

Original Article

Development of salted egg powder by the addition of garlic extract

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Abstrak

Tujuan: Tujuan penelitian ini adalah untuk mengetahui efek penambahan ekstrak bawang putih pada tepung telur asin untuk meningkatkan fungsional dan kualitas fisikokimia tepung telur asin.

Metode: Penelitian ini menggunakan metode percobaan laboratorium dengan Rancangan Acak Lengkap 4 perlakuan dan 4 ulangan. Perlakuan tanpa penambahan ekstrak bawang putih sebagai kontrol (P0), 5% (P1), 10% (P2), dan 15% (P3) penambahan ekstrak bawang putih pada tepung telur asin. Pengeringan dengan metode *pan drying* pada suhu 60°C selama 6 jam digunakan sebagai metode pengeringan. Variabel yang diukur adalah rendemen, warna L*a*b* dengan color reader, kadar air, aktivitas antioksidan dengan DPPH. Analisis variansi (ANOVA) digunakan sebagai analisis data, jika terdapat perbedaan pengaruh diantara perlakuan dilanjutkan dengan Uji Jarak Berganda Duncan (DMRT).

Hasil: Penelitian penambahan ekstrak bawang putih pada tepung telur asin menghasilkan rendemen sebesar 27,22-36,77%, warna L sebesar 75,35-80,33, warna a* 5,01-6,33, warna b* 26,99-31,66, kadar air sebesar 2,23-2,77%, dan aktivitas antioksidan sebesar 2,30-11,64%.

Kesimpulan: Perlakuan terbaik dari penelitian ini yaitu tepung telur asin dengan penambahan ekstrak bawang putih sebanyak 15%, menghasilkan produk tepung telur asin dengan rendemen 36,77%, warna L sebesar 75,35, warna a* sebesar 6,33, warna b* sebesar 31,66, kadar air sebesar 2,23 dan aktivitas antioksidan sebesar 11,64%.

Kata Kunci: Aktivitas antioksidan; Ekstrak bawang putih; *Pan drying*; Tepung telur asin

Abstract

Objective: The objective of this study was to determine the effect of garlic extract for the improvement of functional and physicochemical quality of salted egg powder.

Methods: This study used was a laboratory experimental design with a completely randomized design (CRD) with 4 treatments and 4 replications. The treatment were without the addition of garlic extract as a control (P0), 5% (P1), 10% (P2), and 15% (P3) addition of garlic extract to salted egg powder. Pan drying method at 60°C for 6 hours was used as a drying method. The variables measured were yield, Lightness, redness, and yellowness color, moisture content, antioxidant activity. Analysis of Variance (ANOVA) was used as data analysis, if there was a significantly different effect, it was continued with Duncan's Multiple Range Test (DMRT).

Results: This study produced salted egg powder with a yield of 27.22-36.77%, color L of 75.35-80.33, color a* 5.01-6.33, color b* 26.99-31.66, moisture content of 2.23-2.77%, and antioxidant activity of 2.30-11.64%.

Conclusions: The best treatment of this research is salted egg powder with the addition of garlic extract as much as 15% and produces a product with a yield of 36.77%, color L of 75.35, color a* of 6.33, color b* of 31.66, moisture content of 2.23 and antioxidant activity of 11.64%.

Keywords: Antioxidant activity; Garlic extract; Pan drying; Salted egg powder

INTRODUCTION

Eggs are a product that is easily damaged, so it requires proper handling, preservation, and processing. Hurdle technology is a technique that uses several combinations of technologies to extend shelf life. The treatment in egg product processing, technological hurdles were salting and drying. The advantages of the salting method can extend the shelf life and provide a good taste. The advantages of the drying technique in the manufacture of powder are simple, and practical to apply to other products, for example, bakery, candy, mayonnaise, and other processed products.

Salted eggs are made from duck eggs because they have larger pores compared to other poultry eggs, making it easier for salt to be absorbed into all parts of the egg when salted. Salted eggs can be stored for 14 days. The drying process is carried out to extend the shelf life into powder form. Salted egg powder can be prepared by evaporation or hydration to reduce the water content of the product. The advantage of the drying technique is the reduction in product volume and weight so that it is more practical and efficient.

Dried salted egg powder will oxidize if stored poorly, so it takes natural antioxidants that are safe to use to prevent oxidation in the product. Garlic is a natural antioxidant because it has active compounds of flavonoids, allicin, and organosulfur components that have properties as therapeutic ingredients in the form of antibacterial, antiviral, antifungal, antibiotic, and antioxidant. In addition, the added garlic extract is expected to improve the taste of the salted egg powder produced. Not many studies have examined the use of natural antioxidants to improve the quality and shelf life of salted egg powder. Based on the above study, a study was conducted to determine the optimal percentage of garlic extract using the pan drying method of evaporation technology on salted egg powder. This research is expected to produce salted

egg powder products that are stable during storage and of good quality in terms of yield, L color, a* color, b* color, moisture content and antioxidant activity.

MATERIALS AND METHODS

Research material

The research material used salted egg powder made from fresh salted eggs added with garlic extract and then dried by pan drying method. Salted eggs are produced from salted duck eggs for 12 days using the dry method. Garlic extract is an additional ingredient in the process of making salted egg powder.

Research methods

A completely randomized design (CRD) with 4 treatments and 4 replications was used as the experimental design of the study, wherein treatment without garlic extract addition was set as a control 0% (P0), while 5% (P1), 10% (P2), and 15% (P3) indicated the addition percentage of the garlic extract into salted egg powder.

Salted Egg making procedure

Salted eggs are made from duck eggs from a duck farm in the Singosari area, Malang. Duck eggs are selected to choose duck eggs that have good quality. The eggs used were 1 day old fresh eggs which had an average weight of 65 ± 2.00 g. Eggs are rubbed and washed with warm water and then dried. The pasta dough for the salting process by making a salting medium by making a 3:1 ratio between brick powder and salt and mixing it with 3500 ml of water to make a paste. Eggs are wrapped with a thickness of 0.5 cm and stored for 12 days in a dry place. Harvesting is done by cleaning from the paste that sticks, washing and drying it.

Garlic Extract Making

Garlic extract followed the procedure with modifications [1]. Garlic extract was made by selecting fresh and yellowish garlic, then

washing it clean and letting it dry, then weighed. Next, the garlic that has been peeled and washed is crushed. The garlic was chopped and then blended until smooth, macerated for 3x24 hours using 96% ethanol, then filtered with filter paper. The filtration results are evaporated using a rotary vacuum evaporator. The extract was placed in a sterile vial and covered with aluminum foil.

Making Salted Egg Powder

Method of making salted egg powder is that fresh salted eggs are broken and separated from their shells and then placed in a glass beaker. Homogenization is done using a stirrer (spatula). Drying salted eggs using the pan drying method. Eggs that have been homogenized, added with garlic extract according to the treatment then poured into a 16 x 16 x 1.5 cm baking dish and leveled so that it has the same thickness of 3 mm, after that the pan is placed in an oven with a temperature of 60°C at a drying time of 8 hours. Whole salted eggs that have been dried and then cooled, then mashed using a dry mill for 3 minutes and filtered to 80 mesh to produce a fine salted egg powder. Ready egg powder can be stored in an airtight container.

Data Analysis

The data obtained were analyzed using Microsoft excel and the mean and standard

deviation were taken. The resulting data were analyzed using analysis of variance (ANOVA). If there was a significant difference between treatments, the Duncan Multiple Range Test (DMRT) is carried out.

RESULTS

Yield

Data and analysis of various yields of salted egg powder with the addition of garlic extract gave a highly significant effect ($P < 0.01$). The average yield of salted egg powder with the addition of garlic extract can be seen in Table 1.

L*, a* dan b* Color

Data and analysis of color variation of salted egg powder L*, a*, and b* color with the addition of garlic extract gave a highly significant effect ($P < 0.01$). The average values of L*, a*, and b* of salted egg powder with the addition of garlic extract can be seen in Table 2.

Moisture Content

Data and analysis of water content variance of salted egg powder with the addition of garlic extract gave a highly significant effect ($P < 0.01$). The average value of the water content of salted egg powder with the addition of garlic extract can be seen in Table 3.

Table 1. Average Value of Yield percentage of Salted Egg Powder

Treatment	Yield Value
P0	27.22 ± 0.66 ^a
P1	31.99 ± 0.90 ^b
P2	33.95 ± 0.89 ^c
P3	36.77 ± 0.20 ^d

Note: Different superscripts in the same column show a highly significant difference ($P < 0.01$)

Table 2. Average Value of L*, a*, b* Color of Salted Egg Powder

Treatment	L Color	a* Color	b* Color
P0	80.33 ± 0.79 ^a	5.01 ± 0.81	26.99 ± 0.76 ^a
P1	78.59 ± 0.46 ^b	5.60 ± 0.66	30.98 ± 0.57 ^b
P2	77.33 ± 0.94 ^{bc}	5.78 ± 0.84	31.10 ± 0.52 ^b
P3	75.35 ± 0.76 ^c	6.33 ± 0.37	31.66 ± 0.96 ^b

Note: Different superscripts in the same column show a highly significant difference ($P < 0.01$)

Table 3. Average Value of Moisture Content of Salted Egg Powder

Treatment	Moisture Content (%)
P0	2.77 ± 0.07 ^d
P1	2.61 ± 0.05 ^c
P2	2.46 ± 0.05 ^b
P3	2.23 ± 0.06 ^a

Note: Different superscripts in the same column show a highly significant difference (P<0.01)

Table 4. Average Value of Antioxidant Activity of Salted Egg Powder

Treatment	Antioxidant Activity (%)
P0	2.30 ± 0.18 ^a
P1	4.56 ± 0.39 ^b
P2	7.52 ± 0.30 ^c
P3	11.64 ± 0.19 ^d

Note: Different superscripts in the same column show a highly significant difference (P<0.01)

Antioxidant Activities

Data and analysis of the various antioxidant activities of salted egg powder with the addition of garlic extract gave a highly significant effect (P<0.01) on the antioxidant activity of powder. The average value of the antioxidant activity of salted egg powder with the addition of garlic extract can be seen in Table 4.

DISCUSSION

Table 1 shows that the yield percentage of salted egg powder increased with the addition of garlic extract. The highest yield percentage was found in treatment 3 (P3) and the lowest yield was found in the control treatment. The higher the yield of the product indicates that the treatment given to the product manufacturing process is more effective and efficient. The yield of salted egg powder can be determined based on the ratio between the weight of egg powder and the weight of fresh eggs. The results of these calculations are expressed in percent. Yield is the ratio of the weight of the product to the weight of the material then multiplied by 100% [2]. The drying process in the process of making egg powder will cause the evaporation of carbon dioxide (CO₂) and water (H₂O) increasing the percentage yield. The salted egg powdering process was carried out for 8 hours at a temperature of 60°C. The

continuous drying process can increase the yield value due to longer drying and increasing temperature [3]. The increase in yield value was also due to a decrease in the moisture content of the product. The smaller the moisture content in a product can affect the percentage yield. The lost moisture content of the material will cause the processed material to be denser and lighter [4]. In addition, the concentration of garlic extract can increase the rate of enzymatic reactions which can affect the yield of salted egg powder [5]. The standard percentage of egg powder yield is 22% [6].

Table 2 shows that the color brightness L* in salted egg powder with the addition of garlic extract decreased. The highest L color was found in control salted egg powder and the lowest L color was salted egg powder with the addition of 15 percent garlic extract. The reddish color (a*) in salted egg powder increased with the addition of garlic extract. The average color value of a* salted egg powder is 5.01-6.33. The highest a* color was found in salted egg powder with the addition of P3 garlic extract and the lowest a* color was control salted egg to powder. The color b* of salted egg powder with the addition of garlic extract increased. The highest b* color was found in salted egg powder with the addition of garlic extract (P3) and the lowest b* color was control salted egg powder (P0). The more

addition of garlic extract causes the brightness of salted egg powder to decrease. Fresh garlic contains 33.06 g of carbohydrates per 100 g of garlic [7]. This is due to the heating process of salted egg powder during drying and causes the Maillard reaction [8]. The Maillard reaction is caused by a reaction between the aldehyde group (carbohydrate) and the amino group (protein) in the drying process of egg powder. Glucose is a component that plays an important role in the Maillard reaction. In addition, the color change in salted egg powder is influenced by the concentration of salt during the previous salting process [9].

Table 2 shows that the more garlic extract was added to salted powder, the a^* color of salted egg powder would increase. The color a^* indicates a greenish-red color, the more garlic extract is added, the closer the color will be to red. The increase in reddish color in dried salted egg powder is due to the Maillard reaction.

The more addition of garlic extract to salted powder, the yellowness (b^*) of salted egg powder will increase. The color of the yolk is also influenced by the carotenoids contained in the egg yolk. Carotenoids are pigments with bioactivity as pro-vitamin A which can reduce the risk of cell degeneration and increase immunity [10]. In addition, the free fat present in the egg yolk during the homogenization process causes the color of the yolk to be mixed with the egg white. Garlic extract also has a slightly yellowish color, so the more garlic extract is added, the higher the b^* value.

Table 3 shows that the moisture content of salted egg powder with the addition of garlic extract decreased. The highest moisture content was in the control treatment and the lowest moisture content was in treatment 3 (P3). Moisture percentage is a material that evaporates when heated with a certain temperature and time. The moisture content in salted egg powder will be lost due to long storage and storage temperature which can accelerate the occurrence of metabolic reactions and bacterial growth [11]. The principle of the drying method is that the water contained in a material will evaporate when heated at a temperature of 105°C for a certain time. The difference in weight before and after heating is the moisture content [12]. The moisture

content serves to maintain the structure of the egg contents and the freshness quality of whole eggs [6]. It can be seen that the loss of most of the water in the drying process of salted egg powder greatly affects the quality and functional properties of salted egg powder.

The moisture content of salted egg powder decreased with the addition of 5% to 15% garlic extract. The decrease in moisture content was caused by heating at a certain temperature and time during the drying process. The heating process will cause the water contained in the material to evaporate. The low moisture content of salted egg powder is also influenced by the total salt contained in the eggs. The moisture content of salted duck eggs is lower than that of fresh duck eggs because the presence of salt in salted eggs can eliminate the free water content of the eggs [13]. Another factor that affects the decrease in the moisture content of salted egg powder is the process of salting. During the salting process, the proportion of moisture in the egg white and egg yolk will gradually decrease as a result of the osmosis process of water in the egg [14]. The water will migrate from the yolk to the egg white and finally out through the shell. The drying temperature of salted egg powder is 60°C with a drying time of 8 hours. Pan-dried egg powder undergoes a longer heating process, higher denaturation, and aggregation of ovomucin so that the solubility is lower.

Table 4 shows that the antioxidant activity of salted egg powder with the addition of garlic extract has increased. The highest antioxidant activity value was found in the addition of 15% garlic extract, and the lowest antioxidant activity value was found in the control treatment. The antioxidant activity of salted egg powder increased with the increase in the percentage of garlic extract used. This is caused garlic acts as a natural antioxidant. Garlic contains chemical compounds including allicin, polyphenols, ajoene, flavonoids and saponins [15]. Garlic extract no tannins detected [16]. Allicin in garlic will come out when cut or crushed. Allicin contains a lot of sulfur and is responsible for its taste, aroma and other pharmacological properties such as anticancer, antibacterial, antifungal and antioxidant [17]. Antioxidants are substances

that can ward off free radicals or prevent oxidation reactions from free radicals. Oxidation is a chemical reaction that can transfer electrons from a substance to an oxidizing agent [18]. The antioxidant activity of garlic can be influenced by the conditions and methods of making salted egg powder. Garlic has an antioxidant activity of 53.66% which means garlic can reduce free radical compounds up to 53.66% [19]. Garlic phenolic compounds have one or more groups, namely hydrogen proton donors and neutralizing free radicals. The antioxidants contained in garlic extract can protect the body from free radicals and the effects of Reactive Oxygen Species (ROS). ROS such as superoxide anions (O_2^-), hydroxyl ($-OH$), peroxy (ROO^-), alkoxy radicals ($RO\cdot$), and hydrogen peroxide (H_2O_2) will attack proteins, lipids, and/or damage DNA, causing disease in humans. Allicin is the main bioactive compound that acts as an antioxidant, which accounts for 70–80% of the total antioxidant compounds in garlic [20]. The largest total allicin content in the extract of one fresh garlic clove is 12 mg/g and will be stable at 4°C for 7 days [21].

CONCLUSION

It can be concluded that the addition of 15% garlic extract to salted egg powder produced the best-salted egg powder product with a yield of 36.77%, Lightness color of 75.35, redness a^* color of 6.33, yellowness color b^* of 31.66, the moisture content of 2.23 and antioxidant activity of 11.64%.

CONFLICT OF INTEREST

The authors declare no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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