



Evaluation of the Quality of Pumpkin Seed Flour and Capsules as Food Supplements

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ARTICLE INFO

eISSN: 2356-4067

DOI:10.30597/mkmi.v18i2.20847

Published online Jun, 2022

Keywords:

Capsules;

flour;

nutraceutics;

pumpkin seed;

ABSTRACT

Pumpkin seeds contain a variety of useful nutrients, so they become a food supplement. This study aimed to evaluate the quality of pumpkin seed flour and capsules. This study used the experimental method. The pumpkin used came from a local market in Makassar City. Cleaned pumpkin seeds-then dried in the sun for \pm 7 hours. After that, put them in the oven at a temperature of 70-75°C for 3 hours. Next, blended them until they became smooth flour and sieved through a 70 mesh sieve. Put the flour into a capsule shell size 00. The quality of pumpkin seed flour and capsules is tested at the Neutraceutical Laboratory and the Integrated Laboratory of Hasanuddin University. The evaluation of flour quality was carried out with 3 indicators which are the moisture content test, the incompressible density test, and the flow time test. Meanwhile, the evaluation of capsule quality was also carried out with 3 indicators, which are the time disintegration test, the weight diversity test, and the shelf-life test. Based on the evaluation of flour quality, pumpkin seed flour meet the required standards for the moisture content test (3.57%) and the incompressible density test (0.2427 g/cm³), but did not meet the required standards for the flow time test. Furthermore, pumpkin seed capsules meet the required standards for the three indicators tested, namely, the weight diversity (according to Pharmacopeia 1 edition 3), the time disintegration (6 minutes) and the shelf-life (115 days). Pumpkin seed flour and capsules can be used as food supplements because they meet the required standards to evaluate quality.

INTRODUCTION

Pumpkin has about 825 species.¹ It is easy to grow in tropical and subtropical areas, including in Indonesia. Pumpkin is a fruit that is usually used as a vegetable in people's daily consumption. Delicious pumpkin flesh is often processed into cakes. Unfortunately, pumpkin seeds are often thrown away. There are people who process pumpkin seeds into snacks such as kuaci. But most often, pumpkin seeds are considered as waste. There is still very little use of pumpkin seeds as agro-industry products.²

Actually, Pumpkin seeds contain so many benefits. Both macronutrients and micronutrients. In addition, pumpkin seeds also contain high antioxidants. Many studies show that the antioxidant content in pumpkin seed extract can improve fertility, prevent atherosclerosis (hardening of the arteries), high blood pressure and heart disease by improving fat metabolism.³ Pumpkin seeds can be used as food or medical purposes to treat enterozoa and prostate problems.⁴

Pumpkin seeds contain very interesting nutraceuticals and the oil is used as a functional food to improve conditions of hypertension, diabetes and cancer.⁵ Pumpkin seeds are good source of protein and have pharmacological activity.⁶ Pumpkin seeds contain good exogenous amino acids as well as omega-3 and omega-6 fatty acids which are needed for hormonal balance, brain function and skin health.⁷ Pumpkin seeds contain alkaloids, steroids and phenol as well as hydroquinone compounds and also ethyl acetate which can inhibit bacterial growth.⁸ Pumpkin seed oil has the potential as an antihypertensive.⁹

With these various benefits, pumpkin seeds have potential to be developed into functional food or supplements at affordable prices.¹⁰ The nutraceutical content in pumpkin seeds makes it very potential to be developed into innovative products.¹¹ Studies have also shown that pumpkin seed extract supplementation can lower blood pressure,¹² as well as can be function as cardioprotective.¹³

Food supplements are products which developed to complement nutritional needs. Food supplements contain several nutritious ingredients, such as vitamins, minerals, amino acids or

other substances. Food supplements can be derived from plants or non-plants. However, these ingredients when given in certain concentrations will provide nutritional value or physiological effects.¹⁴ Food supplements are usually packaged in capsule form. Capsules are solid preparations which consist of drugs in hard or soft shells and soluble. The active ingredients are put into capsules with the aim of masking unpleasant tastes and odors. Besides, by packing the active substance ingredients in capsules, it will make it easier to use and accelerate the absorption.¹⁵

Pumpkin seeds can be developed into a food supplement by packing the flour into capsules. Thus, it is hoped that the nutraceutical content of pumpkin seeds can be useful for maintaining health. This study aimed to evaluate the quality of pumpkin seed flour and capsules so that their potential can be assessed as a food supplement.

MATERIAL AND METHOD

Tools and Materials

The tools used were glass, moisture balance, blender, stopwatch, hot plate, oven, 70 mesh sieve, flow tester, analytical scale and tweezers. The materials used were fresh pumpkin seeds, distilled water, and capsule shell size 00.

Making Pumpkin Seed Flour

The pumpkin seed flour was made at the Culinary Laboratory of the Faculty of Public Health, Hasanuddin University. The pumpkin seeds were collected from pumpkins sold at the local market-which then washed and cleaned. Pumpkin seeds were dried in the sun for 7 hours and then baked in the oven at a temperature of 70-75°C for 3 hours. Pumpkin seeds were then blended until they became smooth flour and sieved through a 70 mesh sieve.

Pumpkin Seed Flour Quality Test

The quality test of pumpkin seed flour was carried out at the Pharmacy Laboratory of the Faculty of Pharmacy, Hasanuddin University. The quality tests which have been carried out, it consisted of tests for moisture content, incompressible density and flow time. The moisture content test was carried out with a moisture meter (G-Won Hitech) at a temperature of 105°C for 5 minutes. The incompressible density test was carried out by weighing the weight of the sample then put it into a measuring cup to see the vol-

ume. The flow time test was carried out by pouring 100 grams of granules (flour) into a funnel with the end of the stem closed, the lid was opened and the granules were let flow until they ran out. After that, the length of time was recorded by using a timekeeping device (stop-watch).

Pumpkin Seed Capsule Quality Test

The Capsule Weight Uniformity Test was carried out by using 20 capsules, which were weighed one by one-the results should be no more than 2 capsules which weight deviated from the average content weight of more than 10% and none of the capsule which weight deviated from the average content weight-or, were greater than 25%.

The time disintegration test was carried out by inserting 900 mL of Aquadest into a 1000 mL beaker glass. The disintegration temperature was set at $37^{\circ}\text{C} \pm 2^{\circ}\text{C}$. Put 6 capsules to be tested in each of the basket tubes. Inserted the 10 mesh gauze as described in the basket series, this gauze was placed on the surface of the top plate of the basket series. The basket was put into a 1-liter glass beaker containing distilled water. Ran the appliance for 30 minutes then lifted the basket and observed all the capsules. All capsules must be crushed, except for the part of the capsule shell. The requirement for disintegration of traditional medicine for hard capsules is < 30 minutes. Based on the results of the examination carried out at the Nutraceutical laboratory of the Faculty of Pharmacy, Hasanuddin University, the time disintegration of pumpkin seed capsules was 6 minutes. Shelf-life is the time lapse between food ingredients being produced until they are unacceptable to consumers due to quality deviations. The shelf-life test of pumpkin seed capsules was carried out at the Integrated Laboratory of the Faculty of Public Health, Hasanuddin University.

RESULTS

Based on the results of the tests, pumpkin seed flour in this study has a moisture content of 3.57% and an incompressible density of 0.2427 g/ml (Table 1). Based on Table 2, it can be seen that pumpkin seed capsules have a time disintegration of 6 minutes, good weight uniformity, and shelf-life of 115 days.

Table 1. Quality of Pumpkin Seed Flour

Ingredient	Parameter	Measurement Results	Interpretation
Pumpkin Seed Flour	Moisture Content	3.57%	Meet the Required Standards (Qualified)
	Incompressible Density	0.2427 g/ml	Meet the Required Standards (Qualified)
	Flow Time	Not Flowing	Cannot be Measured

Source: Primary Data, 2021

DISCUSSION

Moisture content is water content based on dry weight. Good moisture content ranges from 1-5%.¹⁶ Granules that have a moisture content of less than 5% will be stable and good during storage. If the moisture content is too high, the flour will become moist and easily damaged, so the shelf-life will be shorter. The Calculation of water content or moisture content is based on the calculation of dry weight where the weight of water in the sample is divided by the weight of dry sample. The requirement for good moisture content is 1-5%. The water content of pumpkin seed flour in this study is low because it has been dried before (only 3.57%). The longer the drying time, the lower the moisture content. The process of formulating plants into functional food should always consider this water content test. For example, a study conducted on the formulation of soursop juice effervescent preparations, found that the water content in the formulation ranged from 0.19-0.28%.¹⁷ Meanwhile, a study conducted on the formulation of dry aloe vera extract, found that the water content in the formulation ranged from 0.20-0.21%.¹⁸ The water content in pumpkin seed flour is higher than in effervescent preparations because of the different processing methods. But the water content of this pumpkin seed flour is lower than carrageenan-based capsules from seaweed which has a water content of 14.2%.¹⁹

Table 2. Quality of Pumpkin Seed Capsules

Ingredient	Parameter	Measurement Results	Interpretation
Pumpkin Seed Capsules	Time Disintegration	6 Minutes	Meet the Required Standards (Qualified)
	Weight Uniformity	Not more than 2 capsules, each of which the weight of the contents deviates from the average weight of contents by more than 10% and not one capsule whose weight deviates from the average weight of contents by more than 25%.	Meet the Required Standards (Qualified)
	Shelf-Life	115 Days	Meet the Required Standards (Qualified)

Source: Primary Data, 2021

Density is the mass per unit volume of a substance at a given temperature. This property is one of the simplest physical properties and is used to determine the purity of a substance. This recent study showed that pumpkin seed flour has a density of 0.2427 g/ml which means fulfilling the requirement for incompressible density >0.21 g/ml.²⁰

The flow time test was carried out to determine the time required for pumpkin seed flour to flow through the test equipment. To our best knowledge, it is the first study to examine flour flow from the seeds. Several factors that affect whether or not flour is easy to flow are the size and shape of the particles, surface area, density, strength, and stiffness.²¹ The results of the flow time test in this study show that pumpkin seed flour cannot be measured because it contains oil so it is cohesive. Therefore, pumpkin flour granules do not meet the standards 1 set by Aulton (1988). Pumpkin seeds contain oil which causes the flour to be hygroscopic. Because of this, the flour becomes lumpy and cannot flow. Flow time is one of the important factors that ensure uniformity of weight. However, in this study, pumpkin seed flour which has become capsules does not experience weight deviation outside the determined standards.

The Time Disintegration is very important in determining the quality of a supplement. In order for the active substance to be properly absorbed, the capsule must disintegrate in body fluids to be dissolved afterwards. The time disintegration is influenced by the type and amount

of crushing materials.²² The fast time disintegration is also affected by the granules. Another factor related to time disintegration is hardness. The time disintegration of pumpkin seed capsules is faster than dried yogurt capsules. Dried yogurt capsules have an average time disintegration of 9 minutes.²³ Likewise with carrageenan-based capsules from seaweed, the capsules have a longer time disintegration than pumpkin seed capsules which is an average of 13.35 minutes.¹⁹

Weight uniformity is an important parameter because it reflects the level (dose) of active substance in the capsule. However, one of the factors that support the effectiveness of food supplements is the accuracy of the dosage of the active substances contained in it.²⁴ Weight uniformity is an aspect that is studied in the pharmaceutical field because it is related to drug effectiveness. Several studies, for example, found that pharmaceutical preparations did not meet the required standards for this weight uniformity. For example, a study conducted in Bandar Lampung, found that 95.24% of powder preparations did not meet weight uniformity.²⁵ Likewise, a study conducted in Mataram found that all tested pulveres mixtures did not meet the required standards for weight uniformity according to the Indonesian Pharmacopoeia III.²⁶ A study conducted in Makassar, found that the results of the weight uniformity test of the hard gelatin capsule on dosage preparations showed that there were capsules that had weight deviations.²⁷

Shelf-life indicates the potential for a material

to be stored for a certain period of time. This shelf-life relates to the possibility of a product being produced in large quantities and commercialized. The results show that pumpkin seed capsules have a fairly good shelf-life, almost for 4 months. This shows that pumpkin seed capsules have the potential to be a food supplement. Different foodstuffs have different shelf lives. The shelf life depends on the type of food. Foods of animal origin usually have a shorter shelf life. For example, the shelf life of high lysine on milk fish with liquid evaporation and the addition of anti-microbial as well as antioxidant compounds from betel leaf during 8 weeks. The study showed that betel capsules and liquid smoke were proven to inhibit microorganisms.²⁸ Meanwhile, yogurt which developed from cow's milk then packaged in capsule form, has a shorter shelf life for 24 days.²³

The shelf life of Lycopene from Maltodekstrin Coated Tomatoes in capsule packaging found that the shelf life of capsules differed based on temperature. The higher the storage temperature, the shorter the shelf life of Lycopene Capsules.²⁹ Another study found that the shelf life of Lycopene for Tomatoes (*Lycopersicon* Psyforme) mixed with Maltodekstrin in capsules was 12.93 weeks.³⁰ The shelf life of Purple Sweet Potato Anthocyanin Extract (Pome Batat L.var.Ayamurasaki) mixed with Maltodekstrin in capsule packaging ranges from 134-4747 days.³¹

CONCLUSION AND RECOMMENDATION

Based on the results of research on the quality of pumpkin seed flour and capsules based on several parameters, it can be concluded that pumpkin seed flour and capsules can be used as a food supplement. It is necessary to study other methods to develop the potential of pumpkin seeds as an abundant biological resource in Indonesia.

ACKNOWLEDGMENTS

The researcher would like to thank the Ministry of Research, Technology and Higher Education of the Republic of Indonesia for the grant assistance for Basic Research of Excellence Higher Education provided for this research, with agreement number 8044/UN4.1.2.3/PL.02.00/2021.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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