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Utilization of Mixed Oyek Cassava, Corn Grits, Brown Rice and Soy Grits in the Production of Snack Extrusion.

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ABSTRACT

This research attempted to improve the diversification and increase the value of agricultural raw materials. Materials used in this study is the mixture of primary materials containing carbohydrates such as cassava oyek, brown rice, and corn, with additional material that soy as a protein source. The investigation used the combination of six formulation with the percentage of raw materials: A (50%: 20%: 20%: 10%), B (20%: 50%: 20%: 10%), C (20%: 20%: 50%: 10%), D (45%: 45%: 0%: 10%), E (0%: 45%: 45%: 10%) and F (45%: 0%: 45%: 10%) each for cassava oyek (ouk), corn grits (CG), brown rice (BR) and soybean grits (SG) respectively. The observation of this study consisted the evaluation of raw materials and the characteristics of extruded snacks such as moisture content, ash content, protein content, fat, carbohydrates, energy value and sensory value. The results showed that extruded foods from the formulation B was the most acceptable result.
Keywords: Snack extrusion, Cassava oyek, corn grits, brown rice grits, soy bean.

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INTRODUCTION

Extruded foods such as snacks are common foods which are likeable and consumed by everyone nowadays, in which may contain certain functional components [1-3]. Processing by using extrusion method is a process that causes water and materials containing starch and protein made into plastics and cooked with a combination of pressure, heat and mechanical friction [4]. When the extrusion method used to make snacks, there are two types of developed materials: the materials containing the main source of starch such as wheat, corn, rice; and the materials consisting of starch source in combination with a mixture of ingredients that are high in protein such as beans.

Food extrusion process from corn is well known because it has crisp texture and easy to make [5]. The development raw materials source for food extrusion is continuously done to obtain the cheap and availability of the materials. Therefore, the use of a several ingredients mixtur that have starch and protein source is potential to be observed.

This research aims to use the diversity of food and increase the value of agricultural products. The raw material used in this research were the combination of cassava oyek, brown rice and corn grits and soy as a protein source. Soybean is identified as a good source of protein and has been widely consumed and benefited for human health [6-9].

Three raw materials used were the cabohydrate rich materials. Based on previous studies, the addition of excessive protein may cause the non inflated product. The formulation of the protein source addition in food extrusion needs to be studied further. The main purpose of the mixing process is to provide the utilization possibility of other foods which have not been used optimally as a substitute material. It is important to support the process of diversification [5].

One effort to improve the food diversification is to use materials which are not commonly used but may increase the value of existing extrusion food products. The use of a combination of oyek cassava, brown rice and corn as a source of carbohydrates is potential to be developed because of the abundant of availability in Indonesia.

EXPERIMENTAL

Research and Method

Materials and Equipment

The main raw materials used in this study were cassava, brown rice, corn and soybeans. The processing equipments used were a single screw extruder and some analytical instrumentations.

Experimental Design

There were six formulations of raw materials mixture developed in this research with the order of the raw materials as follows: cassava oyek (ouk): corn grits (CG): brown rice (BR): soybean grits (SG).

A (50:20:20:10),
B (20:50:20:10),
C (20:20:50:10),
D (45:45:0:10),
E (0:45:45:10),
F (45:0:45:10).

Materials Preparation

Corn, brown rice and soybeans used as grits were smoothed by disc mill before sieved with a 20 mesh sieve. Oyek was formed by destroying cleaned and peeled cassava before being dried and formed into granules and homogenized at 20 mesh size.

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The making of the Extruded Snack

All raw materials were mixed according to the formulations and then put into a single screw extrusion machine

Evaluation

The observations were carried out by observing the quality of raw materials and snack extrusion. The quality observation including the moisture content, ash content, protein content, fat, carbohydrates, energy value and sensory analysis

RESULT AND DISCUSSION

The steps which were carried out in the extrusion process were gelatinization, cooking, cutting, mixing, sterilization, and bubbling. These proceses were integral with the process of extrusion [5]. According to Harper, 1981 [10], the extrusion process occured at high temperature short time (HTST) because the temperatures can reach 200° C only in a short time (5-10 seconds).

Many factors affect the extrusion products. The extrusion process is influenced by the size, water content, amylopectin content and amylose content of the raw materials which are used. The water content of the material can determine the speed of the cooking process. High content of amylopectin will affect the swelling of the product, meanwhile, amylose content acts as forming crispness. Raw materials which contained protein also may determine the texture of the extruded product [5].

The changes that occur in the material during the extrusion process is physical-chemical change. The extrusion process using mechanical and heat energy with high pressure resulting the powder form of materials and granules become more liquid. Therefore, characteristics such as the fraction of the surface material, hardness, density of particles are important to be noted. Preliminary observations made on the raw material of the extruded snacks before processing. The observations of raw materials include moisture, ash, protein, fat, carbohydrates, and amylose content and amylopectin.

The chemical composition of the raw materials used in this study are shown in Table 1. Thus, the source of carbohydrate derived from corn, cassava and brown rice and the source of protein derived from soy beans.

Table 1: The chemical composition of the raw materials.

Analysis	Corn grits	Cassava oyek	Brown rice	Soybean
Water content (%)	14,82	15,43	12,84	9,03
Ash content (%)	2,4	0,7	2,6	4,31
Fat Content (%)	5,03	0,11	0,73	13,23
Protein (%)	7,06	1,05	6,1	31,15
Carbohydrate (%)	70,69	77,66	79,11	42,28
Amylosa (%)	21,6	3,23	3,74	0,87
Amylopectin (%)	68	65	53	0
Gelatinization Temp (%)	59,7	33,2	70,2	96,8

The variation of the composition was performed on three sources of carbohydrates, while the variation of protein sources were fixed. The soybeans could not assign the larger portion, because soybeans have a high gelatinization temperature that will affect the products that will be produced.

Proximate analysis

Water content

The influence of the combination of the raw materials that have been used against the quality of snacks can be seen in table 2

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Table 2: The Results of analysis of variance treatments of snack extrusion's formulation.

Formulation	(%)					Energy Value
	Water content	Ash content	Protein	Fat	Carbohy-drate	Kcal/100 g
A	7,60	0,81	23.90	0,25	***66,34***	359,88
B	9,17	1,13	27.15	***0,95***	64,52	359.76
C	8,99	***1,46***	29.26	0,50	60,11	335,97
D	8,59	0,61	24.81	0,83	64,41	***382,76***
E	***9,47***	1,15	***34,49***	0,66	55,68	359.76
F	8,01	1,34	26.14	0,10	62,86	355,32

From Table 2, it can be seen that the moisture content of extruded snacks gained 7.60% - 9.47%. The lowest water levels was in the formulation A (7.60%), while for the highest water content was in the formulation E (9.47%).

The requirements of the snack quality extrusion based on SNI 01-2886-2000 [11] that the maximum water content of extruded products is 4%. But the extruded product was not matched with the SNI of extruded snacks. The obtained water content was higher than the maximum limit of SNI snack extrusion which is about 7.60% - 9.47%.

According to Muchtadi (1988) [5], an increase in the water content of the extrusion snack can be caused by many things including the moisture content of raw materials, moreover, the raw material that containing protein can causes the imperfection of swelling process, so the water does not evaporate well in the product. This causes the water content of the product is still quite high.

Ash content

Ash content is inorganic residue that remains after a material is burned. Ash content can also be interpreted as a non-volatile components, persisted during the combustion process and annealed organic compounds [12]. The obtained ash content of extruded snack ranged from 0.61% - 1.46%. The lowest ash content was found in the formulation D (0.61%) and the highest ash content was found in the formulation C (1.46%).

It can be seen in Table 2 that the high addition of brown rice grits resulted higher levels of ash in the extruded product, due to minerals contained in brown rice enough to affect the ash content of the extruded snack. The rice has a mineral value which was dominant from other raw materials. It has more calcium, phosphorus and iron. Ash content of brown rice also has a dominant percentage compared with corn and cassava.

Protein content

The obtained protein content of extruded snack ranged between 23.90% - 34.49%. The lowest protein content was obtained in the formulation A (23.90%), and for the highest protein content was obtained in the formulation E (34.49%).

According to the table, it can be seen that addition of corn grits and brown rice can cause the high protein content in the product. This is probbaly caused by protein contents in raw materials such as corn and brown rice which affect the percentage of protein products.

Fat Content

The obtained fat content of snack extrusion ranged between 0.10% - 0.95%. The lowest fat content was obtained in the formulation F (0.10%), while for the highest fat content was obtained in the formulation B (0.95%). As w can see from the table, the percentage of fat content was very low (below 1%). This was because

the dominant raw materials used was carbohydrates. The sources of fat probably be derived from soybeans and corn. Since the composition of soy beans are fixed, the variation of corn were assumed to have effect on fat content in product

Carbohydrate content

The obtained levels of carbohydrate of snack extrusion ranged between 55.68% - 66.34%. The lowest carbohydrate content was found in the formulation E (55, 68%), and for the highest carbohydrate content was found in the formulation A (66.34%). The obtained carbohydrate levels for extruded snacks were generally higher than the levels of protein and fat because the raw materials most used contain high carbohydrate.

The extrusion technology is perfectly suit to proceed since raw materials consist of high carbohydrate but the use of it solely generated the poor quality of nutritional value in snack extrusion, therefore, by adding the raw materials contain protein is highly recommended.

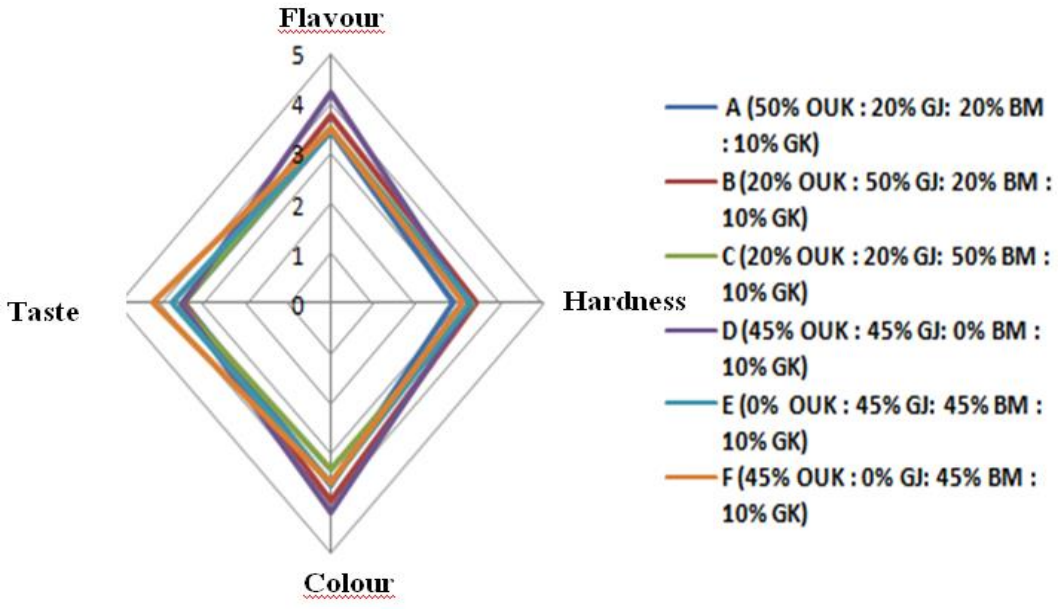
Additional analysis

Energy value

The sensory and the energy value were also analyzed for the additional analysis. The obtained enegy value of extruded snack ranged between 335.97 to 382.76 kcal / 100 g. The highest energy value was found in the formulation D (382.76 kcal / 100 g), and the lowest energy value was found in the formulation C (335.97 kcal / 100 g). Reduction of the energy value is assumed due to the influence of micronutrients. The addition of brown rice resulted in lower energy value because brown rice is good for diet food ue to it's low glycemic index value.

Sensory analysis

Based on the sensory analysis graph on picture 1, the outer graph shows the highest value in the level of preference. The formulation D had high level of preference shown by the chart and was not much different from the formulation B, but the criteria of the product can not be only seen from sensory analysis data, but also from its nutritional adequacy. So it can be concluded that the best product in this research was the formulation B. The formulation B was not much different with formulation D in sensory analysis result but in terms of nutrition, formulation B has a higher nutrient content than the formulation D. Extruded products shown on picture 2.



Picture 1: Sensory analysis graph.

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Formula A

Formula

Formula

Formula

Formula

Formula

Picture 2: Picture of extruded products.

CONCLUSION

The best products from the results of this study were selected based on the analysis of sensory analysis and chemical analysis (proximate). The best formulation was B with an average level of sensory

analysis results were scent = 3.75%, texture = 3.42%, color = 3.95% and sense = 3, 45%. The chemical contents were : water content = 9.17%, ash content = 1.13%, protein = 27.15%, fat = 0.95%, carbohydrates = 64.52% and energy value 359.76 kcal/100 g. Meanwhile, the utilization of oyek mixture of cassava, corn grits, brown rice and soy grits had good quality criteria except for the water content.

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