Physicochemical and Functional Characteristics of Composite Flour from Purple Sweet Potato Starch (Ipomoea Batatas L.) Modified with HMT, Dextrin and Low Fat Milk

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Abstract: The aim of this research is to know the physicochemical characteristics and functional of composite flour from purple sweet potato starch (*Ipomoea batatas L.*) modified HMT, dextrin and low fat milk. This research was conducted by using complete randomized design with two factors, namely: first factor is the comparison of HMT flour, dextrin and low fat milk (K), ie: K1 = 70:20:10, K2 = 60:20:20, K3 = 50:20:30, K4 = 40:20:40. The second factor is the percentage of xanthan gum (E), ie: E1 = 0%, E2 = 0.05%, E3 = 0.1%, E4 = 0.5%. Parameters observed were moisture content, ash content and protein content. The results of the study were obtained as follows: the combining ratio of sweet potato starch modified HMT, dextrin and low fat milk gave different significant effect (P <0.01) on ash and protein content. The addition of xanthan gum gave different significant effect (P <0,01) to ash content, and gave no significant effect (P> 0,05) to moisture and protein content.

1 INTRODUCTION

Purple sweet potato has a very feasible potential to be considered in supporting the food diversification program based on flour and starch products, however, the consumption of purple sweet potato is still less attractive to the public, while purple sweet potato contains high food fiber so that it is still less attractive to the public. can be used as a functional food product. , also contains anthocyanin pigments which are higher than other sweet potato varieties, and contain antioxidants that function to ward off free radicals.

Efforts that can be made to increase consumption of purple sweet potato in the community are diversification of its processed products, including processing purple sweet potatoes into composite flour formulated with a certain composition and the addition of additional ingredients in the form of dextrins and low-fat milk. and hydrocolloids such as xanthan gum. produce composite flour with chemical properties and a thickness similar to wheat flour so that it can be used as a substitute for wheat flour.

Regarding the current health condition of the Indonesian people, based on the results of a 2007 study, the proportion of causes of death due to Diabetes Mellitus (DM) at the age of 45-54 years in urban areas ranks second, namely 14.7. % (Ministry of Health, 2013). Diabetes mellitus (DM) is a disease that is closely related to the diet of modern society. One strategy to reduce the risk and prevent diabetes is to reduce or even avoid the consumption of hyperglycemic foods (can increase blood glucose levels quickly and high) and replace them with food products that have a low glycemic index (GI). Dietary fiber also plays a role in lowering the GI of food products. The content of dietary fiber found in purple sweet potato can be increased by modifying the starch of purple sweet potato flour

Physical modification of starch can be done by means of Heat Moisture Treatment (HMT). Where the Heat Moisture Treatment (HMT) method causes changes in the conformation of starch molecules and results in a more resistant crystalline structure.

Based on the information above, the authors wish to conduct research on the physicochemical and functional characteristics of composite flour from modified purple sweet potato (*Ipomoea Batatas L.*) flour, dextrin and low fat milk.

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2 MATERIALS AND METHOD

2.1 Materials

The main ingredient used in this research is purple sweet potato. The chemicals used in this study were as follows: Dextrin, Low Fat Milk, Xanthan Gum, Aquades and Sodium Metabisulfite (Na2S2O5). The equipment used in this study were as follows: Oven, Refrigerator, Desiccator, Blender, Knife, Spoon, Basin, 40 mesh Sieve, Beaker Glass, Petri Cup, Measuring Cup, Aluminum Foil.

2.2 Methodology

The research was conducted using factorial randomized design (CRD) which consisted of two factors, namely:
Factor I: Comparison of Forage Flour, Dextrin and Low Fat Milk (K) which consists of 4 levels, namely:
K1 = 70: 20: 10
K2 = 60: 20: 20
K3 = 50: 20: 30
K4 = 40: 20: 40

Factor II: The percentage of Xanthan Gum (E) consists of 4 levels, namely:
E1 = 0%
E2 = 0.05%
E3 = 0.1%
E4 = 0.5%

The number of treatment combinations (Tc) is 4 x 4 = 16, so the number of experimental replications (n) can be calculated as follows:
Tc (n-1) ≥ 15
16 (n-1) ≥15
16 n-16 ≥ 15
16n ≥ 31
n ≥ 1,973 ..... Rounded off to n = 2

2.3 Preparation of Purple Sweet Potato Flour

Peel the purple sweet potato. Wash it with running water. Chop 3 cm thick and soak in a 2000 ppm (0.2%) sodium metabisulfite (Na2S2O5) solution for 20 minutes. Blanching purple sweet potato for 5 minutes at 80 ° C. Dry in oven at 60 ° C for 6 hours. Grind the dried purple sweet potato then sift with a 40-60 mesh sieve.

2.4 Preparation of Modified Purple Sweet Potato Flour

Approximately 100 g of purple sweet potato flour were analyzed for moisture content. Add water so that the water content reaches 25-30% and stir until evenly distributed. Put it in the freezer for 24 hours. Then modify the purple sweet potato flour using the Heat Moisture Treatment method with a temperature of 100 ° C for 3 hours. Put the modified flour into a closed pan.

2.5 Preparation of Purple Sweet Potato Composite Flour

Mixing the ratio of purple sweet potato flour that has been modified forage with dextrin and low-fat milk according to the treatment, namely (70:20:10, 60:20:20, 50:20:30, 40:20:40). Then add xanthan gum in the ratio according to treatment (0%, 0.05%, 0.1% and 0.5%).

2.6 Observation Parameters

Observations were made based on an analysis which included: water content, ash content and protein content.

3 RESULTS AND DISCUSSION

3.1 Water Content

The comparison of forage-modified purple sweet potato flour, dextrin and low-fat milk with the addition of xanthan gum gave no significant effect (P> 0.05) on the moisture content of the composite flour, so that further testing was not carried out.

3.2 Ash Content

The comparison of forage-modified purple sweet potato flour, dextrins and low-fat milk had a very significant effect (P <0.01) on the ash content of the composite flour. The results of the average difference test indicate the level of difference for each level can be seen in Table 1.

Table 1: The results of the mean difference test of the effect of the comparison of forage-modified purple sweet potato flour, dextrins and low-fat milk on the ash content of the composite flour

HMT: Dextrin: Low Fat Milk	Avg. Distance		0.05	0.01
70:20:10	4.191	-	-	-
60:20:20	3.820	2	0.197	0.271
50:20:30	3.776	3	0.207	0.285
40:20:40	3.519	4	0.212	0.292

Figure 1 **s**hows that the less addition of forage-modified purple sweet potato flour with a fixed dextrin ratio and the more low-fat milk, the lower the ash content. This is because the high ash content in the composite flour is influenced by the high ash content in purple sweet potato flour, namely 5.31% (Widjanarko, 2008) while the ash content in low-fat milk is 0.7%. At K4, the ash content decreased due to the smaller ratio of forage-modified purple sweet potato flour. Sudarmadji (2010) also stated that the higher the value of the ash content, the more organic matter content in the product. The components of inorganic materials in a material vary greatly in both type and quantity. The content of inorganic materials contained in a material includes calcium, potassium, phosphorus, iron, magnesium and others.

The addition of xanthan gum had a very significant effect (P <0.01) on the ash content of the composite flour. The results of the average difference test indicate the level of difference for each level can be seen in Table 2**.**

Table 2: The results of the average difference test for the effect of adding xanthan gum on the ash content of the composite flour

Xanthan Gum	Avg. Distance		0.05	0.01
0%	3.625	-	-	-
0.05%	3.723	2	0.197	0.271
0.1%	3.899	3	0.207	0.285
0.5%	4.059	4	0.212	0.292

Table 2 shows that the increase in ash content is directly proportional to the concentration of the addition of xanthan gum. According to Garcia Ochoa (2000), the ash content contained in xanthan gum reaches 7-12%. Minerals contained in xanthan gum are calcium 0.35-0.65%, potassium 0.40-0.56% and 0.55-0.69% sodium (Lee, 2002). So that the more xanthan gum is added, the higher the ash content.

Effect of Interaction between Comparison of Forage Modified Purple Sweet Potato Flour, Dextrins and Low Fat Milk with the addition of Xanthan Gum to Ash Content of Composite Flour The treatment interaction ratio of forage-modified purple sweet potato flour, dextrin and low-fat milk with the addition of xanthan gum gave an insignificant difference (P> 0.05) on the ash content so that further testing was not carried out.

3.3 Protein Content

The Comparison Effect of Forage Modified Purple Sweet Potato Flour, Dextrin and Low Fat Milk on Protein Content of Composite Flour. Comparison of forage-modified purple sweet potato flour, dextrins and low-fat milk had a very significant effect (P <0.01) on the protein content of composite flour. The results of the average difference test indicate the level of difference for each level can be seen in Table 3.

Table 3: The results of the mean difference test of the effect of the comparison of forage-modified purple sweet potato flour, dextrins and low-fat milk on protein content of composite flour

HMT: Dextrin: Low Fat Milk	Avg. Distance		0.05	0.01
70:20:10	4.529^{D}	-	-	-
60:20:20	6.041^{C}	2	0.075	0.103
50:20:30	6.974^{B}	3	0.079	0.109
40:20:40	7.925^{A}	4	0.081	0.111

Note: Different letters in the notation column indicate significantly different effects on the level (P <0.05) and was significantly different at the level (P <0.01).

Table 3 shows that the less the addition of the modified purple sweet potato flour ratio with the fixed dextrin ratio and the more low-fat milk, the higher the protein. The protein content is quite good because it is higher than the protein found in purple sweet potato flour, namely 2.79% (Anwar, et al., 1993). The increase in protein levels is due to the addition of low-fat milk which contains protein for better nutrition, the protein found in low-fat milk (Tropicana Slim) where in one cup of milk (45 g) has 7 grams of protein which is important to meet daily protein needs (Tropicana, 2015).

4 CONCLUSION

Comparison of the mixing of forage-modified purple sweet potato flour, dextrins and low-fat milk had a very significant effect (P <0.01) on ash content and protein content. The addition of xanthan gum had a very significant effect (P <0.01) on ash content The best treatment is found in K4E1 treatment.

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