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Physical Processing of Cereal Grain as Fish Feed Filler

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ABSTRACT: The use of raw materials for fish feed requires fillers that can come from carbohydrate sources as raw materials in the form of flour, mixed into pellets. Cereal grains such as rice, corn, wheat, and sorghum are popular as food, some of which are used as feed ingredients because they contain a lot of carbohydrates and are easy to form after being in the form of flour. This review aims For a review of the processing physiology of grain cereals, reviewed from changes in nutrition and its potential as filler material for fish pellets. Processing the physique becomes form flour on grains can repair the nutrition, reducing anti-nutrients, expanding the surface so that it is easy to digest. Its use in fish pellets up to a level of 39% can be used as filler material for fish feed.

KEYWORDS: Cereal grains, fillers, physical processing

1. INTRODUCTION

Seeds from the cereals group are a type of food origin plant that comes from seed plants (Angiosperms) and plays an important role in human and animal nutrition. Seeds and cereals are the main sources of carbohydrates as fillers for fish pellets. They play an important role in providing cheap energy; in addition, seeds of cereals also have various uses in the food and agricultural industries. Physical processing of cereal grains is an important process in the food industry that aims to produce processed products from grains such as wheat, rice, corn, and so on. This process involves a series of steps such as cleaning, separating, milling, and sieving to produce flour, wheat, glutinous rice, or other grain products. This physical processing may also include drying, storing, and packaging to maintain the quality and shelf life of the product. Physical processing of grains in food is to improve the quality of the end product, for food safety, for the utilization of resources, ease of further processing, for increase shelf life, for consumer satisfaction, and regulatory compliance.

Cereal grains are widely grown for food needs; however, knowledge is needed for farmers about the potential of grains from physical processing and their by-products for fish feed. This is considering the increasingly limited land allocated for the provision of feed ingredients. In addition, generally, plant-based feed ingredients, including grains, are related to the bulky properties of the ingredients, so knowledge about the physical processing aspects is very important.

The purpose of this review article is to examine the various physical processing methods of grain cereal which can affect the nutritional content in grains and their potential as fish feed material.

The method used is the descriptive method by reviewing libraries from various research journals. The type of literature studied is a journal study, assembled, and an effective method for processing grains and cereals that are used as fish feed. The results of the search journal were made into a reference in writing this and the next review.

2. MATERIALS AND METHODS

Physical processing is an effort to change the nature of the feed through a process or treatment of temperature changes so that the feed at the end of the process will experience a decrease in water content. The processing process that can be carried out on cereal grains is physical processing, which includes drying, milling, reducing the size, steaming, soaking, and making pellets (Muchtadi, 1989).

Cereal grains are often used because they are a source of carbohydrates and can be easily found and obtained in the surrounding environment by cultivators. The disadvantage of cereal grains is that they contain a lot of fiber so that they require further processing so that they can be used as fish feed, but behind the many fibers in the grain skin contains alpha amylase-bound starch polysacharide, which can be utilized and the end of the endosperm/ germ in the end seeds, contains high protein, so that rice bran has higher protein content than rice.

Physical processing of feed is the change of form from grains/cereals into flour or other products. The main purpose of feed processing is basically to reduce the nature of feed adsorption (Christian et al. 1988). The advantages of pellet feed are increasing feed consumption and efficiency, increasing feed metabolic energy levels, increasing nutrient content, killing pathogenic bacteria,

reducing the amount of feed that is spilled, extending storage time, ensuring the balance of feed nutrients, and preventing vitamin oxidation.

The processing process is the process of changing the form of raw materials into finished materials or products that have different properties from the original materials, which aim to extend the shelf life and to create food diversification. The difference between physical processing and formulation lies in the stages,

2.1 Grain Drying

Drying is an important process in the preservation of feed ingredients, both in the feed industry and the agricultural processing industry. Its main purpose is to extend the shelf life of agricultural products, inhibit the physiological activity of grains, and save transportation costs. Drying can be done in two ways: naturally, using sunlight, and artificially, using a drying machine (grain dryer). The principle of this drying is to remove water from the material until it reaches a water content that is safe for processing or storage (Nur et al., 2022). Drying corn use machine dryer for a duration of 30 minutes resulted in a percentage decrease in water content from 22.83% to 18.38%. Meanwhile, in the research of Dure et al. (2016) who dried corn with a method involving air outside at relatively high temperatures with an average humidity relative to the air by 83.7%, the water content contained in corn decreased from 38.6% to 6.7%.

2.2 Immersion

Cereal processing, such as sorghum seeds, often requires soaking to facilitate subsequent processes, such as milling or cooking. Water absorption into seeds is very important in this processing industry. The amount of water absorbed during soaking is influenced by several factors, including initial water content, seed variety, soaking duration, temperature, and water acidity. Soaking can also improve the nutritional quality of some grains, because in sorghum seeds, soaking can reduce the content of tannin, which is anti-nutritional (Asropi et al., 2019). Kweon et al. (2009) found that wheat that has undergone conditioning with a water content of 12% for 3 days can produce a maximum yield of 71.48%. The soaking method of sorghum seeds using water at a temperature of 30˚C for 24 hours removes tannin content of 30%, while chemical material removes tannin by 70-80%. This tannin substance will influence more colors white in white sorghum seeds (Sabran et al. 2012), so it can be beneficial for food. However, the dividing factor from this tannin needs to be paid attention to its important aspect with attention to the food safety factor.

2.3 Bran milling and by-products

Rice bran is a by-product of the rice milling process in a rice milling factory. This bran has the potential as a fish feed ingredient. However, its nutritional content can vary depending on the rice milling process, where some factories separate the husk from the bran, and some mix them, so it is necessary to re-check the quality of the rice bran available on the market. Rice bran is widely used in making rations because it is available throughout the year and has good palatability in animals at an affordable price. Along with global and local competition, one strategy to reduce dependence on imported materials is to know the aspects of using alternative raw materials that are available sustainably, by paying attention to the quality and quantity of cereal grain materials. In the use of rice bran, there are two types of bran, namely bran without husk and bran with husk. Bran without husk own crude protein content of 9.16-9.83% and a rough fiber of 14.02-15.41% (Mila and Sudarma 2021, Haetami et al. 2022).

3. RESULTS AND DISCUSSION

Table 1. Several examples of physical processing methods for grain

Type of processing	Instrumentation/tools	Objective	Reference
Drying	microwave (oven) rotary dryer type machine rack-type machine (tray)	• Reducing the water content of the material to a certain limit, so that biological reactions stop and microorganisms and insects cannot live in it. • The maximum water content in feed is 10% because if it is more, it can stimulate the growth of fungi and microbes. • facilitate the process of processing raw materials into flour.	Taufiq 2004 Darmawiyanti, et.al 2005
Steaming	Machine dough steamer material feed	• improve nutritional value (release crude protein and anti-nutrient bonds). • reduce tannin content • increase density value	Asrofi, 2019
Milling	Roll Miles Hammer Mile Disk-mil	• Smoothing the ingredients, standard grains and other standard materials • Increase palatability to feed • Increase feed digestibility	Saputra, 2022
Warmup Mechanic	Grinding grains results dry air	• as sterilization • reducing antinutrients from the heat of the milling process	Murad, et.al. 2015

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The physical processing of cereal grains in changing the form through the grinding process into flour or other forms (Table 1). The advantages of physical processing are extending the shelf life of feed ingredients (Table 2), inactivating several anti-nutrients (eg: saponin in grains, tannin in sorghum, non-starch polysacharide in cereal grains and so on) (Asrofi, et al. 2019).

Formulation Feed is the calculation of the amount of raw materials that will be used to make fish feed, including the use of fillers from the physical processing of cereal grains. In preparing fish feed formulations, it is necessary to know some of the nutritional content needed by fish, namely protein ranging from 20-60%, fat 4-18%, carbohydrates consisting of crude fiber less than 8% and BETN 20-30%, vitamins and minerals ranging from 2-5%. The carbohydrate requirements of fish feed are classified according to their food habits, namely herbivores (40-60%), omnivores (30-40%), and carnivores (10-30%) (Haetami et al., 2021).

Table 2. Physical Processing of Nutritional Content

Types of Cereal Grains	Stages of Processing	Nutrient content	Reference
Corn (seed flour)	- Making corn rice - Dry Flour. - Adding yeast to tape - Use of lime solution	Water 17.02%, ash 4.21%, crude protein 10.57%, crude fiber 2.41%, and crude fat 4.60%.	Latif et al. 2022, Lapui et al. 2021
Sorghum (seed flour)	- Grain Testing Mill - Immersion (20%) - Air dry/stored (aluminum foil 12 hours) for water balance - milled (Pin Disc Mill).	Carbohydrates 80.42%, protein 10.11%, fat 3.65%, fiber 2.74%, and ash 2.24% The duration of grinding decreases functional properties, and palatability increases.	Suarni, 2004
Wheat (seed flour)	- cleaning - water addition (conditioning) - milling packing and storage	Carbohydrates 58.8-66.2%; crude protein 19.66%; crude fiber 6.84% and crude fat 4.8%	Haetami, 2021

Table 3. Research results processing products using grain cereals for fish feed

Material	Types of Animals	Presentation of giving (%)	Biological Influence	Source
Rice bran (dry method)	Parrot fish	10;20;25;24 & 39% on feed formulation	The use of bran can be done up to a level of 39% in formulation compared to commercial feed, which contains lower rough fiber.	Lestari et al. 2013
Corn flour (dry method)	Jelawat Fish	10%	Corn flour filler 10 % actually increases the final weight and daily growth rate of fish, with a growth rate difference of ± 2.5%.	2019
Steaming of rice bran 30" (wet method)	Milkfish (Chanos shanos)	30%	Reduce the phytate that can hinder protease enzyme activity. so that it increases the digestion of bran by fish, and has a positive impact on fish growth.	Arnol et al. 2019

Grain cereals can be beneficial as a standard basal protein source in fish feed. Some study results show improved growth in fish, but there are also those that don't give real influence. Required many process stages in milling grain cereals, depending on the ingredients, one of which is in the grains. The addition of watercan soften the endosperm of the grain so that when ground, it is easily crushed and produces finer flour. The physical form of the material can change to become smaller so that the fish can digest more easily and can influence fish growth. According to Lestari et al. (2013), bran, which is only ground, does not have a real influence on the growth of Tilapia fish, but in research by Arnol et al. (2019), steamed bran, moreover, gave a real influence to growth of Baronang fish.

4. CONCLUSIONS

Physical processing of cereal grains includes the process of reducing the size, soaking, and drying. The main purpose of processing cereal grains is to reduce the properties of ambe and antinutrients, and to facilitate further processing, as a filler in fish pellets.

Cereal grain milling from corn, wheat, and sorghum, which is processed into flour, and the by-products are used as standard material for making Fish pellets. Soaking and flouring method seed cereals used as pellet material composition up to 39% do not have a negative impact on fish growth .

REFERENCES

1) Afgani, CA 2023. Rice Flour Making Training in Parate Village, Samapuin District, Sumbawa Regency. Journal of Agro Community Dedication (JADM), 4(1), 23-27.
2) Aminah, S., & Hersoelistyorini, W. 2012. Chemical characteristics of cereal and legume sprout flour with blanching variations. In Proceedings of National & International Seminars (Vol. 1, No. 1).

3) Arnol, M., Rosni, R., & Rudi, A. 2020. Changes in the nutrition of fine bran with different steaming times as feed for barb (Siganus guttatus). Bulletin of Aquaculture Engineering, 17(1), 45-49.
4) Arsyad, M. 2018. Effect of Drying on the Rate of Water Content and Weight Decrease of Corn (Zea mays L.) for Bisi 2 and Nk22 Varieties. Agropolitan Journal. Vol 5, No. 1
5) Asropi, A. Bintoro, N. Karyadi, W, N. Rahayoe, S. Saputro, D, A. 2019. Kinetics of Changes in Physical Properties and Tannin Content of Sorghum Seeds (Sorghum bicolor L.) During Soaking. Agritech Journal. Vol 39, No (3)
6) Bachtiar, IY, & Lentera, T. 2002. Rearing of goldfish in yard ponds. AgroMedia.
7) Budiyanto, A. Rahmawati. Arif, A. Wijaya, E. 2021. The Effect of Softening Techniques to Yield, Whiteness, and Shape as well as Size of Sweet Sorghum Starch Granules (Sorghum bicolor (L). Moench). Journal of Food Technology. 3(1). Pages 55-59.
8) Dure, R. Wenur, F. Rawung, H. 2016. Drying Corn (Zea mays L.) Using a Dryer with Combination Solar and Biomass Energy. E-Journal of Sam Ratulangi University.
9) Haetami, K., Junianto, Abun. 2021. Fish Feed Nutrients and Formulation. Unpad Press.
10) Lapui, AR, Nopriani, U., & Mongi, H. 2021. Analysis of the nutritional content of corn flour (Zea mays Lam) from Uedele Village, Tojo District, Tojo Una Regency for Animal Feed. Agropet, 18(2), 42-46.
11) Mila, R, J,. Sudarma, A, M,. 2021. Analysis of Nutritional Content of Rice Bran as Animal Feed and Income of Rice Milling Business in Umalulu, East Sumba Regency. Tropical Livestock Bulletin. 2(2): 90-97 .
12) Murad, M, Sabani, R, Putra, GMD, 2015. Drying of Candlenut Seeds on Batch Type Dryer Model Furnace Based on Candlenut Shell Fuel. Scientific Journal of Agricultural Engineering and Biosystems, Vol.3, No. 1, March 2015
13) Latief, NS, Yamin, A, A. Syamsu, A, J. 2022. Quality Physical Results of Drying Corn as Feed Ingredients using Vertical Dryer Machine. Journal Scientific Agribios. Vol 20, No 2.
14) Pangaribuan, S. Nuryawati, T. Suprapto, A. 2016. Physical and Mechanical Properties and Effect of Polishing on Physical and Mechanical Properties of Sorghum Seeds Variety KD 4. Proceedings of the National Seminar on Agricultural Technology Development. Lampung State Polytechnic. ISBN 978-602-70530-4-5 pages 81-86.
15) Sabran, M. Gunawan, E., Hardono, Prabawati, S., Pitono, J., Sankarto, B., Wardana, IP, Mamat, HS, Rachmat, R., Romjali, E., Pardal, S., Wachid, and Hermawanto, R. 2012. Innovation Technology Builds Food Security and Well-being of Farmers. Research and Development Agency Agriculture: Jakarta.
16) Saputra, R. 2022. Design process for grain flouring machines using the Vdi 2221 method. Sainstech: Journal of Research and Studies in Science and Technology, 32(2), 55-66.
17) Suarni . 2016. The Role of Physicochemical Properties of Sorghum in Food and Industrial Diversification and Its Development Prospects. Journal of Agricultural Research and Development Vol. 35 No. 3. Pages 99-110
18) Surianti, Hasrianti. Putri, S, R. Wahyudi. 2022. Utilization of Local Raw Materials (Rice Bran) as Artificial Feed for Tilapia in Bulucenrana Village, Sidrap. Journal of Community Service. Vol, 2. No, 2. Pages 43-50
19) Yanto, H. 2019. The Effect of Feeding with Different Levels of Fine Bran and Fermented Yellow Corn on the Growth Performance of Jelawat Fish (Leptobarbus Hoevenii Bleeker). Ruaya Journal. Vol. 7.No. 1