution, 96% ethanol and hot water. Transfer the precipitate to a known weight beaker and dry at 105ºC. Precipitate was transferred to a known weight beaker and dried at 105ºC. The following formula has been used for the calculation of the fiber content:

$$\%\ Fiber\ Content = \frac{W\ fiber\ (g)}{W\ sample\ (g)}\ x\ 100\%$$

2.5.4 Protein Content

Protein content testing using the Kjeldhahl method (AOAC, 2005). Protein content testing is carried out in 3 stages, namely destruction, distillation and titration. Calculation of protein content using the following formula:

$$\%\ Protein\ Content = \frac{(D\ -\ C)\ x\ n\ NaOH\ x\ 0.014\ x\ 6}{B\ -\ A}\ x\ 100\%$$

2.5.5 Color Analysis

Color analysis is performed using a color reader (AOAC, 2005). Before analyzing the sample with a color reader, the color reader must be calibrated using a black and white plate. Cut the sample about 2 cm x 2 cm x 2 cm then place it on a tray. Place the color reader lens on the sample and click the power button. The color value can be seen on the screen with 3 types of colors, namely reddish, yellowish, and brightness.

2.5.6 Total Microorganisms

Total microorganisms were determined using the Total Plate Count (TPC) method (SNI 3820:2015). Total microorganisms were calculated using the pour plate method with a colony range of 25 – 250.

3. RESULT AND DISCUSSION

3.1 Quality of Goat Patties with Added Red Onion Peel Powder

3.1.1 Carbohydrate Content

Carbohydrates are important compounds in natural products, serving primarily as energy sources and secondarily as aromatic and bioactive precursors. The carbohydrate content in the treatment of goat patties with the addition of different red onion peel powder is presented in Table 1, showing a very significant effect on carbohydrate content (P <.01). The higher the addition of red onion peel powder, the higher the carbohydrate content. The increase in carbohydrate content is because red onion peel powder has a carbohydrate content ranging from 70.74 - 79.54% (Sagar, et al., 2021). Carbohydrates are fibers that can bind processed meat products, therefore carbohydrates affect the texture of processed meat products.
(Evanuarini, et al., 2023) stated that the carbohydrate content made from chicken patties with added beetroot skin flour ranged from 15.03 - 17.45%, this is because red beet skin flour will affect the quality of the final product in each treatment. Adding ingredients that contain high amounts of protein, fat, ash and water increases the carbohydrate content. Similar research stated by (Suychinov, et al., 2023) that the addition of spinach flour to beef patties can increase carbohydrate levels by 5.86 - 16.36%, this can provide a source of dietary fiber and additional nutrients for consumers.

3.1.2 Fat Content

Fat is an oil contained in all food ingredients with different levels. By nature, grease insoluble in water but soluble in organic solvents like ether, benzene, coliform (Libera, et al., 2021). The percentage of fat in the treatment of goat patties with the addition of different red onion peel powder is presented in Table 1 showing a very significant effect on the fat content (P <.01). The higher the addition of red onion peel powder to goat meat patties, the lower the fat content. This decrease in fat content is due to the low fat content of red onion peel powder, which is 0.30-0.47% (Sagar, et al., 2021). The Indonesian National Standard (SNI) states that the maximum fat content of beef patties is 20%, goat meat patties with the addition of shallot skin powder are still in the standard range, namely 24.20% -30.39%. The fat content of beef patties after cooking is 22.77%, this is because it has the property of binding water and fat (Bunmee, et al., 2022).

3.1.3 Fiber Content

The fiber content in the treatment of goat patties with the addition of different red onion peel powder is presented in Table 1 showing a very significant effect on fiber content (P <.01). The higher the addition of red onion peel powder, the higher the fiber content. The lowest fiber contents were found in the control treatment at 0.530 %, still within the range of the Indonesian National Norm (SNI) of 0.56 % for dough fiber content. The average fiber content of goat meat patties with the addition of red onion peel powder was 0.530%-1.755%, this increase was due to the fiber content of red onion peel powder ranging from 4.45%-8.28% (Sagar, et al., 2021).
(Evanuarini, et al., 2023) stated that the fiber content made from chicken patties with added beetroot skin ranged from 0.71–1.15%, this was due to the amount of crude fiber in beet skin flour of 3.57%. Food ingredients containing fiber provide benefits in making meat patties, so that they can produce fiber-rich meat patties. Another study revealed by (Kausar, et al., 2024) the beef patty with psyllium husk flour and fenugreek leaves has a dietary fiber content of 1.317%. The use of red onion peel powder contains high amounts of dietary fiber for human health and has functional properties such as antimicrobial, anticancer, and antioxidants (Chadorshabi, et al., 2022).

3.1.4 Protein Content

Non-meat proteins are often used in meat analogue products to improve texture and emulsion stability, reduce cooking losses, increase yields and reduce costs. Protein consumed in small amounts can cause decreased growth and impaired immunity in the body. The protein content in the treatment of goat meat patties with the addition of different red onion peel powder is presented in Table 1 showing a very significant effect on protein content (P <.01). The higher the addition of red onion peel powder to goat patties, the more protein. Lowest protein found in control treatment was 14.40% and the highest was added 6% (T3) at 16.06%, this is still in the range of the Indonesian National Standard

(SNI) for the maximum protein content of the patties quality requirement of 13%. The increase in protein content is due to the cooking process of the patties and the protein content of the red onion peel powder ranges from 10 - 12% (Chadorshabi, et al., 2022). Chicken nuggets with Kalakai filler range from 11.87% to 14.17% protein content. (Shada, et al., 2022).

3.1.5 Color Analysis

Color is an important parameter that must be considered because it creates consumer appeal when they first see a food product. Several factors affect the color, including fermentation time, pH, protein content, oxidation of glucose molecules, and ionic strength. Table 1 shows the color analysis (L a*b*) of goat patties treated with various red onion peel powders. A very significant influence on L a*b* levels could be observed (P <.01). The higher the addition of red onion peel powder, the higher the level of brightness (L) in goat patties. The levels of L a*b* were determined based on the different additions of onion skin powder at concentrations of 0%, 2%, 4% and 6%. The a*value indicates a red shade and the b*value indicates a more yellowish shade. Red onion peel can provide reddish pigments (a*) in goat patties because red onion peel contains natural dyes, namely anthocyanins, especially from the cyanidin and peonidin groups (Gorrepati, et al., 2024).
(Tharukliling et al., 2021) revealed that beef patties with the highest red fruit paste addition produced an a* value of 41.98. This is due to the high carotene and tocopherol content in red fruit paste, which is able to give color to the patties. The addition of red onion skin powder extract to beef patties also has a higher brightness value (a*). Another study reported by (Soares, et al., 2021) stated that the redness value (a*) in beef patties showed good results with the application of onion film.

3.1.6 Total Microorganisms

Total microorganisms in treating the following goat patties with various additions of red onion peel powder are presented in Table 1. A very significant effect was shown in the total microorganisms (P <.01). The higher the addition of red onion peel powder to goat patties, the lower the total microorganisms. Total microorganisms decreased with the addition of 6% red onion peel powder. The highest total microorganism value was in the control treatment of 0.17 x 103 CFU/mL and the lowest was in the addition of 6% of 0.14 x 103 CFU/mL. The Indonesian National Standard (SNI) states that the maximum total microorganism in patties is 1 x 105. Patties with the addition of red onion peel powder are still within the standard range.
The number of microbes in food ingredients is influenced by the level of hygiene of the processing of a product (Delhalle, et al., 2020). Red onion peel powder can inhibit the growth of *Bacillus cereus* bacteria that can grow on food ingredients such as meat by 83.3%. Red onion peel powder high amounts of phenolic and anthocyanin compounds so that it can be used as an inhibitor of microorganisms (Albandary, 2023). Red onion peel powder more bioactive components than other edible bulbs. The addition of red onion peel powder may act as an antimicrobial due to its high flavonoid content, which includes quercetin, which has antioxidative, anti-inflammatory, antiallergic, and antimicrobial potential against various types of pathogens including E. faecalis, S. aureus, and P. aeruginosa. (Ali, et al., 2023).
The addition of red onion peel powder can slow down the growth of microorganisms. (Abdel-Naeem, et al., 2022) stated that phenolic acid compounds in fresh banana peel extract have good antibacterial activity against chicken patties. Another study is the addition of chickpea seed extract to beef patties. The addition of gram seed extract may help Inhibition of growth of E. coli and S. Typhimurium bacteria because gram seed extract contains high levels of phenolic compounds (Alsoufi and Aziz, 2023).

Table 1. Quality of goat patties with the addition of red onion peel powder

Variable	Treatments			
	T_0 ± SD	T_1 ± SD	T_2 ± SD	T_3 ± SD
Carbohydrate Content (%)	8.93 ± 0.85[a]	12.83 ± 0.42[b]	13.19 ± 0.77[c]	13.64 ± 0.92[d]
Fat Content (%)	30.39 ± 0.65[d]	27.20 ± 0.54[c]	25.75 ± 0.72[b]	24.20 ± 0.85[a]
Fiber Content (%)	0.53 ± 0.07[a]	0.87 ± 0.08[b]	0.92 ± 0.06[c]	1.76 ± 0.17[d]
Pritein Content (%)	14.40 ± 0.13[a]	15.13 ± 0.08[b]	15.54 ± 0.10[c]	16.06 ± 0.13[d]
Lightness (L)	43.20 ± 0.67[a]	35.54 ± 0.96[b]	39.14 ± 0.96[c]	43.20 ± 0.67[d]
Redness (a*)	7.94 ± 0.62[a]	13.19 ± 0.92[b]	20.22 ± 0.85[c]	35.87 ± 0.84[d]
Yellowness (b*)	28.16 ± 0.70[d]	25.76 ± 0.98[c]	21.06 ± 0.94[b]	17.90 ± 0.67[a]
Total Microorganisms (CFU/mL)	0.17 ± 0.01[a]	0.16 ± 0.01[b]	0.15 ± 0.01[c]	0.14 ± 0.01[d]

**a,b,c,d show very significant effects*

4. CONCLUSION

Red onion peel powder has the potential to be used as a natural fiber agent. The addition of 6% red onion peel powder to goat patties can improve the physicochemical and microbial quality based on carbohydrate content, fat content, fiber content, protein content, L a*b* color and total microorganisms. Different treatments can have a very significant effect on each variable.

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