



Nutritional Content of Bromelain Enzyme Fermented Coconut Dregs as Feed for *Oreochromis Niloticus*

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Abstract

The aims of the study is to nutritional content of bromelain enzyme fermented coconut dregs as feed for *oreochromis niloticus*. The research procedure bromelain enzyme preparation, coconut dregs fermentation process, experimental design. The result of the research is the proximate test that has been carried out on coconut pulp that has been fermented using the bromelain enzyme, it reveals many things. Namely, the water content and ash content of the coconut pulp that has been fermented using the bromelain enzyme is deemed excellent since it displays a value of less than 12 percent . It is different with crude protein which is less than the National Norm on feed since it only displays a value of 6.20 percent when the standard is 20-35 percent . Another with crude fat and crude fiber. Crude fat and crude fiber in coconut dregs that have been fermented with bromelain enzymes have risen and are far from standard. The normal crude fat is only 2-10 percent , whereas the crude fat in coconut pulp after fermentation with bromelain enzymes is more than 20 percent . And the normal crude fiber is only 4-18 percent , this is less than the crude fiber in fermented coconut pulp because it displays more than 29 percent.

Introduction

This industrial waste from the coconut processing industry has a high enough level of feed ingredient to be used as a raw material for fish feed. Coconut production totals 19.5 billion grains per year, which is equivalent to 12.02 billion tons of coconut meat per year, and it is used as a feed ingredient for fish feed. As a result, for every 100 kg of coconut flesh processed for the production of pure oil, 19.5 kilogram of coconut pulp is generated. As a result of this, coconut pulp has been shown to be an excellent vegetable source for animal feed in many studies, but has not been extensively utilized as a fish feed.

The low protein content and high crude fiber content of coconut dregs make them unsuitable for use as a fish feed ingredient. Coconut pulp contains 23.77 grams of carbs, which is a significant portion of its nutritional value. Fat 9.44 percent, water 13.35 percent, ash 5.92 percent, protein 5.09 percent, and crude fiber 30.40 percent; therefore, the use of fiber in fish feed should not exceed 8 percent to ensure that the digestive process absorbs sufficient food, and the use of protein for herbivorous fish should be 15-25 percent to ensure optimal growth in herbivorous fish.

Because pineapple extract containing bromelain can manufacture enzymes, including cellulose enzymes and protease enzymes, efforts to enhance the protein content while decreasing the fiber content of coconut flour are carried out via the method of fermentation technology utilizing bromelain.

The effect of bromelain enzyme activity on the production of amino acids in coconut pulp flour, and the effect of concentrations of 10 (Nanda et al., 2020). percent, 15 percent, 20 percent, and 25 percent on the production of coconut pulp protein, with a concentration of 25 percent

favoring the production of a large amount of soluble protein. It is anticipated that cellulose enzymes will be able to rebuild and relax lignocellulose and lignihemisellulose linkages, allowing coconut pulp to be more readily digested than previously thought. The bromelain enzyme, on the other hand, has been shown to enhance the protein content of coconut pulp by hydrolyzing protein into simple molecules in the form of amino acids (Damodaran, 2008).

Research Functions and Benefits

This study was carried out in order to establish the optimum fermented bromelain dosage for the nutritional content of coconut pulp as tilapia feed in order to discover an alternative feed for tilapia in order to find alternative feed for tilapia (*Oreochromis niloticus*). This coconut dregs may also be used to provide information to the topic of agriculture regarding the role of household trash included within it.

Its body model and tail fin, as well as its elevated back and flat spherical body, have all been seen in Tilapia (*Oreochromis niloticus*). Tilapia has been shown to have a straight line (vertical). In order for the tilapia (*Oreochromis niloticus*) to be able to survive in fresh water, it must have a tail to move, as well as pelvic fins, pectoral fins, and rigid gill covers to support its body. Fish have 5 fins, which are classified as dorsal fins, pectoral fins, ventral fins, anal fins, and caudal fins. Dorsal fins are the largest and most prominent. Dorsal fins are large and extend all the way from the gill cover up to the tip of the tail fin. In addition to a pair of tiny pectoral and pelvic fins, there is just one anal fin, which is very large and fairly lengthy. The number of tail fins on the other hand is just one, and it is a spherical fruit in form.

Methods

Research Procedure

Bromelain Enzyme Preparation

Using a grater to smash the pineapple cob, a solution of pineapple bromelain extract containing protease enzymes is obtained. The protein content of the extract is then determined by comparing the absorbance of the bromelain enzyme extract with the standard curve of gelatin, which is a standard curve of gelatin (Gil & Maupoey, 2018). By using a spectrophotometer, researchers were able to determine the amount of protein present in the bromelain enzyme extracted from the crude extract of pineapple weevil. The transmitter or absorbent of a blank or comparison solution will be measured by the spectrometer, and the protein content will be determined both quantitatively and qualitatively by the spectrometer (Smirnova et al., 2020).

Coconut Dregs Fermentation Process

A preset dosage of bromelain enzyme was added to dried coconut dregs, which were then placed in a fermentation container and vacuumed to eliminate any air. After that, the fermentation container was securely covered and left to incubate for one week at 37 degrees Celsius.

Experimental Design

Using the following dosages of the bromelain enzyme, we will examine the changes in the nutritional content of fermented coconut pulp with the bromelain enzyme in this descriptive study. Treatment A is performed without the use of the bromelain enzyme. Treatment B included the administration of bromelain enzyme at a concentration of 1.5 mL/100g coconut dregs. Treatment C received a dose of bromelain enzyme equivalent to 1.75 mL/100g coconut dregs. Treatment D included the administration of bromelain enzyme at a concentration of 2.0 mL/100g coconut dregs

Results and Discussion

According to Table 2, the following are the findings of the proximate analysis performed on the nutritional content of coconut pulp fermented by bromelain enzymes in each treatment:

Table 2. Proximate analysis of coconut pulp fermented by bromelain enzymemel.

Treatment	Composition (%)				
	Protein	Fat	Coarse Fiber	Air	Abu
Before Fermentation	5,20	31,29	18,69	3,92	1,60
A (0 ml/100g)	6,20	22, 61	35,29	8,50	1,25
B (1,5 ml/100g)	5,51	26,80	36,28	8,74	1,23
C (1,75 ml/100g)	5,56	24,41	29,03	8,87	1,28
D (2 ml/100g)	5,47	26,84	33,31	8,92	1,37

After fermentation with bromelain enzyme, the crude protein content of unfermented coconut pulp increased to 5.20 percent, with an increase in protein content after fermentation with enzyme. Crude protein levels in treatment A (0 ml/100 mg) increased to 6.20 percent, while those in treatment B (1.5 ml/100 mg) decreased to 5.51 percent. Crude protein levels in treatment C (1.75 ml/100 grams) increased again by 5.56 percent, and those in treatment D (2.0 ml/100 mg) decreased again by 5.47 percent, indicating that the treatment was effective. According to the data in the table above, there are variations in the protein content of coconut pulp depending on the concentration of the bromelain enzyme extract used, which varies from the content. Treatment A yielded the greatest concentration of crude protein. This showed that the high quantity of bromelain enzyme extract that had been added did not correspond to the rise in protein content that had occurred. Because the addition of bromelain enzyme extract in treatment D (2 ml/100 g) resulted in a decrease in protein content, this indicated that the activity of bromelain enzyme in hydrolyzing proteins had decreased. Bromelain enzyme is an enzyme that works optimally at a specific concentration, and its activity will decrease if the concentration is saturated. While crude protein in treatments A, B, C, and D is not more than 6.20 percent, the results of the proximate test on coconut dregs that have been fermented using bromelain enzymes in treatments A, B, C, and D have a value that is significantly less than the National Standard on fish feed, which is 20-35 centigrams per kilogram of dry matter (dry matter).

Fermentation of coconut pulp with bromelain enzymes results in a reduction in crude lipid content, according to the researchers. After fermentation, crude fat in unfermented coconut pulp decreased to 22.61 percent in treatment A (0 ml/100g), increased to 26.80 percent in treatment B (1.5 ml/100 mg), then decreased again to 24.41 percent in treatment C (1.75 ml/100 mg), and then increased by 26.84 percent in treatment D (2.0 ml/100 mg). It was discovered that the fat content of coconut dregs fermented with the bromelain enzyme was lower than that of the same feed fermented without the enzyme. This is most likely because the fermentation process is designed to reduce fat content of the feed, and also because there is activity during the storage process, which means that the fat content tends to be low. The longer the feed is withdrawn, the more the crude fat substance grows. This is due to the combination between lowering the quality of natural components utilized by bacteria to build fat and increasing the length of time the feed is withheld. In addition, increasing the concentration of bromelain compounds has been shown to lower crude fat levels. This is because the chemical bromelain concentrate has the ability to resist the oxidation reaction. Flavonoids, which are found in abundance in this bromelain catalyst remover, have been shown to have cancer-preventive properties. In support of this, Ayunda (2014) concluded that the flavonoids present in a material

serve as a distinctive cell reinforcement capable of inhibiting oxidation interactions, which is supported by other research. Anti-cancer drugs work by interfering with the oxidation of fat in the body's metabolic system. It is possible for free extremists to have their oxidation reactions delayed or inhibited in the presence of cancer-prevention medicines. If cancer-preventive medicines were not available, the fat-oxidation reaction would be terminated by the free-extremist response. Using the chemical bromelain, the general test results for aged coconut residues revealed a value that was significantly lower than the National Standard in terms of maintenance, specifically 2-10 percent, whereas the general test for each of the four treatments revealed an estimate of more than 20 percent.

After being fermented with the bromelain enzyme, there was a statistically significant increase in the crude fiber content of the coconut pulp. When the crude fiber was not fermented, it was only 18.69 percent. When the crude fiber was fermented, it was 35.29 percent in treatment A (0 ml/100 g), 36.28 percent in treatment B (1.5 ml/100 mg), 29.03 percent in treatment C (1.75 ml/100 mg), and 33.31 percent in treatment D (2.0 ml/100 mg). Combined soluble and insoluble fibers make up crude fiber, which is measured in grams. Crude fiber is a component of carbohydrates that cannot be digested and is thus not a significant nutrition for marine fish (Krogdahl et al., 2005). Crude fiber will cause contaminants to accumulate in the culture container, but it is still required to aid in the expulsion of feces by the bacteria. The optimum crude fiber content for promoting fish development in tilapia is 4-18 percent, with 4 being the best value. Using the bromelain enzyme, coconut pulp was fermented, followed by the application of a proximate test. Crude fat was found to be higher than the optimal amount of crude fat required to support fish growth, which was 4-18 percent, and the proximate test results for each treatment revealed a value of more than 29 percent.

Following the fermentation of coconut dregs with the bromelain enzyme at various dosages, it can be shown in Table 2 that the water content in each treatment increased as a result of the fermentation. During the fermentation process, the water content of coconut pulp decreased to 3.29 percent. While this was happening, after fermentation with the addition of bromelain enzyme, the water content increased to 8.50 percent in treatment A (0 ml/100 g), 8.74 percent in treatment B (1.5 ml/100 g), and 8.87 percent in Treatment C (1.75 ml/100 g), while it increased to 8.92 percent in treatment D (2 ml/100 g). The water content in issue is the quantity of water included in the components of feed, which in this instance is coconut pulp in this case is coconut pulp (Prades et al., 2012). The proximal test is used to determine the amount of water present (Barrett et al., 2010). Following the completion of the proximate test, it will be possible to determine the water content of the coconut pulp before and after it has been fermented. According to the National Standard on Fish Feed Standards, the amount of water included in the feed is less than 12 percent of the total amount of feed. Treatments A, B, C, and D, in which fermentation had been carried out, had excellent water content values since the water content was less than 12 percent in each of these treatments. When a material has a low water content, it may be used to create a stockpile limit, which reduces the likelihood of a danger during the treatment of the binder.

The ripening of the coconut residue results in an increase in the amount of flake in the final product. Prior to ripening, the impurities in the remaining coconut were 1.06 percent; however, after aging, the impurities increased to 1.24 percent in treatment A (0 milliliters per 100 grams), 1.23 percent in treatment B (1.5 milliliters per 100 grams), 1.28 percent in treatment C (1.75 milliliters per 100 grams) and increased to 1.37 percent in treatment D (2.0 milliliters per 100 grams). Because of the inclusion of coconut residues, it is possible that mineral compounds included in these waste products may emerge. The higher the mineral concentration, the greater the amount of debris transported. The debris content indicates the size of the mineral substances

contained in the feed binder, because minerals are inorganic substances that do not consume during the ignition cycle (Kijo-Kleczkowska et al., 2016). The debris content indicates the size of the mineral substances contained in the feed binder (Sulistiyanto et al., 2018). The remaining ripe coconut, along with a bromelain catalyst, will aid in the growth of microorganisms, and the minerals found in the bodies of microbes will aid in the organization of their bodies. Bacteria need certain minerals for the growth and digestion of food (Heo et al., 2013). Microbes need some kind of mineral in order to assist them alter the course of events (Burns et al., 2013). Due to their values being less than 12 percent in the presence of aging, the residues of treatments A, B, C, and D demonstrated an appropriate value.

Nutritional Needs of Tilapia

Assumption of the food required by fish, particularly protein, carbohydrate, and fat. Improper nutrition may influence improvement, for example a little protein causes fish utilize protein hotspots mainly for fundamental functions and little for development. The protein content is high, making protein squandered and creating a rise in the salt level that can be smelled in the water. Fish feed requirements will be fulfilled by the availability of protein in the feed. Proteins are complexes composed of fundamental amino acids which are a combination of sub-atoms comprising amino (-NH₂) and carboxyl (-CO₂H) and virtually negligible connections.

Carbohydrates are the biggest natural group found in plants, consisting of components (Mudgil& Barak, 2013). C_n (H₂O)_n and carbohydrates are one of the segments that serve as energy sources for fish and effectively influence protein. Sugar breaks down more rapidly in liquids and may be used as a paste to improve feed density. The lack of carbs and fats may cause development to be hindered since fish utilize protein as a source of fuel for fat and carbohydrates which should be a source of fuel. The demand for carbohydrates that have a high limit and the mobility of amylase components in tilapia will influence the rise in starch absorption (Sajina et al., 2019). Fatty substances are natural chemicals that include carbon (C), hydrogen (H), and oxygen (O) components as basic components. Some of them include nitrogen and phosphorus. Fat is important as a source of energy in exercise and makes a difference.

According to the growth requirements of tilapia, it may be found in the table. Accessibility of appropriate feed for the growth of tilapia must have choices to satisfy the health requirements of fish. Part of the healthy requirements of fish on a par with other animals, which play a part in the physiological and biochemical structure of everyday activities, including (O-fish, 2007): a. Protein Protein is required by fish in sustaining body cells, replacing damaged body tissues, tissue development, and may be utilized as a source of backup energy, fish protein requirements in general vary from 35-50 percent . Carnivorous fish protein requires 40-50 percent and 25-35 percent omnivore. The protein needs of each species of fish is varied, which is affected by many variables, including fish size, water quality, quantity of feed consumed by fish, availability and quality of feed and protein quality. In general, fish require fish that need food with protein levels ranging from 20-50 percent , if the protein in the feed is less than 6 percent, the fish cannot develop.

Fat

Fat is the primary source of energy in digestion, maintains the form and capacity of cell layers or tissues that are essential for specific organs, assists in nutrition retention, keeps the body light, and acts as a cancer prevention agent. Fats in feed have an essential role to perform, since they provide as a source of energy and fundamental unsaturated fats. From the survey findings, it is known that a high source of fat is present in coconut cake 24.7 percent . Most fish need

feed with a fat level of about 4-8 percent . The fat requirement for freshwater fish varies from 4-8 percent . And according to fish food regulations at least 3 percent . The development of tilapia will appear excellent if it is fed with a balanced feed nutritional composition, which includes protein, carbs, fat, vitamins, minerals and fiber.

There is an energy source that is mainly produced by plants via the photosynthesis cycle. Fish requirement for starch is highly depending on the kind of fish. Meat-eating fish expect a 9 percent decrease in starch, omnivore fish need up to 18.6 percent carbs and herbivorous fish require higher carbohydrates, reaching 61 percent . Previously, dietary carbohydrates were polysaccharides, disaccharides, and monosaccharides. Because fish do not have saliva, the process of producing sugar starts in parts, but is severe in the region of the gut that contains pancreatic amylase molecules.

Many carbohydrate molecules have a role in intestinal fragmentation, including amylase, lactase, cellulase, and others. Starch and glycogen are digested by amylase molecules to produce maltose and dextrin. Maltase and dextrin will be hydrolyzed by lactase a-limit dextrinase protein into glucose. Disaccharides are digested by lactase or sucrase molecules to generate galactose, glucose, and fructose. Cellulose will be degraded by chemical cellulase into cellulose, then cellulose will be hydrolyzed by cellulose protein into glucose. In this kind of glucose, carbs may be absorbed by the intestinal divider. Once absorbed by cells, glucose may be rapidly transformed into energy or stored as glycogen. The primary route in starch digestion is pyruvate which may be converted to lactate without the requirement for oxygen (anaerobic glycolysis) (anaerobic glycolysis). However, under specific circumstances such as in rapid swimming, energy may be raised even if the quantity is modest while believing that the respiratory system would be redirected by the additional oxygen. This anaerobic reaction ultimately produces lactate such that lactate will build (particularly in muscle tissue) until oxygen can be utilized. Lactate interaction, oxidation, will be transformed into carbon dioxide.

Nutrition

Very little quantities are required, particularly for health pleasures for the growth of fish. Satisfactory nutrients are required for digestion, more particularly as coenzymes. Based on the real characteristics, nutrients may be classified into two categories, into particular water-soluble nutrients, including nutrients B and C, and fat-soluble ones, including nutrients A, D, E, K. Nutrients in feed for normal growth, bodily care, and generations. Nutrients are unexpected natural combinations, usually tiny atomic size. Nutrients are needed by fish in tiny quantities with the goal of maintaining them in modest levels in the feed (1 - 4 percent of the total feed segment) (1 - 4 percent of the total feed segment).

Mineral

The primary ability of minerals in the fish body is to control skeletal design, maintain colloidal framework (osmotic compression factor, thickness, dispersion), and direct corrosive base balance. Assimilation of specific minerals, as well as nutrients, minerals are required in restricted amounts. Minerals required for fish include calcium, phosphorus, sodium, manganese, iron, copper, iodine, and cobalt. Calcium and phosphorus are required for bone formation and to sustain proper tissue function. Iron is required for the organization of robust red platelets and manganese in the fertilization cycle.

Feed

Feed is a key element influencing the growth of tilapia. The protein content in the diet is a fundamental source of fuel such as cell segments and body tissues that underpin the growth of

tilapia. In the digestive process, components are required that can hydrolyze peptide bonds into amino acids. Amino acids are acquired from sources. proteins. Protein acquired from daily meals is broken down in digestion in the form of amino acids. Amino acid levels in coconut pulp waste may be raised, especially by fermenting coconut pulp using bromelain enzymes. The products of the fermentation are subsequently used as feed components for tilapia.

Coconut Pulp

Coconut Residue Until now, the primary product of coconut which is extensively utilized by the community is its organic product to be used as oil. To be honest, aside from natural coconut products, other components that are left behind and not used are often termed trash. The remainder of the coconut is squandered from the process of producing coconut milk. In addition, the growth of coconut trees via animal husbandry is primarily carried out to drain coconut oil derived from organic product networks with side effects in the form of coconut residue. During the production of virgin coconut oil, the newly ground coconut flesh is then dried and pressed until the oil isolates. The outcome of 9 cycles of virgin coconut oil is coconut residue. The remainder of the coconut is a side effect of producing virgin coconut oil, it turns out that it has a pretty high protein level. This means the leftover coconut may be utilized and processed into feed. Coconut residue consists of 13.35 percent water, 17.09 percent protein, 9.44 percent fat, 23.77 percent sugar, 5.92 percent flakes, and 30.4 percent unprocessed fiber. The crude material included in coconut residue reaches 23 percent , and the fiber content that can be absorbed efficiently is helpful in producing coconut residue as a feed regulator.

Compound

Chemicals are protein-strengthening chemicals produced from protein components and are also synergistic which have a boost in utilization to speed up the metabolic cycle in the creature's body. For what reason is this segment so essential in the metabolic cycle, it will not be expedited by reducing the activation energy needed for the metabolic reaction to be started. The characteristics of reactants are chemical qualities that distinguish various chemicals and proteins. Synergistic characteristics are derived from the cofactor groups which may be natural mixes (coenzymes and prosthetic junctions), or inorganic mixtures (metal particles) (metal particles).

The way proteins function in metabolic responses in the live organism is by decreasing the initiation energy, which is the energy that should be available to start the response. By reducing the "cost", the interactions that form will also be considerably quicker.

The way enzymes function in speeding chemical processes is by interacting with the substrate, after which the substrate will be transformed into a product. When a product is produced, the enzyme will be able to separate itself from the substrate. This is because the enzyme cannot react with the substrate. There are two theories that explain how enzymes operate, the theory is the lock and key theory and the theory of induction.

Enzymes play a very significant function in a chemical process. As stated, the purpose of enzymes is to speed up a chemical process in the organism's body. Without enzymes, the metabolic process is excellent. Anabolism and catabolism will be disrupted. Apart from that, the nature of the enzyme that does not react with the substrate anymore is the most helpful in speeding chemical processes in the organism's body.

Bromelain Enzyme

In specifically one of the protease chemicals, which is a molecule that catalyzes the breakdown of proteins into amino acids by forming blocks via the hydrolysis reaction. Hydrolysis (hydro

= water; lysis = release or interruption / breakdown) is the breakdown of extremely big particles into simpler components using a combination of water. In protein processing, 56 peptide bonds are broken by the insertion of water segments, -H and -OH, in the final chain.

In particular the endopeptidase chemical has a dynamic on-site sulfhydryl (-SH) collecting. These chemicals are typically derived from pineapple plant tissue. This protein functions by oxidizing chemicals, alkylators and heavy metals. Bromelain chemicals are extensively utilized in the food and non-food sectors, such as canned meat, drinks and others.

The bromelain chemical from pineapple plant tissue has the same intensity as papain found in papaya which is able to digest protein up to many times its weight. Bromelain may be derived from pineapple plants both from stems, skins, leaves, natural products, and stems in different quantities. The protein concentration is greater in the organic product tissue, this is shown by the increased movement compared to the action on the stem.

The protein content of bromelain is adequate, there are portions of the stem that are presently underused. The transportation of bromelain on pineapple stems is asymmetrical and relies on the age of the plant. The bromelain content in old tissues, particularly the sticky ones, is practically non-existent or even absent altogether. Bromelain compounds may be liberated by separating cells by centrifugation and then decontamination is done by techniques for testing, gel filtration, and particle trafficking chromatography.

There has also been considerable investigation of bromelain. Utilizing cation exchange chromatography and section electrophoresis in Sephadex G-100 reported that bromelain from pineapple was separated into five proteolytic dynamic segments. The subatomic load of bromelain from pineapple stems by sedimentation dispersion ultracentrifugation and achieved an estimate of 33000 Da. Five proteolytic active components of pineapple tail bromelain are glycoproteins with sub-atomic loads varying from 18,000 to 28,000 Da. While bromelain from pineapple crash comprises of two components which has proteolytic activity. Each of these segments has an atomic charge of 28,000 and 19,000 Da, with the amino terminals being the amino acids valine and alanine. The carboxyl terminal is something comparable, to be more precise the amino acid glycine. Bromelain is a thiol protease that is broken off from pineapple and includes one oligosaccharide asparagine linked to an oligosaccharide chain. Each oligosaccharide atom consists of mannose, fucose, xylose, and N-Acetylglucosamine (Glcnac).

Conclusion

Based on the findings, the proximate test that has been carried out on coconut pulp that has been fermented using the bromelain enzyme, it reveals many things. Namely, the water content and ash content of the coconut pulp that has been fermented using the bromelain enzyme is deemed excellent since it displays a value of less than 12 percent . It is different with crude protein which is less than the National Norm on feed since it only displays a value of 6.20 percent when the standard is 20-35 percent . Another with crude fat and crude fiber. Crude fat and crude fiber in coconut dregs that have been fermented with bromelain enzymes have risen and are far from standard. The normal crude fat is only 2-10 percent , whereas the crude fat in coconut pulp after fermentation with bromelain enzymes is more than 20 percent . And the normal crude fiber is only 4-18 percent , this is less than the crude fiber in fermented coconut pulp because it displays more than 29 percent.

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