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Nutritional Quality Of Fermented Oil Palm Press Fiber By Local Microorganism

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Abstract. Oil palm press fiber is a by product of the agro industry that has a low nutrient content. Nutrients of oil palm press fiber can be improved by fermentation using local microorganisms. The research was conducted experimentally using a completely randomized design (CRD) factorial pattern with 2 factors (3 x 3), namely first factor such as dose of local microorganisms (D_1 = 1%, D_2 = 3% and D_3 = 5%) and second factor such as long of fermentation (L1 = 7 days, L2 = 14 days and L3 = 21 days), with 3 replications. The parameters measured were the nutritional content of fermented oil palm press fiber such as moisture, dry matter, crude protein, crude fat, crude fiber, ash, and nitrogen free extract (NFE). Based on the research results obtained a combination of 5% dose of local microorganisms and 14 days of fermentation time had a significant effect ($P<0.05$) to increased crude protein content but did not have a significant effect ($P>0.05$) on increased dry matter and nitrogen free extract (NFE) and decreased moisture content, crude fiber, and ash.

Keywords*:* oil palm press fiber, fermentation, local microorganisms, chemical content

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1. Introduction

Oil palm press fiber is one of the largest by product produced in the process of processing palm oil [1]. “Table 1” shows the chemical compositions of oil palm press fiber according to [2].

Table 1. The chemical compositions of oil palm press fiber

Chemical content	(%)
Dry Matter	91.66
Crude Protein	4.36
Crude Fat	3.58
Crude Fiber	32.19
Ash	5.61
NNFE	54.26

Oil palm press fiber can be converted through a fermentation process involving living microorganisms to remodel organic matter into an energy source. As a treatment, oil palm press fiber is given fermentation treatment to increase its nutritional content. The microorganisms used in this fermentation process are local microorganisms that can be used as a starter in fermentation technology.

According to [3], local microorganisms are made from natural ingredients as a medium for living and developing microorganisms which are useful for accelerating the destruction of organic matter. Microbes originating from the substrate themselves have a high ability to degrade the substrate [4]. The object of this research is the nutrient content of oil palm press fiber fermented using various doses of local microorganisms and fermentation time.

2. Materials and Methods

The materials research used was rice bran, molasses, urea, pineapple waste, and papaya waste. The tools used are polyethylene plastics, scales, measuring cups, erlenmeyers, pH indicators, thermometers, and cameras.

Methods

The research was conducted experimentally using a completely randomized design (CRD) factorial pattern with 2 factors (3 x 3), with 3 replications.

The factor I (dose of local microorganisms)

D_1 = 1%

D_2 = 3%

D_3 = 5%

The factor II (fermentation time)

L1 = 7 days

L2 = 14 days

L3 = 21 days

Research Parameters

Parameters observed included the nutritional content of oil palm press fiber such as moisture, dry matter, crude protein, ether extract or crude fat, crude fiber, ash, and nitrogen free extract (NFE) with proximate analysis.

Research Implementation

The research was carried out in 2 stages, namely the manufacture of local microorganisms and fermentation of oil palm press fiber.

Data Analysis

Obtained were analyzed using analysis of variance, if the results have a real or very real effect, the Duncan mean range test (DMRT) is carried out.

3. Results and Discussion

Moisture Content

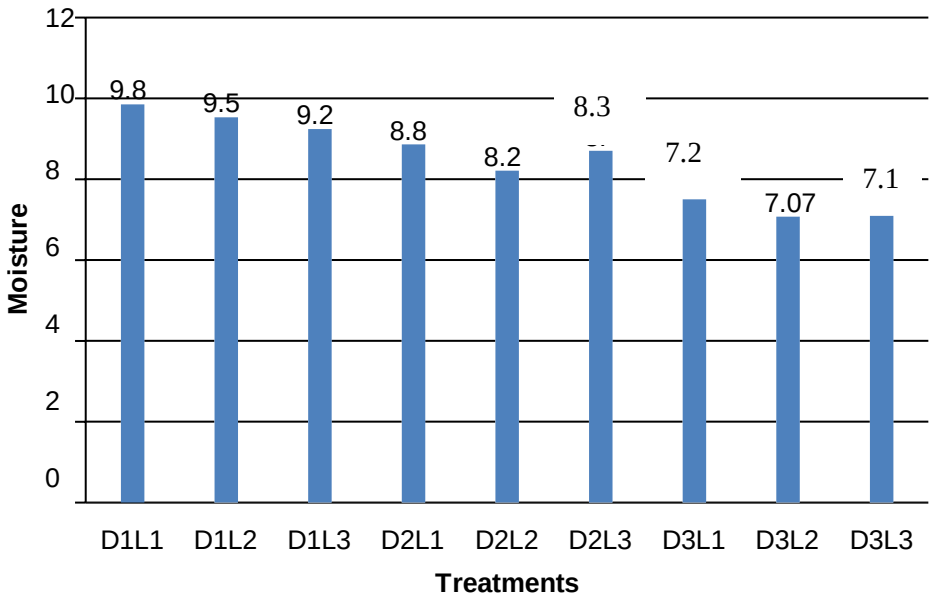

Figure 1. The moisture content of oil palm press fiber fermented by local microorganism

The mean value of the moisture of oil palm press fiber fermented with various doses of local microorganisms and fermentation time ranged from 7.07 - 9.85%. This value is higher than the moisture content of oil palm press fiber with ammonia ranging from 91.23 - 94.24% [5].

The results of the analysis of variance showed that the treatment of various doses of local microorganisms had a significant effect ($P < 0.05$) on the moisture content of oil palm press fiber fermented and the duration of fermentation had a significant effect ($P < 0.05$) on the moisture content of fermented oil palm press fiber, but there was no interaction between various doses of local microorganisms and duration of fermentation. The higher the dose of local microorganisms and the duration of fermentation, the lower the water content of the fermentation. It is suspected that the decrease in water content occurs due to the presence of a water component that is wasted during the overhaul of organic compounds due to microbial activity and with the longer the fermentation process, the less degraded starch source causes the water-holding capacity to decrease.

According to [6], in the fermentation process, most of the water will be left in the product and some will leave the product. [7] states that the longer the fermentation takes place,

the water content decreases, this is because during fermentation there is the degradation of starch by microorganisms which causes a decrease in the ability of the material to retain water so that more bound water is freed, as a result, the texture of the material becomes soft and porous.

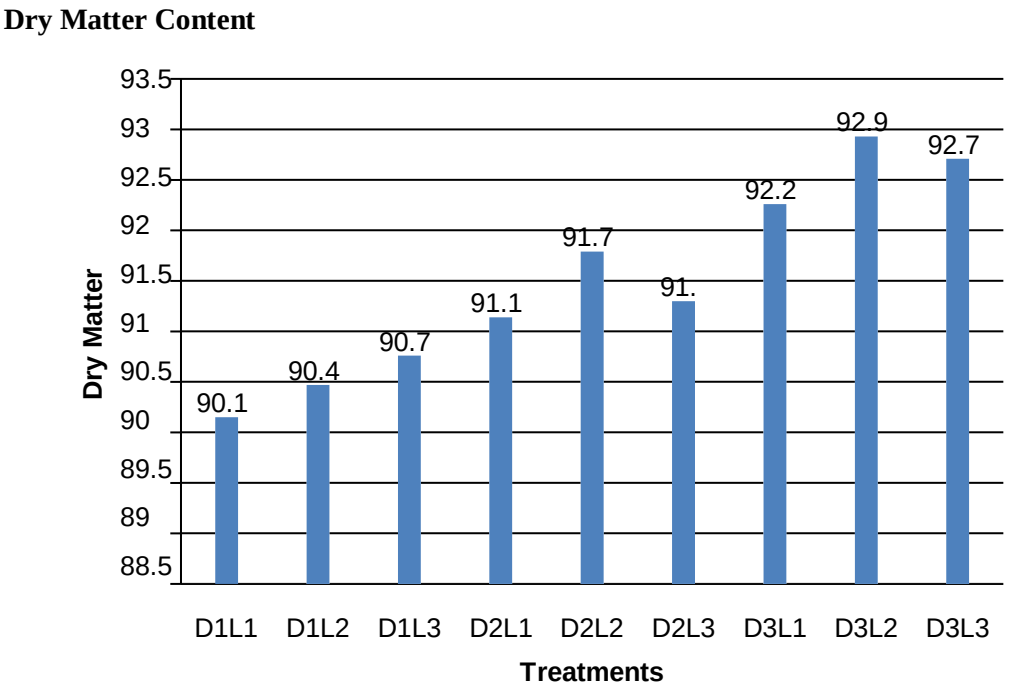

Figure 2. Dry matter content of oil palm press fiber fermented by local microorganism

The mean value of dry matter content of oil palm press fiber fermented with various doses of local microorganisms and fermentation time ranged from 90.15 - 92.93%. This value is lower than research by [2] which states that the dry matter content of oil palm fiber with the addition of buffalo feces is around 97.62% - 97.69%.

The results of the analysis of variance showed that the treatment of various doses had a significant effect ($P < 0.05$) on the dry matter content of fermented oil palm press fiber and the duration of fermentation had a significant effect ($P < 0.05$) on the dry matter of oil palm fiber fermented, but there was no interaction between various doses and fermentation time. The higher the dose, the higher the value of dry matter content, this is thought to be the activity of reducing the water content of fermented coir due to the process of overhauling the complex molecules into their simple structure. According to [8], a series of biochemical reactions occurs in the fermentation process which converts dry matter into energy (heat), water molecules (H_2O), and CO_2 so that the dry matter content decreases.

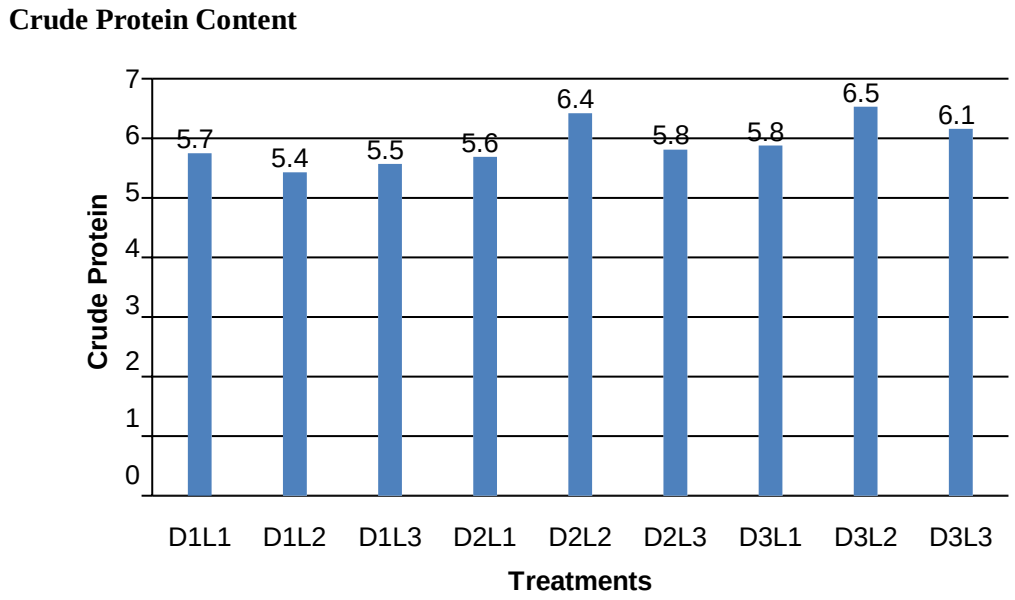

Figure 3. The crude protein content of oil palm press fiber fermented by local microorganism

The mean value of crude protein content of fermented coir with various doses of local microorganisms and fermentation time ranged from 5.43 - 6.53%. Research [2] stated that crude protein content was higher in the range of 12.04 - 14.79%. Furthermore [5] showed a lower crude protein value of 5.35%.

The results of the analysis of variance showed that there was an interaction between dose of local microorganisms and fermentation time on the crude protein content of fermented coir ($P < 0.05$). The best combination of local microorganism dosage treatment and fermentation time was at D_3L_2 which showed a significant effect on the increase in a crude protein of oil palm press fiber up to 6.53%. Based on the results of the study, it is known that the higher the dose and duration of fermentation, the higher the crude protein content. This is presumably by increasing the dose of local microorganisms in a span of up to 14 days, the microbes derived from local microorganisms can reproduce well so that they work actively for microbial metabolism. According to [9] and [10] stated that the increase in crude protein levels was in line with the increasing percentage of inoculums, the addition of inoculums containing microbes consisting of nitrogen-containing elements so that they were counted as proteins.

The crude protein content of oil palm fiber fermented with various doses of local microorganisms and fermentation time has increased, this is thought to be the activity of fiber-degrading enzymes so that microbes can reproduce properly by utilizing energy from the

synthesis of substrate fibers to form single cell protein (SCP). The process of forming single cell proteins in microbial coir fermentation produces enzymes that help in the process of substrate degradation. This is following [11] which states that the increase in crude protein is caused by the presence of enzymes produced by microbes such as protease, lipase, amylase, cellulase, glucoamylase, hemicellulase, pectinase, oxidase, and catalase which change the composition of compounds resulting in changes in chemical composition. the substrate is simpler.

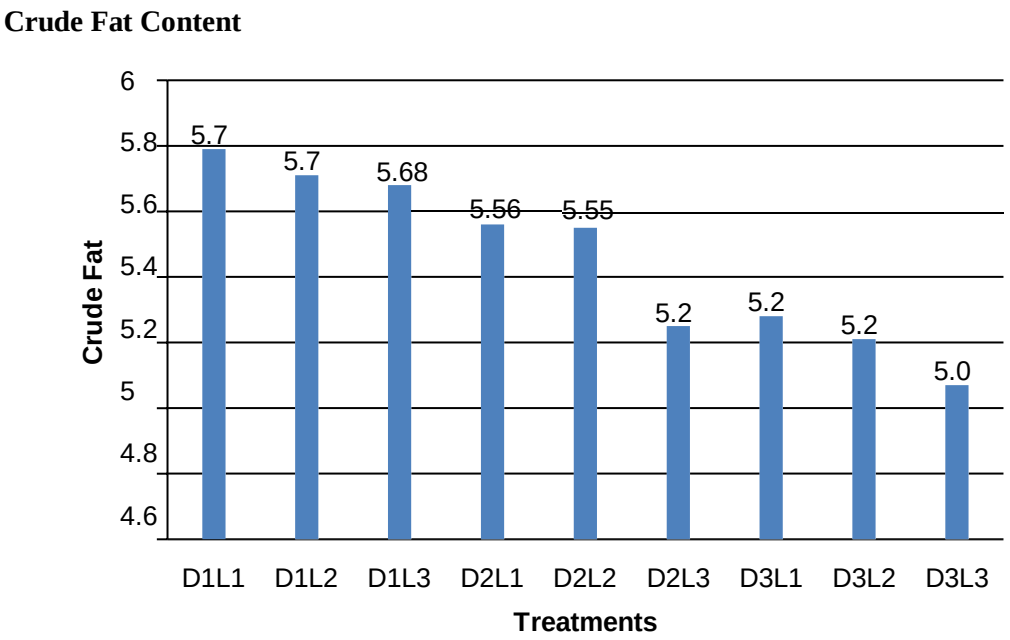

Figure 4. The crude fat content of oil palm press fiber fermented by local microorganism

The mean value of crude fat content of fermented coir with a dose of local microorganisms and fermentation time ranged from 5.07 - 5.79%. This value is relatively the same as crude fat before fermentation of 5.75%, but lower than studies [5] and [12] which state crude fat ranges from 7.04 - 16.03% and 7.60%.

The results of the analysis of variance showed that the treatment of various doses of local microorganisms, fermentation time, and the interaction of the two factors had no significant effect (P> 0.05). The insignificant change in the crude fat content of fermented coir is suspected to be the microbes that play a role in producing the enzyme lipase have not reached the maximum phase so that it has less role in breaking down fat. [13] explained that bacteria that are still in the log phase, namely the cell division phase where slow cell division causes substrate utilization is not optimal, resulting in lactic acid bacteria (LAB) that grows slightly so

that lactic acid bacteria (LAB) that grows has not reached the fast growth phase, which implies that the breakdown of fat has not occurred. fatty acids and glycerol as a source of microbial energy.

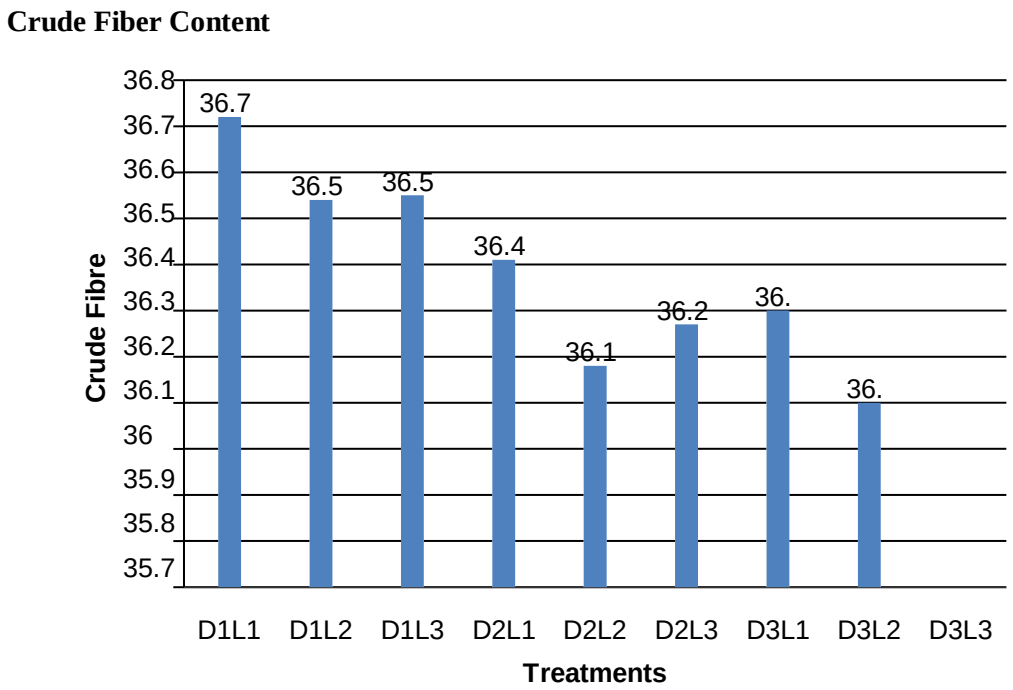

Figure 5. The crude fiber content of oil palm press fiber fermented by local microorganism

The mean value of crude fiber content of fermented oil palm fiber with a dose of local microorganisms and fermentation time ranged from 36.10 - 36.72%. %. This study is in line with research [2] ranging from 35.79 to 36.67%.

The results of the analysis of variance showed that the treatment of various doses had a significant effect ($P < 0.05$) on the crude fiber content of fermented oil palm press fiber and the duration of fermentation had a significant effect ($P < 0.05$) on the crude palm fiber fermentation, but there was no interaction between various doses and fermentation time. Crude fiber content

decreased along with the addition of the dose of local microorganisms and fermentation time in the treatment being tried. This is thought to increase the number of doses and length of fermentation together to increase the ability of microbes to digest fiber to be higher.

According to [14], the higher dose of local microorganisms and the longer the fermentation took place, the higher the mass of cellulolytic microbes that live on the substrate, the more enzymes lipase that degrade cellulose and lignocellulose are produced, where the enzyme can degrade cellulose molecules.

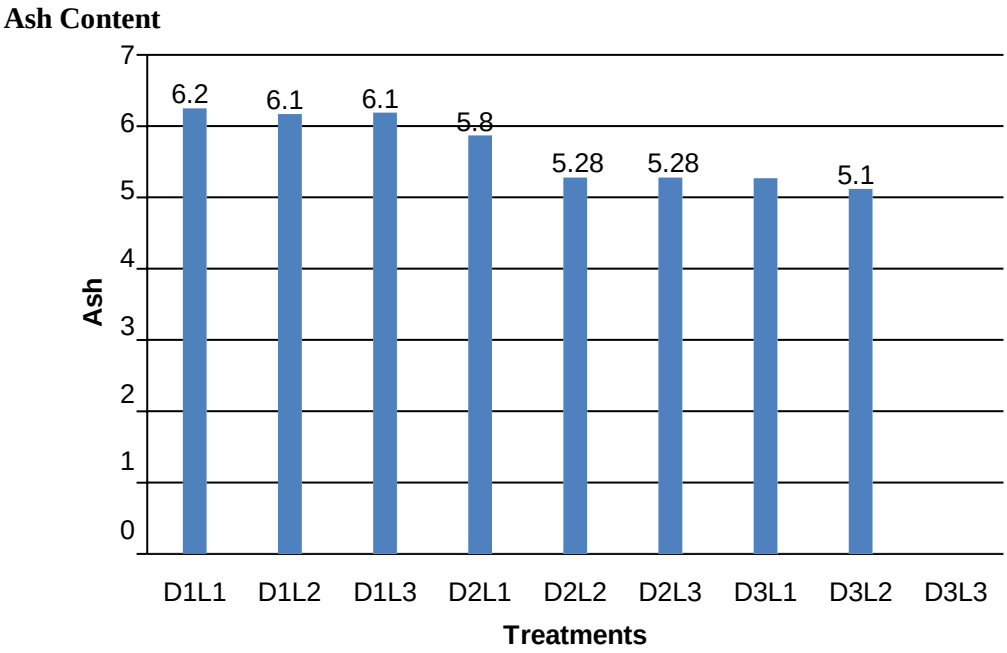

Figure 6. Ash content of oil palm press fiber fermented by local microorganism

The mean value of the ash content of fermented oil palm press fiber at various doses of local microorganisms and fermentation time ranged from 5.12 - 6.25%. This value of ash content was lower than the study [9] ranging from 7.89 - 16.99% followed by a study [2] ranging from 9.24 - 10.83%.

The results of the analysis of variance showed that the treatment of various doses had a

significant effect (P <0.05) on the ash content of oil palm press fiber fermented and the duration of fermentation had a significant effect (P <0.05) on oil palm press fiber fermented ash, but there was no interaction between various doses and fermentation time. The ash content of fermented oil palm press fiber has decreased due to the increased activity of degradation of organic matter. It is assumed that the utilization of the proportion of organic matter in the fermentation process is quite high.

According to [2], the mineral content of the substrate/material used and the addition of inoculum in the fermentation in line with the contributed minerals affect the ash content. Followed by [15] which states that the less organic matter is degraded, the less there will be a proportionate decrease in the ash content, conversely, the more organic matter is degraded, the more there will be a proportionate increase in the ash content.

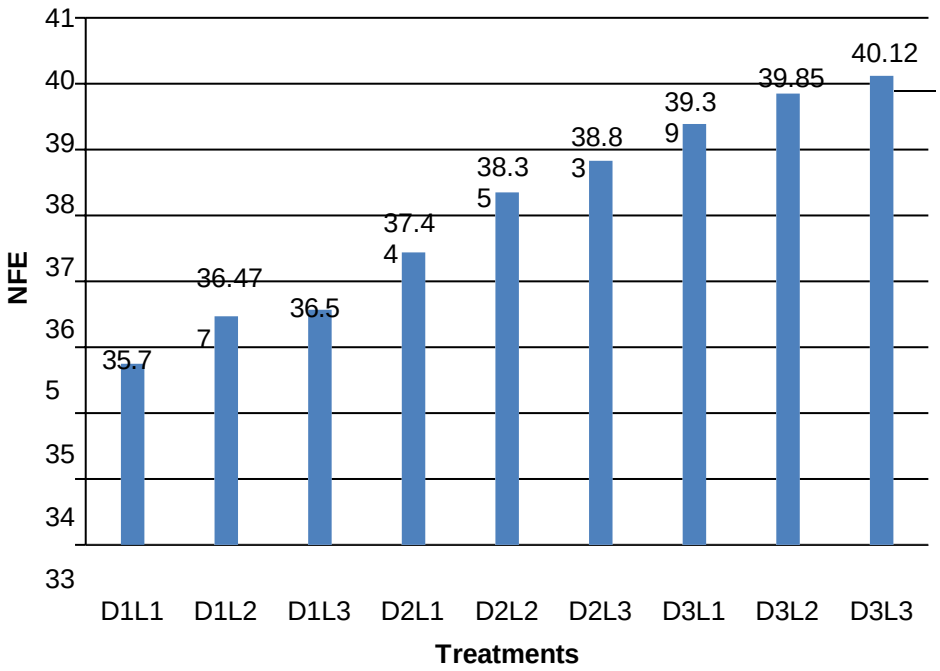

Figure 7. The NFE content of oil palm press fiber fermented by local microorganism

The mean value of the NFE content of fermented oil palm press fiber with a dose of local microorganism and fermentation time ranged from 35.75 - 40.12%. This NFE value is higher than studies [2] and [9] ranging from 31.94 - 35.70% and 17.83 - 20.21%.

The results of the analysis of variance showed that the treatment of various doses of local microorganisms and fermentation time had a significant effect ($P<0.05$) on changes in the NFE content of fermented oil palm press fiber. However, there is no interaction between these two factors. The higher the dose and duration of fermentation had a significant effect on increasing the NFE value of fermented oil palm press fiber. It is suspected that the growth and development of substrate-degrading microbes also increased with the addition of doses of local microorganisms and fermentation time. According to [16], the more organic matter that is degraded in the fermentation process, the lower the ash content will be. The impact of this is an increase in NFE.

4. Conclusion

The results showed that the combination of treatment with a 5% dose of local microorganism and 14 days of fermentation time could increase the value of crude protein content up to 6.53% but the treatment had not yet affected the nutrients of oil palm press fiber in increasing the dry matter content, and the nitrogen free extract (NFE) and reduced water content, crude fat, crude fiber, and ash.

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