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Water and Microbial Contents in *Moringa Oleifera* Seed Flour as Food Supplement to Prevent Stunting

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ABSTRACT

Nowadays, stunting is one of the main focuses of the national development priorities in the health sector. The prevalence of stunting in Indonesia is 30.7% (Riskesdas, 2018) and the prevalence is above tolerance by WHO, which is ≤ 20%. According to the results of the South East Asia Nutrition Surveys (SEANUTS, 2017), around 24.1% of boys and 24.3% of girls in Indonesia are stunting. The prevalence of stunting in West Sulawesi Province is 38.2%, the second-highest in Indonesia, and the District of Mamuju at 47.26% based on the results of Monitoring Nutrition Status in 2017. One of the efforts to prevent stunting is developed food products, such as the potential of Moringa Oleifera seeds as a supplement for children and will be developed into PMT for children under five. As basic research, the aim of this study was to analyze water and microbe contents of *Moringa Oleifera* seeds flour and cookies with *Moringa Oleifera* seeds flour substitutions of 10% and 15%.This research is Randomized design by grouping the experimental units into homogeneous groups. The manufacture of flour and *Moringa Oleifera* seeds cookies was carried out in the laboratory of Health Polytechnic of Mamuju and the examination of water and microbe contents was carried out at the Makassar Health Laboratory Center. Water and microbial contents of *Moringa Oleifera* seeds flour and cookies with 10% and 15% substitution of *Moringa Oleifera* seeds flour were in accordance with SNI standards. Further research is needed to analyze the effect of complementary food with substitution of *Moringa Oleifera* seeds flour on the nutritional status of children under five.

Keywords: Moringa Oleifera Seeds, Cookies, Water, Microbial, Stunting

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INTRODUCTION

The efforts to improve nutritional status in the community is one of the four priority of National Development Programs as the main targets of RPJMN 2020 - 2024. These efforts include reducing the prevalence of stunting with the target in children under 2 years become14%. The problem of stunting in Indonesia describes the existence of chronic nutritional problems since pregnancy and during toddlerhood. This is strongly influenced by the condition of mother/prospective mother, a period of pregnancy, and during infancy/toddlerhood, including suffered diseases during infant [1]. Like other nutritional problems, stunting is not only related to health problems, but also to various other conditions indirectly. Stunting problems can disrupt a child's physical and mental development. Stunting is closely related to an increased risk of mortality and morbidity and decreases the development of motor and mental abilities [2]. In addition, it can increase the risk of obesity, because someone with short stature has a low ideal body weight. If there is an increase in body weight a few kilograms can change the body mass index (BMI) of the person up beyond normal limits. And if the state of overweight and obesity continues for a long time, it will increase the risk of degenerative disease [3].

According to the cut off point by the Word Health Organization (WHO), the prevalence of stunting becomes a public health problem if the prevalence is > 20%. Whereas in Indonesia, the prevalence of stunting based on the results of Riskesdas, 2018 was 30.7%. These data show that Indonesia compared to several neighbors' countries has a very high prevalence, Malaysia (17%), Thailand (16%), and Singapore (4%). The Global Nutrition Report, 2018 shows that Indonesia is in 5th place with the highest stunting in the world [4] [5].One of the efforts that can be done is through food product development into supplements and complementary foods (PMT). One of the foods that have good nutritional content is *Moringa Oleifera*. *Moringa Oleifera* contains multi-element micronutrients which are very much needed, especially for pregnant women and toddlers. The benefits and properties of the *Moringa Oleifera* plant are found in all plant strains, including leaves, stems, roots, and seeds [6].

The high nutrient content makes *Moringa Oleifera* has functional properties for health and overcomes nutritional deficiencies [7]. Therefore, *Moringa Oleifera* is called a Miracle Tree and Mother's Best Friend. Besides that, *Moringa Oleifera* has the potential as a raw material in the cosmetics, medicine, and environmental improvement industries related to pollution and clean water quality. The bioactive compounds in *Moringa Oleifera* cause it to have pharmacological properties. In addition, it has been identified that *Moringa Oleifera* is high in antioxidants and antimicrobials [8] [9] [10]. The use of *Moringa Oleifera* as a nutritional supplement is increasingly widespread, as evidenced by the increasing number of reports of its use in various places both in experimental animals and humans. Based on these facts, this study will develop *Moringa Oleifera* seeds as a dietary supplement to prevent stunting [11], [12]. Currently, the results of *Moringa Oleifera* seeds have not been widely used but have great potential not only in food but also for cosmetics and other industrial needs. The nutritional content contained in *Moringa*

Oleifera Seeds can be used as fortification and raw material for food products [13], [14].

The results of research conducted by Yudianti, 2017 [15], show that the content of dry *Moringa Oleifera* seeds contains high protein and Fe while young *Moringa Oleifera* seeds contain high calcium [16] [17]. From that research, *Moringa Oleifera* seeds contains 70,6 µg/g iron (Fe), calcium 3345,5 µg/g and 25,5% protein. The potential of *Moringa Oleifera* seeds as a supplement will be developed in flour form and will become a supplement in the form of powder or PMT products for pregnant women [18] [19] [20] [21]. This product development considers the economic value and durability of the product. To see the durability of a product, the thing that affects is the shelf life is influenced by water content. Water content in a food ingredient will affect the growth of pathogens and microbial spoilage in food [22]. The purpose of this study was to analyze water and microbial contents of *Moringa Oleifera* seeds flour and cookies with *Moringa Oleifera* seeds flour substitutions of 10% and 15%.

METHODS

This type of research is a Randomized Design which is carried out by classifying the experimental into homogeneous groups and determining the treatment randomly in each group. The manufacture of flour and cookies with 10% and 15% substitution of *Moringa Oleifera* seeds was carried out in the Laboratory Health Polytechnic of Mamuju, and the analyze of water and microbial contents was carried out at the Makassar Health Laboratory Center.

In this study, the use *of Moringa Oleifera seeds* is the basic research for the development of dietary supplements and cookies products. *Moringa Oleifera* seeds are used young Moringa Oleifera seeds. The process of making *Moringa Oleifera* seeds flour goes through several stages. The first stage begins with removing the *Moringa Oleifera* seeds from the skin and placing them in a clean place. Then the *Moringa Oleifera* seeds are washed using running water, separated, and then spread on a drying gutter. *Moringa Oleifera* seeds are then dried and dried for ± 3 days at a temperature of 38-390c. After dry, next process *Moringa Oleifera* seeds into flour using a blender and then sieve using a 100-mesh sieve to separate the small stalks that cannot be crushed with a Warring Blender. The chart of the process of making *Moringa Oleifera* seeds flour can be seen in Figure 1.

RESULT AND DISCUSSION

The water content of food items is usually related to the quality of the food, which determines the stability index during storage [23]. The quality and stability of food are directly affected by moisture content [24]. Water is also one of the substances needed by microorganisms for their growth, apart from water, the nutritional components needed by microbes to grow are carbohydrates, proteins, lipids, minerals, and vitamins [25].

Based on the analysis of water and microbial contents of *Moringa Oleifera* seeds flour, it was shown that the results of the examination of the water content were 3.95%, while for the microbial content in the moringa seed flour there was no microbial content based on the results of laboratory examination (table 1). The analysis of water and microbial content of cookies with a substitution of 10% and 15%, shows that the analysis of the water content of cookies with a 10% substitution has a water content of 4.2% and substitution of 15% has a water content of 3.05%. The microbial content of cookies with a substitution of 10% and 15% do not contain microbiology based on the results of laboratory tests (table 2).

Determination of food quality, in general, is highly dependent on several factors, including taste, color, texture, and nutritional value. In addition, there are several factors, such as visual, color, taste, and aroma factors first and sometimes very decisive, but apart from these factors, shelf life and microbiological properties must also be considered, because they are closely related to product quality, especially shelf life. Table 1 shows that the water content analysis of Moringa Oleifera seeds flour is 3,95% has met the SNI requirements for flour, namely SNI 01-3751-2006 and SNI 01-3751-2009, with a value still below 14.5%. This is in line with the research conducted by Hartanto, 2012 [26] which carried out the moisture content of the flour, which showed that 583 samples had met the SNI requirements with a moisture content ranging from 11.0-14.2% which indicated that the flour products studied had moisture content 14.5%.

Water content is a characteristic that affects the texture and appearance of food ingredients and also determines the freshness and durability of the food ingredients. High water content can cause foodstuffs to be easily overgrown with molds and fungi (Kinanti, 2016). The water content of *Moringa Oleifera* leaf flour in this study was 6.64%. According to Subagio (2006), the moisture content of the flour is around 2-10%, this shows that Moringa leaf flour has a longer shelf life because with water content below 10% it can inhibit the growth of microorganisms.

Water content of cookies with substitution of *Moringa Oleifera* seed flour shows that the water content of cookies with flour substitution of 10% is 4.20% and substitution of 15% is 3.05% is in accordance with SNI cookies (SNI-01-2973-1992), which is below the maximum value of 5%. This is in line with research conducted by Ariantya, 2016 [27], which also made cookies with substitutions from other ingredients besides wheat flour, namely banana heart flour, where the results showed that cookies with the addition of banana heart flour with the same substitution in this study were 10 % and 15% indicate a value of 4.8-4.9% which is also still carried a maximum value of 5% and according to SNI the moisture content of cookies. Analysis of water content in food is important because if the water supply is higher than 14.5%, then this food can be a good medium for the growth of fungi, bacteria, and insects that can damage the quality of food during storage [28]. This research has also proven that products with water content below the SNI value will have very minimal microbial content. The lack of microbial content in the product negates the good quality of the product. It is proven that the results of a microbial analysis on moringa flour and processed cookies show that the microbiological content, namely yeast, mold, and bacteria are still in accordance with the SNI for each product.

CONCLUSION

Water and microbial contents of Moringa Oleifera seed flour and cookies with substitution *Moringa Oleifera* seeds flour 10% and 15% are in accordance with SNI standards both in the flour group and in the cookie's group. *Moringa Oleifera* seed flour can be used as a base for complementary food. We suggested to continuing this research by looking at its impact on the nutritional status of children under five.

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Figure 1: The Prosess of Moringa Oleifera seeds flour

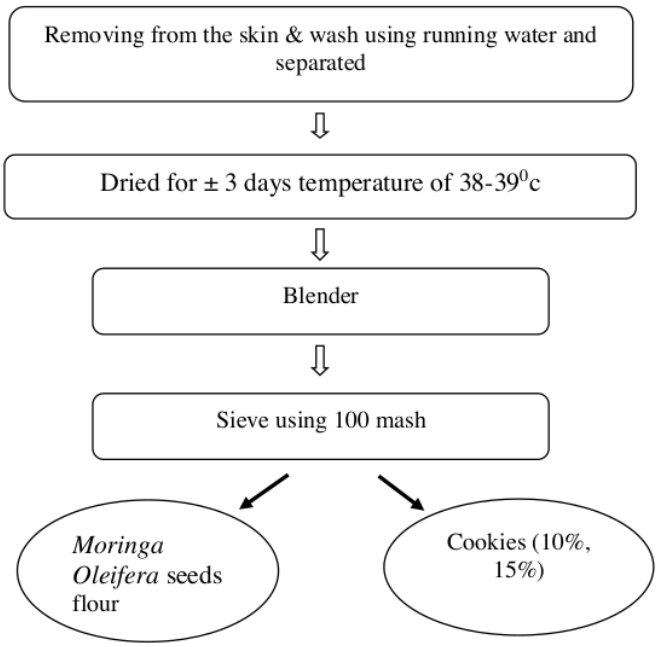

Table 1: Analyze Water and Microbial Contents of *Moringa Oleifera* seeds flour

Produk	Analisis Laboratorium	
	Kadar Air	Kandungan Mikroba
Tepung Biji Kelor	3,95%	0

Tabel 2 : Analyze Water and Microbial Contents of Cookies with Moringa Oleifera

Produk	Analisis Laboratorium	
	Kadar Air	Kandungan Mikroba
Cookies Subtitusi 10%	4,20	0
Cookies Subtitusi 15%	3,05	0

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