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Research Article

Effect of Storage on The Chemical Quality of Pasteurized Milk with Supplemented Soybean Oil and Phycocyanin

Angela Nitia Nefasa[a,*], Ega Zahrotun Nisa[a], Marcelinus Christwardana[b]

[a] Department of Animal Husbandry, Faculty of Faculty of Agriculture and Animal Husbandry, University of Boyolali, Jl. Pandanaran No.405, Winong, Boyolali, Jawa Tengah 57315, Indonesia

[b] Department of Chemistry, Faculty of Science and Mathematics, Diponegoro University, Jl. Prof. Soedarto SH, Semarang- 50275, Indonesia

* Correspondence: nnitia19@gmail;

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Abstract: The interaction between the addition of soybean oil and phycocyanin extract on the protein, fat, and solid non-fat content of pasteurized milk after a one-week storage period is highly important to investigate. Soybean oil is used to improve the quality of pasteurized milk, particularly its chemical quality, consisting of fat, protein, and Solid Non-Fat (SNF). Phycocyanin extract provides a source of protein, whereas soybean oil contains healthy fatty acids. Before the fresh milk is pasteurized, soybean oil and phycocyanin are added. The LTLT (Low Temperature Long Time) technique was used to pasteurize the milk at 63 °C for 30 minutes. After the pasteurization procedure was completed, the milk samples were refrigerated for one week at a temperature of 4 °C. Following the storage period, the chemical composition of pasteurized milk is examined. With the addition of soybean oil and phycocyanin extract, the protein content of milk rose, as shown by the findings. The sample T1 with a concentration of 0.45% soybean oil and 0.50% phycocyanin extract had the greatest amount of protein (3.58). The sample T2 with 0.45% soybean oil concentration and phycocyanin extract (1%) had the greatest fat content (6.4%). Adding soybean oil and phycocyanin extract enhanced the total SNF concentration. On the basis of the study conducted, it can be concluded that the addition of soybean oil and phycocyanin extract to pasteurized milk has an influence and interaction on the milk's protein, fat, and SNF content. The addition of soybean oil and phycocyanin extract to pasteurized milk held for one week may boost protein, fat, and SNF concentrations.

Keywords: cow milk, *Spirulina*, soybean oil, supplementary food

1. Introduction

Milk is one of the animal products with the highest nutritional value. Milk's high nutritional value is almost ideal since it contains all of the essential nutrients for humans, including calcium, fat, protein, vitamins, and others (Yulaikah et al., 2016). High nutritional content in milk is affected by cattle type, milking period, illness, season, animal diet, and other variables (Nugraha et al., 2016). Because milk's nutritious characteristics are susceptible to deterioration, it must be treated and maintained. Pasteurization is one of the methods used to prepare and preserve milk.

Milk pasteurization is a heating technique designed to prevent milk damage caused by harmful microbes while preserving milk's nutritional value. The pasteurization procedure is carried out at temperatures below 100 ° C to eliminate harmful microorganisms that might deteriorate milk (Wanniatie and Zuraida, 2015). In addition to basic heating, milk must also be examined for its protein, fat, and solid non-fat content. The protein content in milk fluctuates often and has nutritional significance (Susanty and Nurdin. 2012). In the meanwhile, milk fat content is heavily impacted by a variety of variables, including the breed of cow that produces it, the amount of lactation, the interval between milkings, the cow's age, and its surroundings. In addition, milk fat and dry matter without milk fat, often known as solid non-fat (SNF), is one of the milk components used to determine the price of milk. Protein, lactose, minerals, and vitamins are the constituent components of SNF. Milk fat imparts a savory flavor to milk, whereas milk lactose imparts a sweet flavor (Suhendra et al., 2014). On the basis of the nutrients included in milk, mainly protein, fat, and non-fat slides, milk may be treated such that its nutritional quality is preserved.

According to the United Soybean Board (2011), the addition of soybean oil to milk does not compromise the natural scent of food items since soybean oil has a natural flavor and nearly little olfactory influence on food. Soybean oil is a vegetable oil derived from soybean seeds. Soybean oil is used because the majority of its fatty acids are necessary fatty acids required by the body (Ketaren, 2005:261). In addition to being beneficial for the body, soybean oil is readily available on the market. Soybean oil has around 15% saturated fatty acids, making it an excellent alternative for fats and oils with high amounts of saturated fatty acids, such as butter. Like other vegetable oils, soy oil is cholesterol-free (Amar and Dewi, 2013). In addition to soybean oil, phycocyanin extract is added. Phycocyanin is a phycobiliprotein pigment with a chromophore structure made up of and subunits (Astui et al., 2019). 20 percent of the dry weight of S. platensis contains a pigment that may be employed in health items, food, and cosmetics (Chaiklahan et al., 2012).

The addition of soybean oil and phycocyanin extract to pasteurized milk may give the milk with additional nutrients. Currently, dairy products using soy oil and phycocyanin extracts may serve as a new functional food component that provides significant value to customers. This study's objective was to assess the impact of adding soybean oil and various phycocyanin extracts to protein, fat, and solid nonfat pasteurized milk. This research aimed to assess the effect of adding soybean oil and phycocyanin extract to pasteurized milk after a week of storage on the protein, fat, and solid non-fat content. This research is meant to offer readers with information, references, and literature about the effects of the addition of soybean oil and phycocyanin extract after one week of storage on the protein, fat, and solid nonfat pasteurized milk. After one week of storage, the combination of soybean oil and phycocyanin extract is hypothesized to have a good influence on the protein, fat, and solid non-fat pasteurized milk.

2. Material and Method

2.1. Material

This study will be conducted in the Laboratory of Nutrition and Food Chemistry at the Diponegoro University in Semarang. The research approach consists of two phases: defining the execution of research processes, then measuring research variables and concluding with data analysis. Fresh cow's milk collected from dairy cattle pens at the Faculty of Animal Husbandry and Agriculture at the Diponegoro University. Soybean oil was collected from one of Semarang's major markets, while phycocyanin was produced from an extract of the microalgae *Spirulina* sp. obtained from the Integrated Laboratory of Diponegoro University.

2.2. Milk Preparation

In the first phase, 0.45 % of soybean oil is combined with 200 g of milk sample. Then, phycocyanin was added at concentrations of 0 percent, 0.5, 1, 1.5, and 2 % to each sample of milk to which soybean oil had been added. Additionally, each sample is placed in a bottle and then sealed. To pasteurize the containers, they are put in a water bath. Adapted from Legowo et al. (2009) utilizing the LTLT (low temperature long time) approach at 63 °C for 30 minutes. This method is often used on a modest industrial scale or in the laboratory. During the pasteurization process, the container is shaken to uniformly heat all of the milk. Next, the temperature of the pasteurized milk will be lowered by allowing it to stand for 5 minutes. The milk samples will then be kept at 4 °C for one week prior to examination. The experimental studies are included in Table 1.

Table 1. Formulation of processed milk

Sample	Cow Milk	Soybean Oil	Phycocyanin
T1	200 ml	0.45%	0%
T2			0.5%
T3			1%
T4			1.5%
T5			2%

2.3. Protein, Fat, and Solid Non-Fat Analysis

The Micro-Kjeldahl technique was adopted from Kumar et al. (2007) for measuring protein content. In the meanwhile, the analysis of fat content measurement was modified from Nielsen's (2010) approach utilizing the Gerber

method. Instead, the analysis of the measurement of non-fat solid content was estimated based on the findings of the measurement of milk's moisture content variable using the oven-drying technique (Nielsen, 2010).

2.4. Statistical Analysis

Triple physicochemical analysis was performed on each sample. Using an analytical approach derived from (Asmariani et al., 2017), the acquired data will be evaluated by calculating the mean, standard deviation, relative standard deviation (RSD), and RSD Horwitz. In addition, during the comparison test stage, correlation and regression analysis (ANOVA) will be utilized to assess the method's accuracy at a significance level of 5%.

3. Result and Discussion

3.1. Protein content

Protein is a supply of amino acids including the atoms C, H, O, and N, which fats and carbohydrates do not possess (Putri, 2016). Figure 1 shows the outcomes of protein testing with the addition of soybean oil and phycocyanin extract. Based on the table, the addition of soybean oil and phycocyanin extract boosted the milk's protein content. However, milk with a concentration of 0.45 % soybean oil and 0.5 % phycocyanin extract (T1) had the greatest protein content. It is hypothesized that the concentration of soybean oil and phycocyanin may boost the protein content of milk more than other concentrations. The findings indicated that the achieved protein level was between 3.08 and 3.56 %, which was still within the standard limit for milk protein content established by the SNI in 1995, which was at least 2.5 % (SNI, 1995). Nutrients in the form of protein molecules that are subsequently broken down into amino acids are optimally absorbable by the body as ingredients for cell formation, tissue repair, and growth. According to Winarno (2004), protein is a component in the body that serves as a builder, regulator, and fuel (Oktavia and Merlita, 2018).

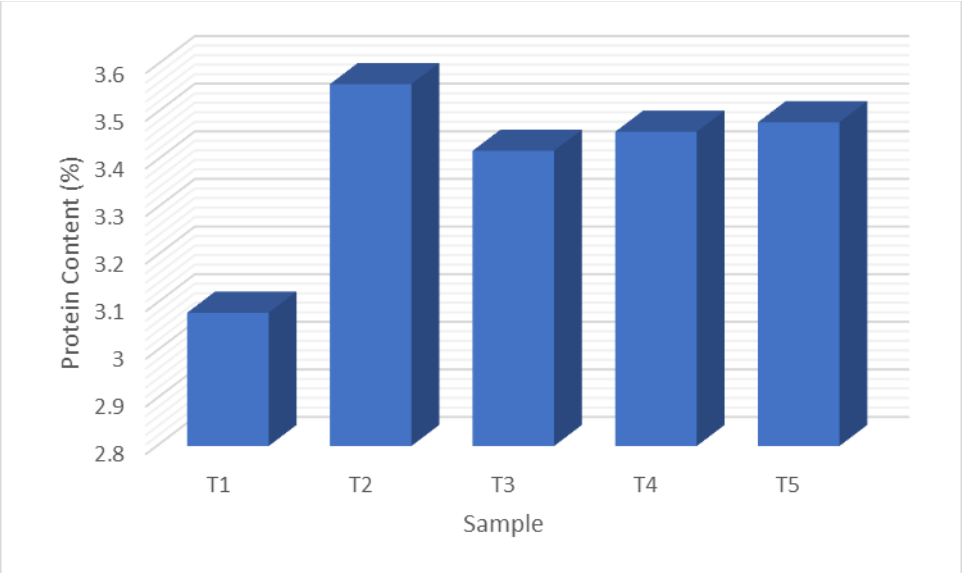

Figure 1. Protein content in all samples

3.2. Fat content

Like other fats included in feed, milk fat is a readily digested source of energy reserves. The fat test including the addition of soybean oil and phycocyanin extract yielded favorable findings, namely a higher fat content than the standard. According to Laryska and Tri (2013), the range of milk fat content is between 2.4% and 5.5%. The test findings indicate that the fat content of milk does not fall below the standard, so it may be broken down into simple forms of glycerol and fatty acids that are optimally accessible to the body. The most essential component of diet, according to Wardana (2012), is fat, which has a role in human health. The T2 therapy had the highest fat content, whereas the T1 treatment had the lowest, as shown in Figure 2. The T1 treatment generated the most protein and the least amount of fat. In agreement with study predictions, the maximum protein content of milk has increased while the fat content has decreased.

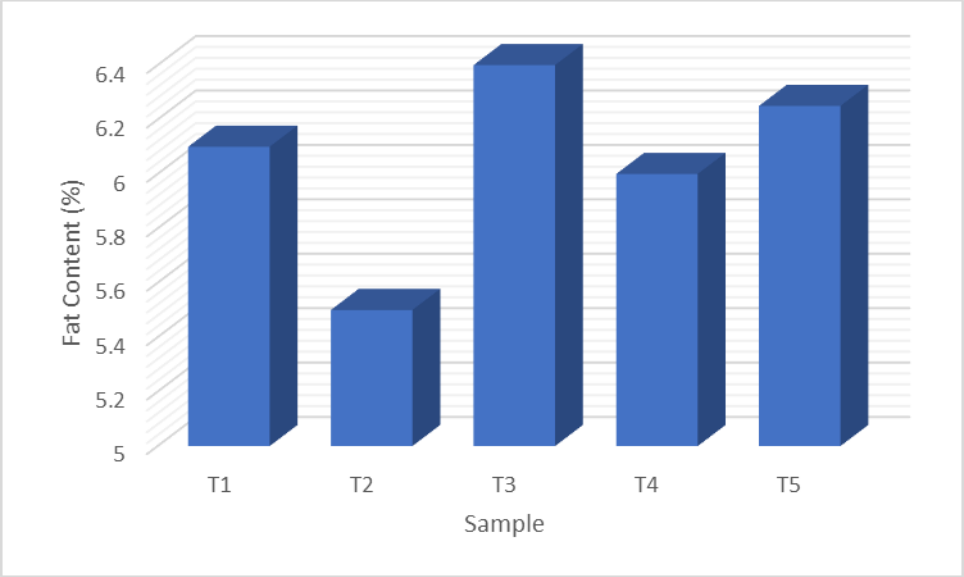

Figure 2. Fat content in all samples

3.3. Solid non-fat content

The Figure 3 contains information on the solid non-fat (SNF) pasteurized milk during refrigerator storage. Analysis of the addition of soybean oil and phycocyanin extract revealed that the concentrations of Solid Non-Fat (SNF) in milk rose at T0, T1, and T2, however the concentrations of SNF dropped at higher times. Despite this, the SNF value for all treatments was over the SNI standard for pasteurized milk. The SNI requirement for pasteurized milk requires at least 7.5% SNF (SNI, 1995).

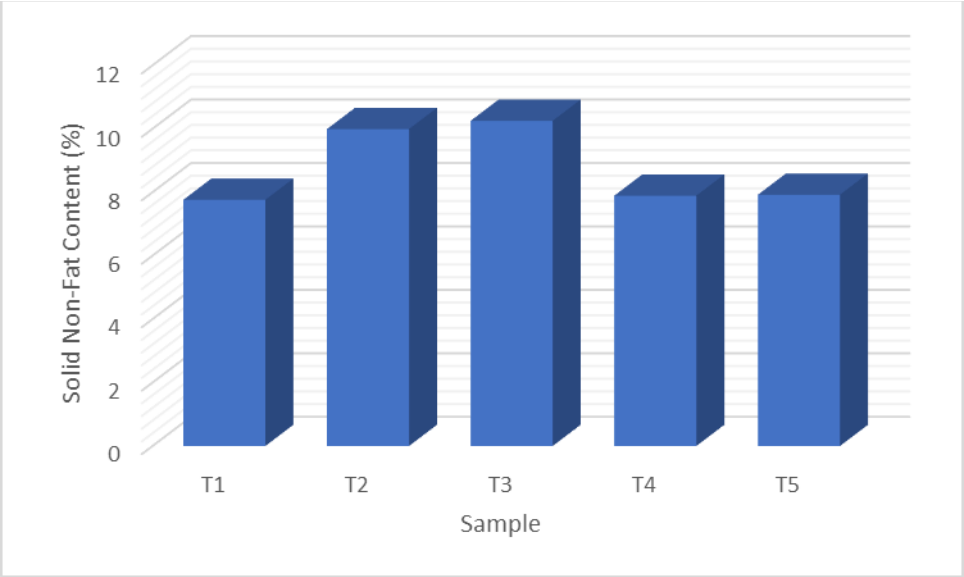

Figure 3. SNF content in all samples

4. Conclusion

On the basis of the research that has been carried out, we are needs to generate the conclusion that there is a connection between the incorporation of soybean oil and the addition of phycocyanin extract into solid non-fat pasteurized milk, and that this connection affects protein as well as fat and milk solids. Increases in protein, fat, and solid non-fat may occur in pasteurized milk with the addition of phycocyanin extract and soybean oil after the milk has been kept for one week.

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