Ready To Eat (RTE) Meatballs with Natural MSG Sources as Delicacy Potency in Indonesia

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ABSTRACT
Indonesia has developed ready to eat (RTE) food in several years along the high activities of the consumers and needs of delicious, fast, and nutritious foods. One of the popular RTE foods in Indonesia is meatball. The common seasoning used in the RTE meatballs is monosodium glutamate (MSG). However, MSG as the primary seasoning of RTE meatballs reported that it contains health risk potency for consumers which correlated to food safety issues. Discovering natural MSG sources from Indonesian herbs can be a delicacy potency for RTE meatballs as well as potentially replace MSG in practices. Natural seasoning could be found in several species of plants. Pack of reference in this review would be something that beneficial to develop further research of RTE meatballs using natural MSG sources. The hurdle technology between retort packaging and addition of natural food enhancer will be a great discovering to keep the quality of ready to eat meatballs during storage or distribution. Kinds of plant have to be analyzed by "Etnobotani" study to identified the glutamic compound which could give the "umami" taste when addes into food such MSG.

Keywords: *Ready to eat, meatballs, natural, monosodium glutamate (MSG)*

1. INTRODUCTION

Nowadays, the hasty and busy life of Indonesian people triggers the way of cooking and processing food development. One potential for hasty and busy life style is ready to eat food. It is because the cook processing of kinds of food spends more time than ready to eat (RTE) food product which is very easy and practice to be consumed. RTE has been developed in Indonesia for several years along the country's development and demand for delicious, fast, and also nutritious food, especially for the workers. To face the growing complexity and hectic metropolitan life, it required to developing ready to eat foods which known as convenience food [1]

Meatballs are meat restructured product which healthy and it produced in cottage and also industrially. Meatballs usually made from beef meat, chicken meat, and also fish meat. Beef meat being the most popular in Indonesia. All kind of Indonesian people love to eat meatballs with the soup [2]. Indonesian meatballs "bakso" are prepared using finely ground beef mixed with starch, salt, and also seasoning, such as garlic and pepper, also sometimes added with additional substance like sodium tripolyphospate (STP) as chewing agent and monosodium glutamate as food enhancer [3]. Since meatballs are popular meat product, we have to increase the taste by using additional substance as a food enhancer which could replace the role of MSG.

Based on Legislation Number 18, 2012 concerning of food, processed food could be defined as food or beverages which produced in certain methods, with or without any additive substance. The legislation also implements for household industry, such as meatball producer. Nowadays, with the retort technology, meatball is one of the processed foods which available in the form of RTE package. In order to develop the delicacy, additive substance such as monosodium glutamate (MSG) has been added to increase its umami taste. The use of MSG in the food is allowed with the maximum limit of 30 mg per bodyweight per day [4]. However, the use of MSG in a long term can cause health risk and not suitable with the food safety principle.

Due to decrease the potential risk of using MSG, researches tries to discover some local plants which have similar function with the MSG. Even though, some researchers found that natural source seems like produce lower umami taste than MSG itself, it already good

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enough to substitute the addiction of MSG and at least, it can make the food is tastier. Generally, the part of plants used to replace MSG substance is the leaf either whole leaf, chopped, or in powder form. The efficacy of the natural substance as a seasoning in local plants had been proved in some researches. This article will discuss the potential of natural seasoning from local plants added in RTE meatballs and critical issues related to food safety of RTE meatballs.

2. METHODOLOGY

This article is the type of literature review. Data reference was taken from legislation of Indonesia, International journals, books, and also proceedings. The first method is finding the main idea of the paper, using 5W1H (what, when, why, where, who, how) analysis. Then, find the point of the idea, and the last is developing the point being a paragraph with many supporting reference which relate with the topics of each subchapters.

2.1 Making RTE Meatballs

Meatball is a meat product made from grinded meat and further process through filled and seasoned, formed to be small balls, and boiled in hot water [5]. The shelf life of meatballs at room temperature is reported only for 12 to 24 hours [6] and the storage of meatballs in refrigerator (temperature 4 ± 1^0C) is only lasts for 14 days [7]. However, shelf life of meatballs in freezer could extended for 4 to 6 months, and if the meatballs packaged by retort method, it will preserved for about a year at room temperature storage.

Materials and methods of making RTE meatballs more or less are same as making meatballs in common. Materials used are 1500 gram of beef meat, 150 gram (10%) tapioca powder, 525 grams (35%) solid ice, 4.5 gram (3%) salt, 7.5 gram (0.5 %) onions powder, 7.5 gram (0.5%) white pepper [8]. In this process, some producers and manufacturers add MSG as the food enhancer. The use of those materials is optional depend on the recipe of each producer's preference. Briefly, the meatball making involves process grinding of meats, mixing the grinded meats with the filler and seasonings, forming the dough into small balls, boiling in the boiled water, and draining the meatballs [9]. RTE meatballs are packaged by retort method which involved sterilization process that may be possible to kill whole microorganism. So, it can make they have longer shelf life and safe to be consumed.

2.2 Packaging of RTE Meatballs

RTE foods have a long history. It has many revisions of its origin in the trench ration from World War I. RTE food was first implemented in 1980 [10]. Nowadays, many products are available in the form of RTE, such as raw fish containing product (sushi, sashimi) [11], salad [12], cereals and yoghurt [13], snacks [14], and meat products [19]. The kind of meat products in the form of RTE are sausage, nugget, cornet, and meatballs. RTE meatball has been developed along the development of many agro-products in the RTE form. One of the important things which take important role in RTE food production is packaging. There are five basic characteristics that must be concerned when choosing the packaging materials, among them are appearance, protection, function, cost, and ease of disposing after consuming [15]. The materials used to pack RTE meatballs must suitable through the packaging method. Retort is one of the packaging methods that familiar in many countries. Besides, it is proven safe, convenience, and produced with the same standard. Retort involves sterilization at temperature 120 to 130°C about 60 minutes with the purpose to reach the stability of food shelf life [16]. Retort involves high temperature so it is possible to kill whole bacteria followed by the extending shelf life of the RTE food. Materials that usually used in RTE meatballs with retort packaging method are the can and retort pouch [17].

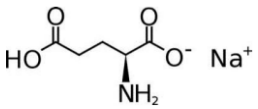
2.3 Potential hazard of RTE meatballs

Based on the several researches, there are several potential hazards which made RTE meatball contains potential health risk for consumers. A research shows that RTE meatballs which for sale in a restaurant in Turkey contains heterocyclic aromatic amines (HCAs) tested by Ultra-Fast Liquid Chromatography (UFLC). HCAs are the kinds of carcinogenic substance [18]. Besides chemistry compounds and maybe considered as potential harmful, microbes also can contaminate RTE meatball or meat product with MSG as one of its ingredients. *Listeria monocytogenes* are isolated from 0.3% of 184,439 collected food samples, and RTE meat product is the part of 40% of the contaminated food [19]. There is relatively high risk of microbial contamination in RTE meat products in a company located at Trinidad, West Indies. Therefore, it needs to improve in food safety and quality assurance of the company [20].

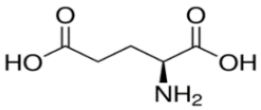
2.4 Monosodium glutamate as flavoring agents

Monosodium glutamate (MSG) is one of effective foods enhancer. The component of MSG contains glutamate (78,2%), natrium (12,2 %), and H_2O (9,6%). The main component of MSG is protein, namely glutamic acid or glutamate. It presents in some kind of food, such as meats, vegetables, poultry, and milk. Glutamate consists of two forms; free and bound. Free glutamate is effectively works as the food enhancer. The form of MSG is white crystal powder with high solubility in water, and has no smell [21]. MSG was first revealed in 1908 by Japanese scientist, namely Professor Kikunae Ikeda [22]. He identified the unique taste of umami attributed by glutamic acid. Umami is one of the five basic tastes, together with sweetness,

sourness, bitterness, and saltiness. Umami can be translated as "pleasant savory taste" [22]. MSG first made in Japan from high protein food, same as seaweed. However, in this time MSG is made from starch, corn sugar, or molasses, a byproduct of sugarcane in the manufacturer of sugar [23]. Based on the research in meat or meat products, MSG dissociation is optimally produced umami taste in pH 6 to 8. The structure of MSG and glutamic acid are as follows [19].



Monosodium glutamat



Glutamic acid

Figure 1. Chemical structure of MSG and glutamic acid

2.5 Determination MSG contains in foods

Based on the Permenkes RI No. 722/Menkes/Per/IX/88 about food additive substance, MSG could be used in every kind of foods in a certain portion and also it should be produced by good manufacturing procedure. Determination MSG inclusion of foods usually use Kjeldahl method [24]. The difference of MSG structure in certain pH makes the extraction and determination of MSG easier. MSG could be determined indirectly as NH_4^+ through titrimetric method. In the titrimetric method, a color indicator is added to a water sample, which is subsequently titrated with 0.02 N H_2SO_4 . At the end point of the titration, the color of the sample turns to a pale lavender color. The amount of sulfuric acid used for the color change is proportional to the amount of $NH4^+$ in sample [25]

2.6 Impact of MSG consumption in the food on human health

The key of 'umami' sensation of MSG points at glutamate acids [26]. MSG has function as a food enhancer in food, especially in high protein foods. Glutamate is amino acid which generally found in the high protein food, such as meat, milk, egg, and also fish. Glutamate has been found in the fastened and free form. Fastened glutamate has no taste, but free glutamate has umami taste. The more glutamate contains in food, the more umami taste the food [27]. Glutamate is commonly added to process food, mostly in Asian cuisine [28]. The adding pure glutamate has no influence in the aroma of the food; it can be pure added or as hidden ingredient of yeast extract or hydrolyzed protein, both containing high percentage of glutamate [29]. The inclusion of MSG in food increases the intake of the food which contains MSG, otherwise decrease the intake of non-MSG food, so the energy intake does not affect by the inclusion of MSG [30]. The processing and packaging of RTE meatballs are inseparable from heating at high temperature, whereas MSG which is heated in the high temperature will be hydrolyzed to pyrolised-1 (Glu-P-1) and glutamamic pyrolind 2 (Glu-P-2) which is mutagenic and carcinogenic substances [31].

Some countries show high consumption of MSG in the food, such as consumption rate in Asian countries which are about 1200-1700 mg per day, EU about 300 – 500 mg per day [32], America about 550 mg per day, UK about 590 mg per day, and Taiwan about 3 g per day [23]. Consumption of MSG in high concentration is believed that it can affect to human health. Some of MSG consumption effects on human health, such as overweight or obesity, asthma exacerbation, and migraine headache [33] have been studying. The impact of MSG consumption in the food depends on the dose and consumption period [34]. MSG usually has not been absorbed through biological membranes, so that almost no MSG absorbed from intestine to blood and it has not access to brain. The inclusion of MSG in normal dose in food does not affect energy intake, body weight, and fat metabolism [35]. One of the popular effect MSG consumption in food is *Chinese Restaurant Syndrome* (CRS). Symptoms of CRS are burning or tingling in the neck, check, face, upper arms, headache, tightness in the face, nausea, palpitation, and difficulty in breathing [36]. Dietary of MSG or L-glutamate is able to modulate physiological function in the stomach, including secretion and motility [37]. MSG has beneficial in the metabolism of the body, but the consumption in long term period reported that it can cause toxic effect. Umami taste which produced by MSG can improve the palatability of the foods that have low fat and salt content, increasing the intensity of two compounds, prolonging the residual taste, and also contributing to the selection of the food [38]. In general, MSG has a GRAS (generally recognized as safe) status and an ADI (acceptable daily intake) which cannot specified. It means that it can be used as a food additive in the necessary amount to achieve the desired technological effect [39]. MSG has function as a glutamin precursor, substance for protein synthesis, and amino acid biosynthesis. On the other side, the MSG consumption over the dose 0.5 to 2.5 g reported that it

can cause bad effect in heart, respiratory organ, also digestive organ [40].

2.7 Potential delicacy of natural MSG from local plants

Indonesia is included as one of 12 countries with its diversity of culture and nature in the world. Indonesia has various species of plants, consist of 1500 species of algae, 80,000 species of spore plants, 595 species of lichen, 2,197 species of spikes, and 30,000 to 40,000 species of floras (15.5% of the total flora species in the world) [41]. Plant consists of root, stem, leaf, seed, flower, and fruit. All of them give beneficial for human life, such as for the pharmacy, food sector, and also building construction. Various species of plants are used in the food sector with the purpose as antibacterial, antioxidant, and as food enhancer. The part of plants that used is leaf, root, or stem. Glutamic acid as the main composition of MSG presents in many kind of natural sources. One of the sources is plants. The using of plants as food enhancer is usually used by most people. The plants that used are the plants grown in their yard, so it is exactly cheap and easy to get. Some of them, such as bay plants *(Syzygium polyanthum*) use its leaves [42], cinnamon (*Cinnamomum verum*) uses its bark [43], star fruit (*Averrhoa bilimbi*) uses its fruit to give acidity and viscous of the food [44], kaffir lime (*citrus hystrix*) uses its leaf and fruit [45], lemongrass (*Cymbopogon citratus*) which used its stem or leaf to processed to be citronella oil [46], bunga lawang (*Illium verum*) uses its flower or fruits as a spices [47], combination of tomato, potato, mushroom and garlic also can give vast flavor profile, because they have many volatile and nonvolatile flavor compounds [33]. There are many plants which widely can be used to enhance the taste of food, but there are some plants which only can grow in certain areas or can be called as the local plants.

The study of the using of plants by the people hereditary in long time period is etnobotani [48]. Sengkubak (*Pycnarrhena cauliflora* Miers) uses its leaf as food enhancer some from West Kalimantan [49] also has potential to develop the essential oil from its leaf, gandaria (*Bouea macrophylla*) scattered in Maluku which used its fruit as enhance taste of chili sauce and pickles [50], andaliman (*Zanthoxylum acanthopodium* DC.) scattered in District Toba Samosir and North Tapanuli, North Sumatera which used its essensial oil [51], and *bekai* or *mekai* plants (*Phycnarrhena tumefacta* Miers) scattered in Berau, East Kalimantan which use its leaves [52], Sungkai (*Albertisia papuana* Becc.) which could be found in Kalimantan forest and used as food enhancer by Dayak tribe [53], and many others. MSG consumption has been worrying in the term of potential toxic effect. Replacing MSG with other natural source of glutamate as umami flavor enhancer can be more safety alternative of human health in the future [54].

2.8 Extraction of plants

Plants have secondary metabolite which contains a huge of bioactive compound, provide exert anti-carcinogenic activity. These compounds, now termed 'phytochemichals', which makes flavor and color of edible plants and beverages derived from them [55]. Bioactive compounds which present in the parts of plant usually separated by extraction method. Extraction is separating certain substance from the solution using suitable solvent [56]. Some extraction method are maceration, inundation, *Ultrasound – assisted solvent extraction*, perkolasi, soxhlet, reflux dan steam destilation [57]. Extract consists of three types, namely liquid extract, thick extract (viscous extract), and dry extract. Liquid extract contains more than 30% water content, thick extract contains 5% to 30% water content, while dry extract contains less than 5% water content. The production of extract depends on the purpose of extraction and the long of time the extract will be used [58].

3. CONCLUSION

The conclusion of this paper is RTE meatballs with the addition of MSG as the food enhancer is safe to consume in the certain limits and dose. However, it reported can cause serious risk in organ performance during a long time with exceeding dose of using. Several local plants in Indonesia have potential delicacy to be natural source of taste enhancer as MSG replacer in the form of powder, whole leaf, extracted, of taken its essential oils.

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