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Development of waffles by adding catfish bone flour (*Pangasius hypophthalmus*) and oyster mushroom powder (*Pleurotus ostreatus*)

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ABSTRAK

Latar belakang: *Substitusi tepung tulang lele dan bubuk jamur tiram dalam pembuatan wafel dapat meningkatkan kadar kalsium pada waffel.*
Tujuan: *Menganalisis substitusi tepung tulang ikan patin dan bubuk jamur tiram terhadap karakteristik sensorik dan kandungan kalsium wafel.*
Metode: *Jenis penelitian ini adalah eksperimental dengan menggunakan RAL. Sampel adalah wafel tepung tulang ikan patin dengan 4 variasi substitusi , yaitu waffle dengan formula standar yaitu 77% tepung terigu, 33% tepung tulang ikan patin tanpa penambahan bubuk jamur (A), waffel dengan pengurangan tepung terigu dengan substitusi tepung tulang ikan patin 33% dan bubuk jamur 17% (B), waffle dengan substitusi tepung tulang ikan patin 33% dan 25% bubuk jamur (C), wafel dengan substitusi tepung tulang ikan patin 33% dan 34% bubuk jamur. Waffle diuji daya terima meliputi warna, aroma, rasa dan tekstur serta kadar kalsium.*
Hasil: *Hasil dari evaluasi sensorik menunjukkan semua kategori hedonic yaitu aroma, rasa dan tekstur kecuali warna tidak berbeda nyata pada p>0,05. Formulasi terbaik diperoleh pada perlakuan B yaitu penambahan tepung tulang ikan patin dan bubuk jamur tiram masing-masing sebanyak 33% dan 17%. Penambahan tepung tulang ikan patin dan bubuk jamur meningkatkan kadar kalsium pada wafel yaitu masing-masing 12,53% dan 16,19% pada penambahan 33% tepung tulang ikan patin (control) dan 33% tepung tulang ikan patin: 17% atau bubuk jamur (formulasi terbaik) ecara berurutan.*
Kesimpulan: *Substitusi tepung tulang lele dan bubuk jamur tiram dalam pembuatan wafel menurunkan daya terima waffle, tetapi meningkatkan kadar kalsium dari waffle.*

KATA KUNCI: *tepung tulang ikan patin; bubuk jamur tiram; evaluasi sensorik; kandungan kalsium*

ABSTRACT

Background: *The substitution of catfish bone flour and oyster mushroom powder to make the waffles have the function in increasing calcium on food.*
Objectives: *To analyze the effects of catfish bone flour and oyster mushroom powder on sensory characteristics and calcium content of waffles.*
Methods: *This was experimental study using random complete design. Samples were waffle of catfish bone flour with 4 different formula, those were 77% wheat flour and 33% of catfish bone flour (control), waffles with the decrease of wheat flour with 33% of catfish bone flour and 17% of oyster mushroom powder © and waffles with the decrease of wheat flour with 33% of catfish bone flour and 34% of oyster mushroom powder (D). Waffles were then evaluated for their hedonic evaluation and the content of calcium.*
Results: *sensory evaluation showed all categories except color were not significantly different at p>0.05. The obtained results indicated that the addition of catfish bone flour and mushroom powder led to a pronounced increase calcium contents in the supplemented of waffles 12.53% and 16.19% at 33% of catfish bone flour (control) and 33% of catfish bone flour: 17% of mushroom powder (best formulation), respectively.*
Conclusion: *The substitution of catfish bone flour and oyster mushroom powder in waffle decrease in acceptability. However, there was increased in calcium the content of waffle.*

KEYWORDS: *catfish bone flour; oyster mushroom powder; sensory evaluation; calcium content*

INTRODUCTION

Calcium is the most abundant mineral in the human body and serves several important functions. Calcium is required for vascular contraction and vasodilation, muscle function, nerve transmission, intracellular signaling and hormonal secretion, though less than 1% of total body calcium is needed to support these critical metabolic functions. In aging adults especially among postmenopausal women, bone damage resulting in bone loss that increases the risk of osteoporosis over time (1).

Osteoporosis is a major public health problem worldwide affecting about 200 million people and resulting in increased morbidity, mortality and decreased the quality of life (2). The Health Ministry Republic of Indonesia stated that the proportion of Indonesian people who are at risk of osteoporosis was 19.7% and continues to rise with the increasing number of elderly in the next years (3). Nutrition is one of the major determinants of osteoporosis (4). Heaney (5) summarized in his review that nearly all controlled intervention studies and approximately 75% of observational studies indicated an improvement in bone health with dietary calcium. Recommendation of calcium intake as much as 1000-1200 mg/day for older individuals can be used to treat and prevent osteoporosis (6). Calcium is a mineral that necessary to develop a food rich in calcium content to fulfill calcium intake every day.

Among the various types of processed foods, a waffle is one of the foods that commonly consumed by the various age of groups. The higher content of carbohydrates and sugar make the waffle consumed as a snack or healthy breakfast. Nevertheless, the calcium content in waffle products in the market is very low, which can only 5% -8% of calcium AKG per serving. Because of the main ingredient of waffle is wheat flour derived from wheat and low in calcium.

One effort that can be done to address and resolve the low levels of calcium in the waffle is by the addition or substitution of basic materials wheat flour with other powdery material that is rich in calcium. Catfish bone is one of the best sources of calcium that contains high calcium that is equal to 264.53 (mg/g) (7).

Vitamin D status is an important determinant of calcium absorption. Based on the research, mushrooms can easily reach the Adequate Intake levels of vitamin D in a single serve (8). Considering of these two issues, the calcium-rich catfish bone and vitamin D-rich oyster mushrooms can be processed into flour and applied to the production of waffle. Therefore, this study aimed to examine the utilization of catfish bone flour (Pangasius hypothalamus) and oyster mushroom powder (Pleurotus ostreatus) as a partial substitution of wheat flour in the production of waffles to increase the calcium conten of waffles.

MATERIALS AND METHODS

Raw materials used were bones of catfish and mushrooms obtained from traditional markets (Siteba Padang Market), wheat flour, cornstarch, sugar flour, eggs, butter, milk powder, liquid milk, yeast, baking powder, salt, waffle, HCl 3N, aquades, La_2O_3. In addition, analytical grade reagents from different sources were used.

Preparation of catfish bone flour

Catfish bone flour was prepared based on Hemung (9).

Preparation of mushroom powder

Mushrooms were dried by dehydrator during 1 day at 60°C, and then, dried mushroom samples were powdered by commercial blender and were

Table 1. Formulation of waffles

Formulation	Wheat Flour (%)	Catfish Bone Flour (%)	Oyster Mushroom Powder (%)
A	67	33	0
B	50	33	17
C	42	33	25
D	33	33	34

stored in glass jars (10) Four formulations have been developed for our study:

Sensory analysis

The assessment of acceptability of the four formulations of the catfish bone waffles was carried out on student at Perintis Padang School of Health Sciences. The samples, labeled with three digit numerals, were presented monadically to consumers following a complete randomized block design. Consumers evaluated the overall acceptance of formulations using a hedonic structured scale of 7 points.

Calcium content

The content of calcium were measured by AOAC (11) by using spectophotometry methods (11).

RESULTS

Sensory analysis of waffles

Colour, flavour, taste, texture and overall acceptability of waffle with or without the addition of catfish bone flour and oyster mushroom powder was generally accepted by panelists **(Figure 1).** Appearance of waffles color can be seen in figure 2, catfish bone flour and oyster mushroom powder were added more than 33% became pale white (**Figure 2**).

Colour, flavour, taste, texture and overall acceptability of waffle by adding catfish bone flour and oyster mushroom powder were evaluated, and the results are presented in **Table 2**. In sensory evaluation, all categories except color were not significantly different at p>0.05. Overall the waffle with 33% of catfish bone flour and without adding mushroom powder showed high sensory scores

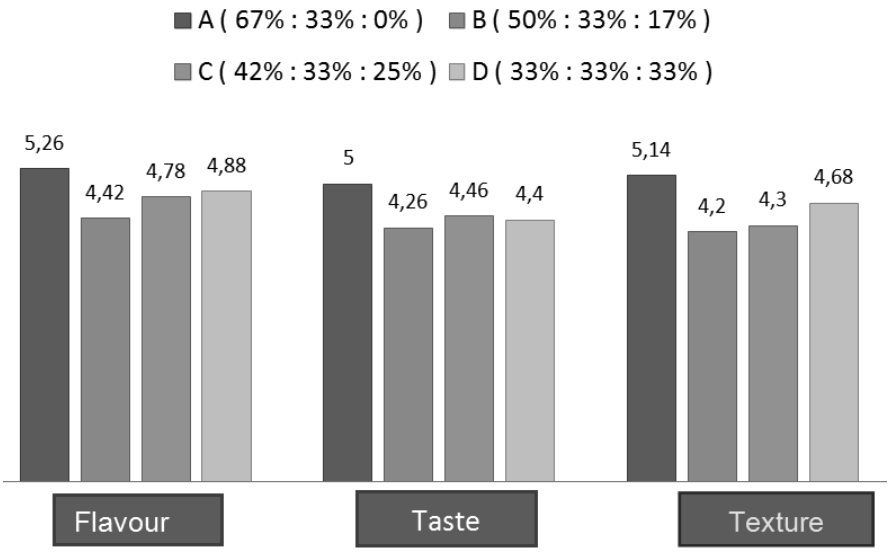

Figure 1. Mean of sensory characeristics of waffles

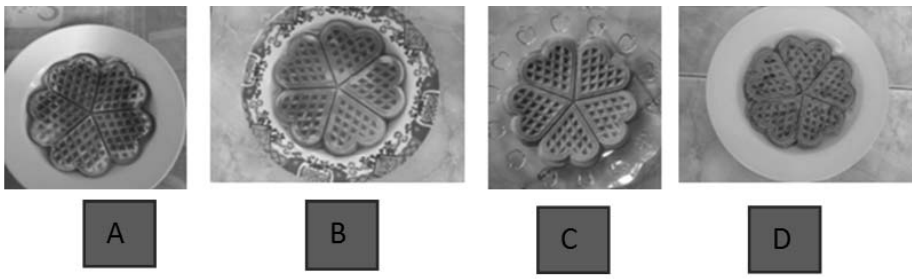

Figure 2. Appearance of waffles color

Tabel 2. Sensory characteristics of waffle prepared with various levels of catfish bone flour and oyster mushroom powder

Formulation	Sensory test (Mean ±SD)				
	Colour	Texture	Flavor	Taste	Overall preference
A	5.84±1.0	5.14±1.5	5.26±1.30	5.00±1.60	4.83
B	4.62±1.40	4.2±1.40	4.42±1.40	4.26±1.4	4.84
C	4.62±1.40	4.3±1.60	4.78±1.20	4.46±1.6	4.53
D	4.24±1.40	4.68±1.60	4.88±1.30	4.4±1.4	4.58
p-value*	0.03	0.61	0.72	0.53	0.90

*One-Way ANOVA, significantly ($p<0.05$)

and preferable acceptability in color, texture, odour, flavor, and overall acceptance.

Calcium content

The obtained results indicated that the addition of catfish bone flour and mushroom powder led to a pronounced increase calcium contents in the supplemented of waffles 12.53% and 16.19% at 33% of catfish bone flour (control) and 33% of catfish bone flour : 17% of mushroom powder (best formulation), respectively.

DISCUSSION

The highest mean level of treatment showed that the color of waffles with the addition of 33% of catfish bone flour and without oyster mushroom powder was more acceptable to panelists with a score of 5.84; waffles with the addition of 33% of catfish bone flour and 33% oyster mushroom powder less acceptable by panelists with a mean score of 4.24. The color of the control sample was lighter and more yellow than any of the other waffles. The texture of waffles with addition 33% of catfish bone flour and without oyster mushroom powder is more acceptable to panelists with 5.14 average score, waffles with the addition 33% of catfish bone flour and 17% oyster mushroom powder less received by panelists with a score of 4.2. In texture profile analysis, hardness, and chewiness of waffles increased by mushroom powder addition. The odour of waffles with addition 33% of catfish bone flour and without oyster mushroom powder is more acceptable to panelists with 5.26 average score, waffles with the addition 33% of catfish bone flour and 17% oyster mushroom powder less received by panelists with a score of 4.42. The flavor of waffles with addition 33% of catfish bone flour and without oyster mushroom powder is more acceptable to panelists with 5.14 average score, waffles with the addition 33% of catfish bone flour and 17% oyster mushroom powder less received by panelists with a score of 4.2 (**Figure 1**).

There are some comments from panelists said that the decrease in acceptability after the adding of mushroom powder is due to the increasingly hard texture, not good odour and taste. This is may be due to the mushroom flour which has its own unpleasant odour. The lower hedonic score for this waffle after added mushroom powder similar with the research Aishah et al (12) showed that mean value of all mushroom based Creaming cake sample received lower score values for colour, appearance and overall acceptance.

The calcium content of waffles by adding catfish bone flour and mushroom powder content were more higher than those reported by Nguyen Thi Thuy et al. They found that when catfish (*Pangasius hypophthalmus*) head and bone meal are mixed with dried oyster mushroom (Pleurotus ostreatus) have calcium content 9.76% (13).

CONCLUSION AND RECOMMENDATION

It can be concluded that catfishbone flour and oyster mushroom powder is an appropriate and cheap source of Ca for human nutrition. Catfishbone flour and oyster mushroom powder supplementation with wheat flour in different levels increased calcium content of waffles. 12.53% and 16/19% at 33% of catfish bone flour (control) and 33% of catfish bone

flour: 17 % of mushroom powder (best formulation), respectively. However, base on sensoric evaluation, acceptability of waffles still lower. The findings of the present study may help in developing commercial processing technology for effective utilisation catfish bone flour and mushroom powder especially for manufacturing of waffles.

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