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## Increasing levels of fibre and mineral (Fe, Ca, and K) in chicken meatballs added dragon fruit peel and oyster mushroom

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## Increasing levels of fibre and mineral (Fe, Ca, and K) in chicken meatballs added dragon fruit peel and oyster mushroom

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**Abstract.** The removal of the peel on dragon fruit fruits is a common step in food production for reasons of aesthetics and hygiene. One way to recycle dragon fruit peel is to make chicken meatball. Chicken meatball in Indonesia, which is called bakso are produced from ground chicken mixed with flour, spices and other mashed ingredients. The mixture is then formed into balls and boiled until cooked. Chicken meatballs contain mostly animal ingredients, so the quality needs to be improved by adding vegetable ingredients. The addition of vegetable ingredients is intended to increase the content of dietary fibre. The fruit fibres used in this study were dragon fruit peel and the vegetable ingredients was oyster mushrooms. The results showed that chicken meatball with higher concentration of dragon fruit peel has higher level of soluble dietary fibre, insoluble dietary fibre, and total dietary fibre content. This indicates that dragon fruit peel has higher levels of soluble dietary fibre, insoluble dietary fibre, and dietary fibre than oyster mushrooms. The addition of dragon fruit peel and oyster mushrooms causes an increase in iron and calcium mineral levels in chicken meatball products, but oyster mushrooms contribute more to increase these minerals. With these nutritious chicken meatballs, dragon fruit peel can be processed to become food that has economic value. Therefore, dragon fruit peel and oyster mushrooms can be used as a good ingredient in the formulation of chicken meatball.

### 1. Introduction

Food waste is problems faced by many countries, one of which is caused by the lack of ideas for processing fruit peels. [1]. There is a big problem from the presence of food waste from fruits and vegetables, namely the difficulty of shipping, sorting and also the nature and the most fatal problem, which is sensitive to damage [2]. There is a study which says that the percentage of food that is thrown away is more than the production of food produced [3]. Another study stated that the highest levels of food waste such as fruits, vegetables, and bread were discarded by students for one week [4].

The removal of the skin on various vegetables and fruits is a common step in food production for reasons of aesthetics and hygiene [5]. In some types of fruit, the peels represent almost 30% of the total weight of the main fruit. Fruit peel is a waste materials type that has many hidden advantages, one of which is dietary fibre [6].

Dietary fibre is part of a nutraceutical that is useful as a guard for gastrointestinal health. Dietary fibre is a complex carbohydrate that is digested by enzymes in human digestion [7]. The benefits of



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dietary fibre for the human body include controlling obesity, controlling diabetes, lowering cholesterol, preventing cardiovascular disease, improving digestion and preventing colon cancer [8]. There are 2 types of dietary fibre, namely soluble and insoluble dietary fibre. Examples of soluble dietary fibre, namely pectin and chewing gum, are abundant in fruits and vegetables, while examples of insoluble dietary fibre are cellulose, hemicellulose, and lignin, which are found in cereals, legumes, and vegetables. [9].

Chicken meatball in Indonesia, which is called bakso are produced from ground chicken mixed with flour, spices, and other mashed ingredients. The mixture is then formed into balls and boiled until cooked. Chicken meatballs contain mostly animal ingredients, so the quality needs to be improved by adding vegetable ingredients. The addition of vegetable ingredients is intended to increase the content of dietary fibre. Generally, the improvement of dietary fibre in chicken meatball could increase nutritional value by making a sense of fullness and reducing energy intake, this can be done by increasing fibre consumption. This study used dragon fruit peel and oyster mushroom in the chicken meatball. Dragon fruit peel is a waste material with a good source of dietary fibre [10]. Dragon fruit peel also has functional activities such as antioxidant activity and good cytotoxic activities [11][12]. The fruit product called pitaya fruit and *buah naga* one of the popular types of fruit in Asia especially in Indonesia. It attracts a lot of attention of consumers because it has high nutritional and medicinal properties [13]. Dragon fruit fruit also called pitaya which belongs to *Cactaceae* family [14]. The red dragon fruit fruit known as *Hylocereus polyrhizus* has red flesh and pink peels [15].

Oyster mushroom with Latin *Pleurotus ostreatus* is a type of mushroom that is widely consumed by Indonesian people because in addition to delicious taste and easy to find, oyster mushroom is also very beneficial for health. Oyster mushrooms contain high nutritional content with fibre and various essential amino acids. Oyster mushrooms also contain compounds that are good for medical aspects because oyster mushrooms presence of many nutritional composition and various active ingredients in *P. ostreatus*, have been reported to have antidiabetic, antibacterial, anticholesterolic, antiarthritic, antioxidant, anticancer, eye health and antiviral activities [16] [17]. Oyster mushrooms contain superior quality protein such as lysine and leucine. Oyster mushrooms also contain vital minerals such as iron, zinc, magnesium, copper, phosphorus, calcium, and potassium [18]. Oyster mushrooms are rich in total dietary fibre (35.6 g/100 g) with insoluble dietary fibre being the highest component (35.4 g/100 g) while soluble dietary fibre had the lowest value (0.2 g/100 g)[19]. Oyster mushrooms also contain important minerals needed by the human body. There are various kinds of mineral elements found in Oyster Mushrooms, namely, Ca in total 32.17±3.77 mg/100g, Fe 56.44±2.7mg/100g and K 1085.09±24.08mg/100g [20].

The addition of dragon fruit peel and oyster mushrooms is expected to increase the fibre content of chicken meatball. For example, biscuits containing 4% and 6% oyster mushroom powder have 5.34 g/100 g and 5.52 g/100 g total dietary fibre, respectively and significantly higher ( $p < 0.05$ ) than biscuits without oyster mushroom powder (4.84 g/100 g) [21]. Research about soybean flour and dragon fruit peel-based functional drinks has a result indicated that dragon fruit peel powder gives higher insoluble, soluble, and total dietary fibre than soy powder [8].

The use of dragon fruit peel flour in cookies produces cookies with high ash content. This is associated with the mineral content of dragon fruit peel [22]. In another previous research, the results obtained the addition of oyster mushrooms in broiler's chicken meatball dough had a very significant effect on the value of chemical composition that is increase moisture, ash but decrease fat, fibre and protein content [23]. Therefore, the purpose of this study was to evaluate the components of dietary fibre and minerals content (Fe, Ca, and K) of chicken meatball with the addition of dragon fruit peel and oyster mushroom.

## 2. Materials and methods

### 2.1. Production of chicken meatball

The procedure for making chicken meatball was started by grating dragon fruit peel, cutting oyster mushrooms and chicken breast into small pieces, and mixing all ingredients (grated dragon fruit peel, pieces of oyster mushroom and chicken breast, tapioca flour, salt, pepper, garlic, eggs, flavouring, ice) using a blender. Forming the ball was done using a spoon while being put into the cooking water. The cooked chicken meatball was marked by the chicken meatball being floating in the cooking water. The formulation of the ingredients used in the manufacture of chicken meatball with the substitution of oyster mushrooms and dragon fruit peel is shown in Table 1.

**Table 1.** Chicken meatball formulation with the addition of dragon fruit peels and oyster mushrooms.

Ingredients	Comparison of Dragon fruit peel and Oyster Mushroom			
	0:0 (S1)	1:2 (S2)	2:1 (S3)	1:1 (S4)
	g	g	g	g
Chicken breast	200	200	200	200
Dragon fruit peel	0	20	40	30
Oyster mushroom	0	40	20	30
Tapioca flour	40	40	40	40
Salt	10	10	10	10
Pepper	5	5	5	5
Garlic	8	8	8	8
Seasoning	5	5	5	5
Chicken eggs	50	50	50	50
Ice	22	22	22	22

### 2.2 Product analysis

The analysis was carried out on chicken meatball products. The analysis carried out is an analysis of total dietary fibre, soluble dietary fibre and insoluble dietary fibre [24]. Mineral was tested using Spectrometer XRF (X-Ray Fluorescence)[25]. Mineral testing (Fe, Ca, and K) was carried out on selected samples including control samples and samples with the highest fibre content to determine the effect of increasing mineral content in chicken meatball (Fe, Ca, and K) with the addition of dragon fruit peel and oyster mushrooms.

### 2.3 Statistical analysis

The experiment was made in a completely randomized design. The results were shown as mean values with standard deviations of triplicate. Statistical analysis of differences between mean values used Duncan's multiple range tests with significance level ( $\alpha = 0,05$ ). Mineral data were analysed using statistics an independent sample T-Test.

## 3. Results and discussion

### 3.1 Dietary fibre components in chicken meatball with addition of dragon fruit peels and oyster mushroom

Dietary fibre are defined based on their compositions, analyses, and physiologic activity [26]. Dietary fibre has a positive effect on health because its consumption is associated with decreased incidence of several diseases, because dietary fibre is one of the parts in plants that is resistant to enzymatic digestion consisting of: cellulose, non-cellulosic polysaccharides such as hemicellulose, pectic substances, gums, mucilages, and a non-carbohydrate component lignin [27]. According to solubility, dietary fibre is

classified as soluble dietary fibre and insoluble dietary fibre. The chicken meatball samples in this study had soluble dietary fibre 0-0.36%, insoluble dietary fibre 0-4.89%, and total dietary fibre 0-5.22%. The higher concentration of dragon fruit peel gives the higher soluble dietary fibre, insoluble dietary fibre, and total dietary fibre content. This indicates that dragon fruit peel has higher level of soluble dietary fibre, insoluble dietary fibre, and total dietary fibre content. than oyster mushrooms. Red dragon fruit peel contains a high amount of fibre (69.3%): 14.82% of soluble fibre and 56.50% of insoluble fibre. Oyster mushrooms are also a good source of total dietary fibre (35.6 g/100 g) with 35.4 g/100 g of insoluble dietary fibre and 0.2 g/100 g of soluble dietary fibre [19]. The potential of white oyster mushroom as a natural antimicrobial and antioxidant which is a favourite food in Indonesia because it is easy to find [28].

The results of dietary component in chicken balls with addition of dragon fruit peels and oyster mushroom can be seen in Table 2. In this study, chicken meatballs without additional dragon fruit peel and oyster mushroom have 0% dietary fibre because chicken meat is not a source of dietary fibre [29]. According to the Ministry of Health of the Republic of Indonesia, chicken meat contains 0% of dietary fibre [30].

The content of soluble fibre and insoluble fibre content in dragon fruit skin and oyster mushrooms is useful for lowering triglyceride levels which are useful for delaying gastric emptying, delaying hunger and satiety longer [31] [32]. Short chain fatty acids consisting of acetate, propionate and butyrate are products of fibre fermentation in the intestine. Cholesterol and triglyceride levels can be reduced by propionate through inhibition of the HMG-CoA reductase enzyme which is processed in the liver [29].

2 **Table 2.** Dietary fibre component in chicken meatball samples.

Sampel	Total Dietary Fibre (%)	Soluble Dietary Fibre (%)	Insoluble Dietary Fibre (%)
S1	0 <sup>a</sup>	0 <sup>a</sup>	0 <sup>a</sup>
S2	3.78 <sup>b</sup>	0.25 <sup>b</sup>	3.53 <sup>b</sup>
S3	5.12 <sup>c</sup>	0.34 <sup>c</sup>	4.79 <sup>c</sup>
5 4	5.22 <sup>c</sup>	0.36 <sup>c</sup>	4.89 <sup>c</sup>

The same lowercase notation in the same line showed no significant difference at the 95% (Duncan test, p<0.05).

### 3.2 Mineral content in chicken meatball with addition of dragon fruit peels and oyster mushroom

Mineral testing (Fe, Ca, and K) was carried out on samples S1 and S3 which were selected samples to determine the effect of increasing mineral content (Fe, Ca, and K) with the addition of dragon fruit peel and oyster mushrooms. The S1 sample is control samples while the S3 sample is the sample with the highest use of dragon fruit peel, so that it has the potential to utilize dragon fruit waste and has a more economical value. The results of the mineral assay are shown in Table 3. Samples S3 and S4 are chicken meatball samples with the highest dietary fibre content.

**Table 3.** Mineral content of chicken meatball samples.

Sample	Mineral	Amount (mg/100 g)	Sig.
S1	Fe	0.81	0.000
S3		1.58	
S1	Ca	5.51	0.000
S3		9.48	
S1	K	37.05	0.728
S3		36.5	

S1: control sample while S3: comparison of dragon fruit and oyster mushroom 2:1.

Based on Table 3, the iron levels of samples S1 and S3 are 0.81 and 1.58 mg/100 g, respectively. Oyster mushrooms contribute to increasing the iron content of chicken meatball.

In the previous meatball research, the absorbance value of iron or Fe was measured using an Atomic Absorption Spectrophotometer (AAS), the results were 0.173 mg/100 g in chicken meatballs and 0.618 mg/100 g in chicken meatballs with the addition of 15% oyster mushrooms[35]. When compared with previous studies, the S3 meatball sample with a ratio of dragon fruit and oyster mushroom 2:1 had a higher iron content of 1.58 mg/100 g.

Sample S3 9.48 mg/100 g has a higher calcium content than sample S1 5.51 mg/100 g. The addition of oyster mushrooms and dragon fruit peel can increase the calcium of chicken meatball products. Oyster mushrooms have the highest calcium content when compared to dragon fruit peel and chicken meat. The calcium content of oyster mushrooms is 30 mg/100 g [34]. The calcium content of chicken meat ranged from 17.82-20.23 mg/100 mg [33]. The concentration of calcium in dragon fruit peel was 9.75 ppm = 0.975 mg/100 g [36]. In this study, there was no significant difference in potassium levels in samples S1 and S3. Sample S3 9.48 mg/100 g has a higher potassium content than sample S1 5.51 mg/100 g.

#### 4. Conclusions

The results of the research on chicken meatball with dragon fruit peel and oyster mushrooms are the higher concentration of dragon fruit peel gives the higher soluble dietary fibre, insoluble dietary fibre, and total dietary fibre content. The addition of dragon fruit peel and oyster mushrooms causes an increase in iron and calcium mineral levels in chicken meatball products. But oyster mushrooms contribute more to the increase in these minerals.

#### 14 Acknowledgements

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