

**SFRN** 2019

Security in  
food,  
renewable  
resources,  
and  
natural  
medicines



# PROCEEDING

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**3rd INTERNATIONAL CONFER-  
ENCE ON SECURITY IN FOOD,  
RENEWABLE RESOURCES, AND  
NATURAL MEDICINES 2019  
(SFRN 2019)**

Convention Hall Politeknik Pertanian Negeri Payakumbuh  
INDONESIA



hosted by,  
Politeknik Pertanian  
Negeri Payakumbuh



co-Hosted by,  
Universitas Andalas  
(UNAND)

## **QUANTUM-LEAP OF AGRI-FOOD SYSTEM 4.0 AND DELIVERY OF SUSTAINABLE DE- VELOPMENTS GOALS (SDGS)**

September 25-26, 2019



**PROCEEDING**  
**3rd INTERNATIONAL CONFERENCE ON SECURITY IN**  
**FOOD, RENEWABLE RESOURCES, AND NATURAL**  
**MEDICINES 2019 (SFRN 2019)**

**September 25-26, 2019**  
**Convention Hall Politeknik Pertanian Negeri Payakumbuh**  
**INDONESIA**

*Theme:*  
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*Theme:*  
**“QUANTUM-LEAP OF AGRI-FOOD SYSTEM 4.0 AND DELIVERY OF  
SUSTAINABLE DEVELOPMENTS GOALS (SDGS)”**

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**Welcome Message**  
**Executive Chairman of The 3rd International Conference on Security in Food,  
Renewable resources, and Natural Medicines (SFRN) 2019**



Dear Honorable ladies and gentlemen,

Good Morning and Assalamu'alaikum wr.wb

On behalf of the SFRN 2019 organizing committee, I am really honoured and delighted to welcome all of you to the 3rd International Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019 at the State Polytechnic of Agriculture Payakumbuh, West Sumatra Indonesia

Our technical program is rich and varied with 8 keynote speeches and 4 invited talks and more than 170 technical papers split between 8 parallel oral sessions and 1 poster sessions. The speakers and participants came from 8 different countries, consist of Academicians, Scientists, Researchers, Practitioners, Professionals, and Government Officials in multidiscipline branch of knowledge, who gathered here today to share and discuss new findings and applications of innovations for promoting Food Security, Renewable Energy, Sustainable Resources and HealthCare Free for All, in particular for those who in needs. As the chairman of conference 2019 SFRN, I know that the success of the conference depends ultimately on the how many people who have worked in planning and organizing both the technical program and supporting social arrangements. This year, the conference is jointly organized by the Payakumbuh State Agricultural Polytechnic and Andalas University. We also thank to the steering committee for their wise and brilliant advice on organizing the technical program; and also to the the Program Committee, both from the Payakumbuh State Agricultural Polytechnic and Andalas University, for their thorough and timely reviewing of the papers and to the Director of Payakumbuh State Agricultural Polytechnic and the rector of Andalas University, and the Head of the Institute for Research and Community Service of Andalas University, and Payakumbuh State Agricultural Polytechnic. Our recognition should go to the Organizing Committee members who have all worked really hard for the details of the important aspects of the conference programs and social activities, and then we extend our gratitude to our students who bore the arduous burden for preparing this event.

We hope this event is also a good step in gaining strengthened cooperation between our universities as we know that the State Agricultural Polytechnic of Payakumbuh is part of the Andalas University previously, of course the psychological relationship between the State Agricultural Polytechnic and the Andalas University is really close.

Finally on behalf of the committee, we apologize profusely for all the shortcomings and everything that is not properly in organizing this event and hopefully AES-Network contributes significantly to the research and technology for the good of humanity.

Thank you

**Fithra Herdian, S.TP, MP**

**Message from Afro-Eurasia Scientific (AES) Network  
3<sup>rd</sup> International Conference on Security in Food, Renewable resources, and  
Natural Medicines (SFRN) 2019**



Dear Honorable and Distinguished guests,  
Ladies and gentlemen,

Assalamu'alaikum Warahmatullahi Wabarakatuh and Good Morning

On behalf of the AES Network, I am honored and delighted to welcome you to the 3<sup>rd</sup> International Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019 at the Agricultural State Poly Technique of Payakumbuh, Indonesia. I believe we have chosen a venue that guarantees a successful technical conference amid the culture, delicacy and scenery of Payakumbuh, the city of “Rendang”.

The AES-Network aims to Promote Livelihood Through Food Security, Promote Future Smart and Green Mobility by Using Renewable Energy, Promote Prosperity by Equally Managing and Distributing the Sustainable Resources and Promoting Enjoyable Long-Life by using Natural Medicines With Free Health Care For All. The AES-Network was established in 2018 and already have memberships from 12 countries. Our members consist of Academicians, Scientists, Researchers, practitioners, professionals, and government officials from multidiscipline branch of knowledge, who gathered and contributed their expertise to share and discuss new findings and applications of innovations for promoting Food Security, Renewable Energy, Sustainable Resources and Free Health Care for All. In particular, the network aims to alleviate the condition of those who in dire needs. In the future, we also expect to provide technical demonstrations, and numerous opportunities for informal networking for Promoting Food Security, Renewable Energy, Sustainable Resources and Free Health Care for All. In this opportunity, we invited you to become our members and join our efforts for a better life to all of mankind.

As a team, we acknowledge the existence of mutual interest among university and college educators, researchers, activists, business sector, entrepreneurs, policy

makers, and all society members. We must promote the need to strengthen cooperation for establishing Security in Food, Renewable Resources, and Natural Medicines in Africa, Europe, and Asia.

The AES-Network believe, a firm foundation for mutual collaboration with the spirit of equality and partnership and thereby contribute towards sustainable development in these three regions.

Therefore, through networking, friendships, and joint efforts, the capacity of our network can be enhanced to address major challenges in securing the Food, Renewable Resources, and Natural Medicines in Africa, Europa, and Asia. Our Network goals are to increase the awareness of educators, researchers, scientific community, business sector, entrepreneurs, and policy makers in Africa, Europa, and Asia, that the future of a better world, lies within their responsibilities, and to improve the networking, mobility and mutual collaboration of scientific community, business sector, entrepreneurs, and policy makers in Africa, Europe, and Asia to energize the delivery of Sustainable Development Goals.

Finally, I hope that, by registering our network, you will be provided a common platform and support the exchange of knowledge, while at the same time, we offer constructive dialogue across and within the various interest and stakeholder groups, including the intended beneficiaries, and arrived at the best solutions to our terminal goal, Promoting Food Security, Renewable Energy, Sustainable Resources and Free Health Care based on scientific evidence in Africa, Europa, and Asian region.

Thank You for Joining us!

**President**

**Assoc. Prof. Dr. Eng. Muhammad Makky**



**Welcome Message**  
**Head of Institute for Research and Community Service**  
**Universitas Andalas**



Dear Honorable and Distinguished guests,  
Ladies and gentlemen,

Assalamu'alaikum Warahmatullahi Wabarakatuh and Good Morning

It is with great pleasure that I welcome the participants of the SFRN 2019 in Payakumbuh, the city of “Rendang”, the prime of Indonesian delicacy.

In this esteem event, we share the knowledges, and imparted it to the people. The quest for knowledge has been from the beginning of time but knowledge only becomes valuable when it is disseminated and applied to benefit humankind. It is hoped that this conference will become a platform to gather and disseminate the latest knowledge which can be adopted for securing the food, resources, and health for mankind, in Asian, European and African region.

Academics, Scientists, Researchers and practitioners from multidiscipline branch of knowledge who gathered here today will be able to share and discuss new findings and applications of innovations for ensuring food security, in particular for those who reside in developing countries. It is envisaged that the intellectual discourse will result in future collaborations between universities, research institutions and industry both locally and internationally. In particular it is expected that focus will be given to issues on environmental and sustainability. Therefore, we urge to all participants, to establish a scientific network that will voice the needs

Researchers in the multi sectoral aspects related to the benefit of mankind have been progressing worldwide. Food is a basic right, while energy drive the world. Human need a lot of resources so the civilization can be flourished. But human is not immune, and thus, ones need to take care of their health regularly. Modern Agri-food systems is the foundations of a decent life, a sound education and the achievement of

the Sustainable Development Goals. Over the past decade, we have witnessed a chain reaction that threatens the very foundations of life for millions of the world's people. Rising energy prices drove up the cost of food and ate away the savings that people otherwise would have spent on health care or education. Unsustainable plantation management induced forest fire and posed haze hazard to the whole Sumatra island and our neighboring countries.

The human cost of the food and energy crisis has been enormous. Millions of families have been pushed into poverty and hunger. Thousands more suffering from the collateral effects. Over the past year, food insecurity led to political unrest in some 30 countries. Yet because the underlying problems persist, we will continue to experience such crises, again and again -- unless we act now. That is why we are here today.

We must make significant changes to feed ourselves, and most especially, to safeguard the poorest and most vulnerable. We must ensure safety nets for those who cannot afford food, or energy, nor even a health service. We must transform agricultural development, markets and how resources is distributed. We must do so based on a thorough understanding of the issues. That is the only possible way we can meet the Goals of Sustainable Development.

Thank You,

**Assoc. Prof. Dr.-Ing. Uyung Gatot S. Dinata,MT.**

**Opening Ceremony  
Rector of Andalas University**



Dear Honorable and Distinguished guests,  
Ladies and gentlemen,

Assalamu'alaikum Warahmatullahi Wabarakatuh and Good Morning

I welcome the opportunity to address you at this important event.

It gives me great pleasure in welcoming you to this 3<sup>rd</sup> Conference on "Security in Food, Renewable resources, and Natural Medicines (SFRN)" 2019. I am delighted that so many have accepted our invitation. I am particularly happy that we have in this room, dedicated individuals from so many stakeholder groups — including our most respected and distinguished guest “The ministry of Agriculture of the Republic of Indonesia”. We also welcome the mayor of Payakumbuh and the Regent of Lima Puluh Kota. We extend our welcome to the civil society, the private sector, international organizations; the science community; and others dedicated to help create an environment in which people can escape food insecurity. Imagine what we can do together if we make the security for all as an our top priority, and pull in the same direction. We can make a difference in the lives of millions.

Food is a basic right. Food security are the foundations of a decent life, a sound education and the achievement of the Sustainable Development Goals Access to medicines - a fundamental element of the right to health. Health is a fundamental human right, indispensable for the exercise of many other rights in particular the right to development, and necessary for living a life in dignity. Moreover, human rights principles and language are being used to support resource access claims as rights-based approaches empower individuals and groups to gain or maintain access to natural resources

Much progress has been made during the last decades but much more needs to be done. Millions of people are Insecure worldwide, meaning that they either starve or they do not know from where their next meal, health care or resources will come.

Much of the progress on security has occurred at the expense of our environment. With business as usual, we foresee that the production improvements during the next decade will be less than the last one, while the environmental degradation will continue, and health will deteriorate significantly. Without available resources to seek, mankind will become endanger species in a very short time.

Solutions to the security problems need to be designed and implemented within a new and rapidly changing environment. Globalization and sweeping technological changes offer new opportunities for solving these problems. A number driving forces or trends must be taken into account in developing appropriate action. Some of the action needed, such as appropriate technology for small farms, is not new but it must be cast in the new and changing global and national environment, taking into account new opportunities and risks. I hope that by providing a forum for knowledge exchange, this conference will help identify the action to be taken. Furthermore, this conference will help to provide constructive dialogue across and within the various interest and stakeholder groups, including the intended beneficiaries, and arrive at the best solutions.

In conclusion, even if those responsible give high priority to achieving sustainable security for all and back it up with action, the world may not achieve the goal by 2030. But we will be much closer than with business as usual. I urge all of us to provide the strongest support for this event, to enable securing the food for all in the closest time possible. It is my sincere optimism that through the accomplishment of the objectives of this event, we will come to an important step nearer to secure the food for all.

Finally, I would like to thank the organizing committee who have spent their utmost efforts to prepare and manage this event successfully. Let me conclude my remarks by wishing our guests happiness, good luck and great success in the conference.

May I announce now the opening of the “3<sup>rd</sup> International Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019” in Payakumbuh.

Thank you.

**Rector,**  
**Prof. Tafdil Husni, SE, MBA, PhD**

**Welcome Message**  
**Director of Politeknik Pertanian Negeri Payakumbuh**



Dear Honorable ladies and gentlemen,

Good Morning and Assalamu'alaikumwr.wb

I congratulate to all participants on the invitation and participate at our beloved campus Payakumbuh State Agricultural Polytechnic. I feel really honoured to welcome all of you at our event, the 3rd International Conference on Security in Food, Renewable Resources, and Natural Medicines (SFRN) 2019 at the Payakumbuh State Agricultural Polytechnic, Indonesia.

Food security is a very important aspect in a country's sovereignty. Food also determines the future direction of a nation. Many social and political fluctuation can also occur if food security is disrupted. Food availability that is smaller than its needs can create economic instability. This critical food condition can even endanger economic and national stability. In the current situation, there are many challenges in exteriorize food security, such as climate change, population, limited natural resources and other challenges both locally, regionally and globally.

Renewable resources are also our starting point to start sustainable development. Research on renewable resources is also very important as the solution in meeting the principles of sustainable development. As we know that Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainability is the foundation for today's leading global framework for international cooperation - the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs)

The discovery of treatment based on local culture also contributes greatly to the good of humanity. Unfortunately, there are still many treatments that have not been carried out by scientific research. So, through this conference we hope it can be a trigger to increase in traditional plant-based treatments that not go through complex

chemical processes, so that the effectiveness of the pillars can be further suppressed and also contribute to the community's economy.

Finally, I would like to express my gratitude to all people who involved in organizing this event and to all of stakeholders who have helped to make this event go on successfully. Please accept my apologize for any shortage, Assalamu'alaikumwr.wb.

Thank you

**Ir. Elvin Hasman, MP**

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## The Study of Chemical Quality and Sensory of Egg Rendang in Payakumbuh

Deni Novia, Indri Juliyarsi, Sri Mulyani

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**Abstract.** Rendang is a traditional food that originated from West Sumatra. This study aims to identify the production quality of egg rendang in Payakumbuh. The material of the study was a 250 gram of egg rendang, obtained from eight registered industries in the Department of Industry and Trade in Payakumbuh, and eight non-registered industries of egg rendering. The study applied a survey method. Statistical analysis (t-test) shows no significant difference in protein, fat content, and sensory test of egg rendang in registered and non-registered industries, but significantly differ on moisture content.

**Keywords:** egg rendang, chemical quality, sensory value, registered and non-registered

### INTRODUCTION

According to the result of the 2011 CNN survey, rendang is one of the most delicious dishes in the world (Sutomo, B. 2012). Rendang is a traditional dish that originated from West Sumatra. Beef rendang, one of many types of rendang, has various tastes in every region in West Sumatra. Different processes and ingredients used in each region enrich the taste of beef rendang. Various types of rendang are made of beef, *suir* (shredded beef), cow's lung, chicken, *lokan* (seashell), eel, fern, egg, and many others.

Egg Rendang is the typical food that travelers were looking for in Payakumbuh, West Sumatra. Eggs with flour and rendang seasoning are processed in such a way, producing crispy and savory egg rendang. In general, egg rendang uses chicken eggs as the main ingredient. Egg rendang is one of the alternatives in improving the utilization of egg production in Payakumbuh region.

Payakumbuh is well known as the city of egg rendang as it produces a huge amount of eggs, especially chicken eggs. To increase the purchasing power of egg, the people of Payakumbuh use eggs as the main ingredient of making rendang. Egg rendang is not only served in traditional ceremonies, marriages, thanksgiving events, but also as food souvenirs. Moreover, the marketing of egg rendang reaches outside West Sumatra, such as Batam, Pekanbaru, and once participated at a traditional food exhibition in Malaysia. Putri research rendang business actors in rendang village, Payakumbuh has a mainstay product namely rendang eggs because it is more durable, smaller capital and more desirable (Putri, Z. E., 2018). Preserving rendang can be done by adding gambier extract (Melia, S., Novia, D. & Juliyarsi, I., 2015). and mangosteen peel extract as a natural antioxidant in making rendang with a

concentration of up to 1% is still organoleptically preferred (Melia, S., Novia, D., Juliyarsi, I. & Purwati, E., 2019). Efforts to socialize egg rendangs were also carried out in the form of training on making egg rendangs for students of FSI Keputrian, Faculty of Animal Science, Unand to improve the quality and selling value (Novia, D. et al. 2017).

The making process of egg rendang in Payakumbuh differs in terms of the main and side ingredients, namely in the manufacturing process, packaging systems, sanitation during the production, as well as the quality of egg rendang both in type and composition. These differences affect the texture, color, and taste, as well as the consumer's acceptance. In the business of beef rendang catering for aircraft service, users have implemented ten HAACCP (Hazard Analysis Critical Control Point) applications except for monitoring (Wicaksani, A. L. & Adriyani, R., 2017). However, egg rendang in Payakumbuh City has not fully implemented food sanitation standards in the production process, to guarantee food security.

The data from the Department of Industry and Trade of Payakumbuh in 2010 show that there are fifteen registered egg rendang industries, but only twelve of them are still active in terms of production, i.e., "Rendang Suir Ernawati", "Erika," "Usmai", "Rila", "Rendang YET", "Rendang MAMI", "Rendang YEN", "Rendang RIRI", "Rendang NIKMAT", "Rendang NIKMAT", "Rendang SAIYO", "Rendang YOLANDA", "Rendang MAR". Moreover, there are still many non-registered egg rendang industries in Payakumbuh (Departement Perindustrian dan Perdagangan Kota Payakumbuh, 2010).

In this study, the data were collected using random sampling from twelve industries of egg rendang registered in the Department of Industry and Trade of Payakumbuh. The samples obtain eight industries as registered samples. These are the industries with the biggest amount of egg rendang production per day. In addition, eight samples are collected from the non-registered egg rendang industries in the Department of Industry and Trade of Payakumbuh. These samples of non-registered industries are for comparing the sample quality of the registered industries.

The study aims to identify the quality of egg rendang production in Payakumbuh City. By identifying and comparing the quality of the samples above, we hope that this study will be able to provide information for the industries, society, fellow researchers as well as the government to improve the quality of egg rendang production, especially in Payakumbuh.

## **MATERIAL AND METHOD**

The material used in the study is 250 grams of egg rendang obtained from 16 industries in Payakumbuh. The chemicals used include concentrated H<sub>2</sub>SO<sub>4</sub>, catalyst, selenium, distilled water, Methyl Red (MM) indicator, NaOH, brown paper, and benzene. The equipments used include analytical scale, plastic bottle, incubator, desiccator, autoclave, beaker glass, measuring cup, water bath, stove, filter pan, Kjeldahl flask, funnel, distillation flask, distiller, 500 ml beaker glass, boiling chip,

volumetric pipette, 500 ml volumetric flask, micro burette, soxhlet flask, electric oven, petri dish, and parchment paper.

The study applies a survey method. Sample collection was carried out using the *Purposive Sampling* method, which is collecting samples with specific criteria, performed by taking the most samples, followed by laboratory analysis of egg rendang samples obtained from the egg rendang industry in Payakumbuh. The population for all samples of the egg rendang industry, both registered and non-registered at the Department of Industry of Payakumbuh is in Table 1.

Table 1 The Total Production of Egg Rendang Industry in Payakumbuh

No	Name of Industry	Total Production (Kg)	Address
1	Rendang Suir Ernawati	30	Simp. Napar
2	Rendang Erika	30	Simp. Napar
3	Address	20	Simp. Napar
4	Rendang Rila	30	Simp. Sicincin
5	Rendang YET	25	Kel. Labuah Baru
6	Rendang Mami	25	Jl. Prof. Hamka No.74
7	Rendang Yen	22	Simp. Napar
8	Rendang Riri	23	Simp. Napar
9	Rendang Nitriwa	5	Koto Baru Simalanggang
10	Rendang Ris	8	Jl. Gatot Subroto No.44
11	Rendang Murliati	10	Jl. Jeruk Lb.Basilang
12	Rendang Kas	8	Jl. Lintas Lintau
13	Rendang Santi	5	Kel. Payobasung
14	Rendang Indah	5	Kel. Nan Kodok
15	Rendang Nurul	7	Kel. Parit Rantang
16	Rendang Tiga Saudara	10	Kampung Tarandam

*The data obtained from the egg industry are processed using the t test for comparison (Sudjana, 1992):*

$$S = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}} \tag{1}$$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \tag{2}$$

where:

- t = T- count
- $\bar{X}_1$  = Average value of sample one
- $\bar{X}_2$  = Average value of sample two
- S = Standard deviation of sample one and two
- $n_1$  = Sample one sum
- $n_2$  = Sample two sum
- $s_1$  = Standard deviation of sample one
- $s_2$  = Standard deviation of sample two

The parameters measured are the moisture content (using oven method based on calculation of wet weight), protein content (using Kjeldahl method), fat content (using Soxhlet extraction method) (AOAC, 2016), and sensory test (using hedonic

test) including flavor, taste, and texture to 25 panelists with a score of 1 = dislike, 2 = like, and 3 = really like.

The research was conducted in three stages, the first stage is in the form of a field survey, the second stage is sampling, and the third stage is a follow-up analysis in the Animal Products Technology Laboratory, Faculty of Animal Science, Andalas University, Padang from September to December 2012. See Figure 1 for details.

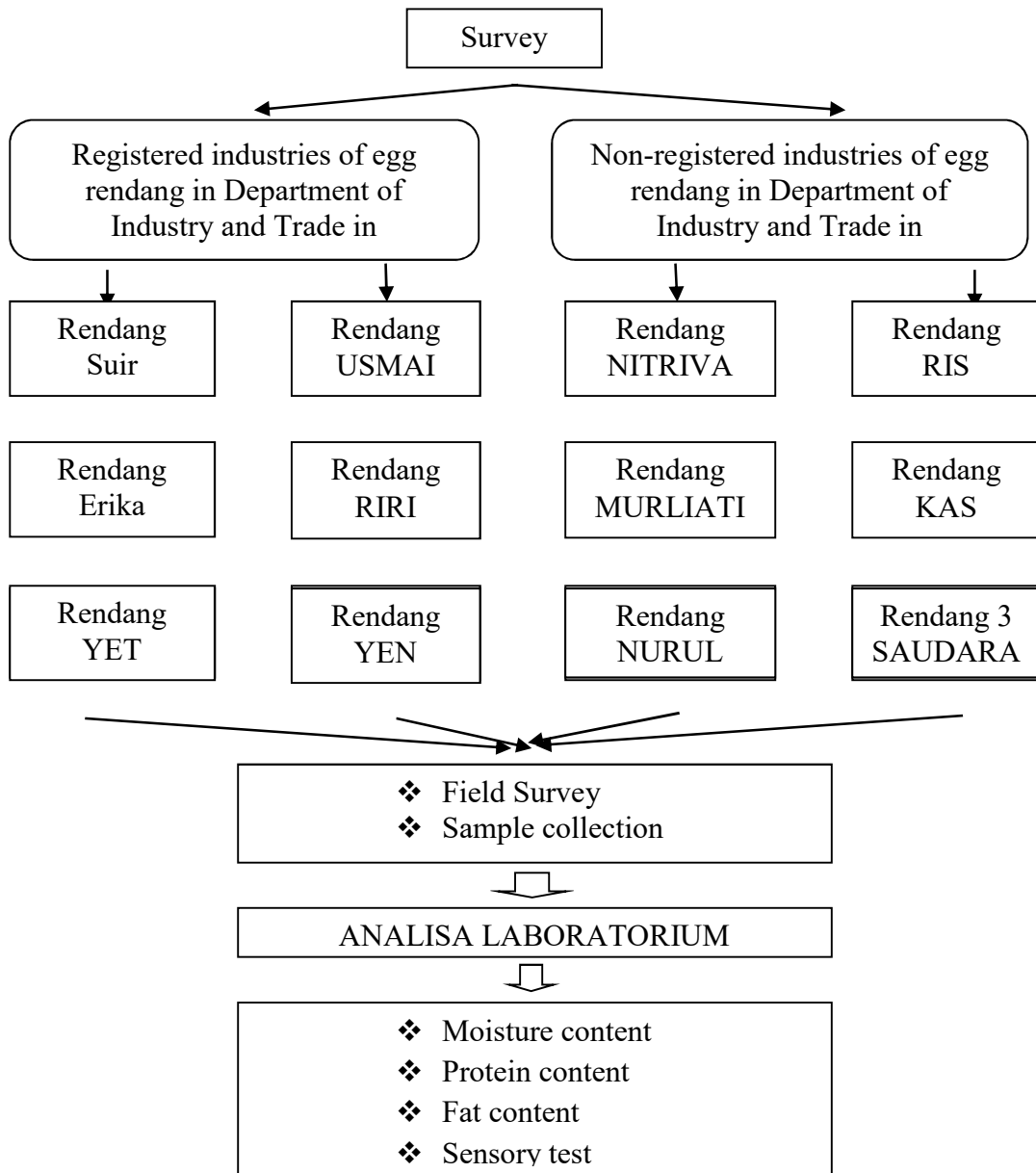


Fig.1 - The diagram of research procedures

## RESULTS

### General Review

Payakumbuh is one of the regions in West Sumatra Province. Geographically, Payakumbuh lies between 11°S and 6°N, and longitude and 95°E and 141°E, with an area of 80.43 km<sup>2</sup>, with an average rainfall of 2,000 to 2,500 mm per year. The

average temperature is 26 ° C, with air humidity ranging from 45% to 50%. The east of Payakumbuh is bordered by the sub-district of Luhak, Harau, and Lima Puluh Kota District. To the west, it is bordered by the sub-district of Luhak and Payakumbuh. In the north by the sub-district of Payakumbuh and Lima Puluh Kota District, and the south bordered by the sub-district of Luhak and Lima Puluh Kota District. The city is divided into eight Nagari, five sub-districts and seventy six kelurahan (Payakumbuh Central Bureau of Statistics, 2003). More details map Payakumbuh can be seen in Fig2.

The study of egg rendang compares between registered industries and non-registered industries of egg rendang in the Department of Industry and Trade of Payakumbuh. There are 15 registered industries of egg rendang in the Department of Industry and Trade of Payakumbuh. From the list, 12 industries are still active in production. For the purposes of the study, a total of eight active industries of egg rendang production were taken, namely "Rendang Suir Ernawati", "Erika", "Usmai", "Rila", "Rendang YET", "Rendang MAMI", "Rendang YEN", "Rendang RIRI ". While there were 8 industries from non-registered industries, namely Rendang "NITRIVA", Rendang "RIS", Rendang "MURLIATI", Rendang "KAS", Rendang "SANTI", Rendang "INDAH", Rendang "NURUL", Rendang "TIGA BERSAUDARA". At the time of re-observation, two industries that were previously not registered as industries have been registered to the Department of Industry and Trade of Payakumbuh, namely "INDAH" and "THIRD" at the end of 2012. (Departement Perindustrian dan Perdagangan Kota Payakumbuh, 2010)

From the results of a questionnaire submitted to producers of the egg rendang industry in Payakumbuh, it shows that 100% of the main ingredients used are chicken eggs. The hygiene level of eggs is classified as 100% clean on both sides. All of the industries use oval and round-shaped eggs. The eggs used for egg rendang are originated from laying hens in each location around the industries in Payakumbuh. The seasonings used by each industry are different, especially the spices, in order to get a distinctive taste on the products.

Coconut as a raw material in making rendang, first shredded coconut, and then taken coconut milk (Wulandari, K. R., Waryono, W. & Pasaribu, P. 2018). Every industry uses fresh santan (coconut milk) which is made of old coconuts. The ratio of egg and coconut is 1: 1. In the results of the questionnaire, the ratio of egg and coconut is 100% for registered industries, while those for non-registered industries are 87.5%. This percentage is due to the process of making egg rendang in the non-registered industries applies a 2:1 ratio of egg and coconut.

The process of making egg rendang starts from 07.00-12.00 WIB. It takes approximately five hours from preparing the ingredients to the cooking process, with the percentage of 50% for the registered industries and 37.5% for the non-registered industries, including the average cooking time is 3-4 hours. All of the industries use 100% of firewood as fuel. The purpose of using firewood as fuel is not only for savings, but also for bringing out the distinctive aroma of the product. According to Sugitha, smoke that comes out of hardwood contains phenol compounds and organic acids, which can affect the taste of the product. (Sugitha, I. M, et al. 2004)



## A. Food Security

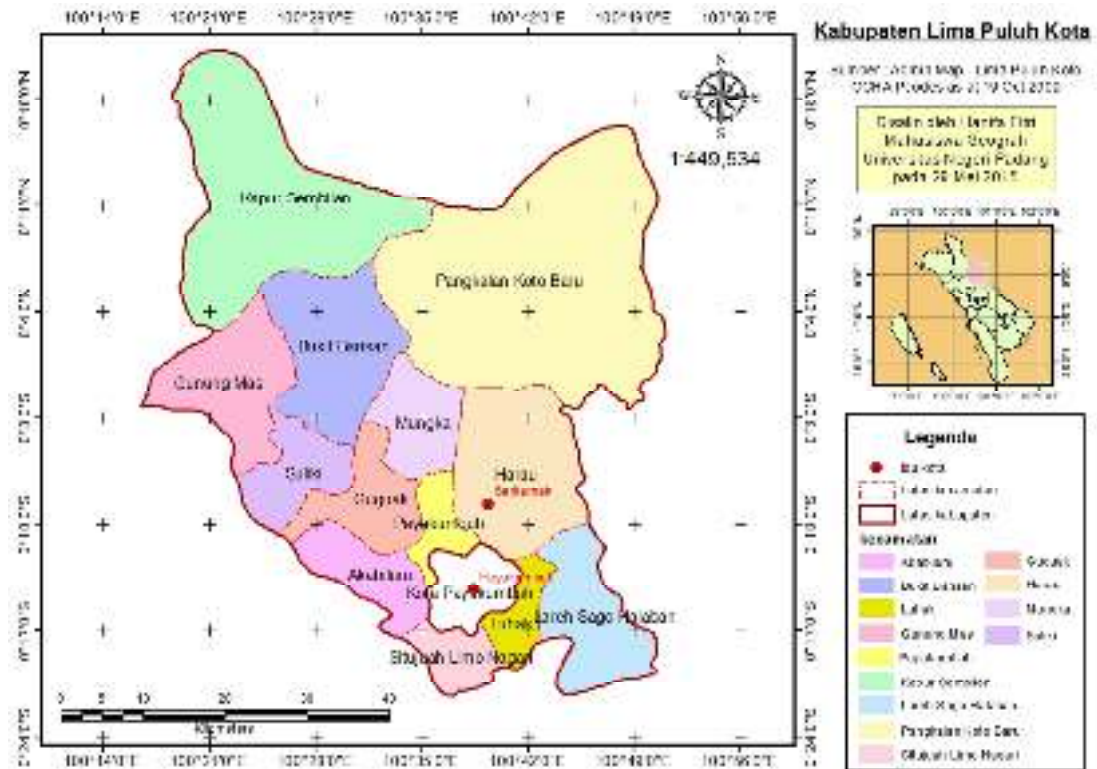


Fig.2 – The Map of Payakumbuh and Lima Puluh Kota District

In registered industries, 25% of the making process uses gloves, while in non-registered industries only 12.5%. The use of water during the processing of rendang telur uses 87.5% of water from Municipal Waterworks for registered industries, while non-registered industries still use (well water) with a percentage of questionnaires of 50%. In this case, water is needed in the production of egg rendang for sanitation during the making process. Furthermore, 12.5% of registered industries use plastic cutting board, while 75% of non-registered industries use wooden boards.

After the making process, rendang telur is packed in polypropylene plastic with a percentage of 62.5% for registered industries and 75% for non-registered industries. The tools used in packaging the product is a sealer, based on the percentage of the questionnaire, registered industries use 100% of the tool, while for non-registered industries only 62.5%. The thickness of the egg rendang produced is 2mm and the results of the questionnaire show the same percentage of 37.5% in both registered and non-registered industries. After being packaged, the product is directly distributed to the marketing area via cars and motorbikes as a means of transportation. The price of egg rendang is IDR 40,000.00 per kilogram in both registered and non-registered industries with a percentage of 62.5% obtained from the questionnaires.

### Moisture Content

The results of the analysis of water content of egg rendang in all Payakumbuh City rendang industries are shown in Table 2.

In Table 2, it shows that the average water content of the product in registered industries is 2.34%, while non-registered industries is 3.17%. The results of the statistical analysis (t-test) on the water content of the product shows significant differences ( $P < 0.05$ ) between registered and non-registered industries. This is because the cooking process determines the water content of the product. Purnomo states that water in food plays a role as a solvent for various components, besides as a reagent material, the form of water in food can be found in the form of bound and unbound water. (Purnomo 1996)

The duration of cooking process also determines the water content of egg rendang. The cooking process of egg rendang requires an average of 3-5 hours. Registered industries that perform 3 hours cooking time is 25%, while non-registered industries is 87.5%, and 5 hours of cooking time only appears 12.5% in non-registered industries. The longer cooking time causes lower water content. It also causes protein denaturation. According to Ophart, heating will make protein denatured so that the ability to bind the water decreases (Ophart, C. E., 2003). The longer the cooking process, the lower moisture content contained in the egg rendang will be, due to the evaporation process.

Table 2 Moisture content of egg rendang (%)

Sample	Registered Sample	Non-registered Sample
1	3.14	2.84
2	2.74	3.62
3	1.38	2.88
4	1.75	2.73
5	1.68	4.51
6	3.64	3.13
7	1.89	2.45
8	2.51	3.21
<b>Total</b>	18.73	25.37
<b>Average</b>	2.34	3.17
<b>Standard Deviation</b>	0.79	0.64

### Proteint Content

The results of the analysis of protein content of egg rendang is shown in Table3.

Table 3. Protein content of egg rendang (%)

Sample	Registered Sample	Non-registered Sample
1	11.91	10.76
2	9.66	8.47
3	8.31	8.00
4	13.59	9.82
5	8.48	10.99
6	10.24	11.24

## A. Food Security

Sample	Registered Sample	Non-registered Sample
7	10.24	8.52
8	9.89	9.48
<b>Total</b>	82.32	77.28
<b>Average</b>	10.29	9.66
<b>Standard Deviation</b>	1.74	1.25

From Table 3, it shows that the average protein content of egg rendang registered industries is 10.29%, while non-registered industries have an average protein content of 9.66%. The results of the statistical analysis (t-test) on the protein content of rendang egg shows no significant difference ( $P > 0.05$ ) between registered and non-registered industries.

The use of eggs as the main material in the manufacturing process can increase the protein content of the egg rendang itself. According to Sugiatmi, based on the nutritional value of eggs, the composition of the protein in egg rendang per 100 gram of eggs is 14.29%. (Sugiatmi. Rendang Telur Yet. 2010)

The protein content of egg rendang has similarities in the use of main materials during the processing, such as eggs, santan (coconut milk), herbs, and spices. The use of eggs in egg rendang can increase the protein content. The use of spices improves the taste of the egg rendang.

## Fat Content

Table 4 Fat content of egg rendang (%)

Sample	Registered Sample	Non-registered Sample
1	34.71	30.34
2	38.32	34.07
3	37.49	36.45
4	37.40	38.70
5	31.32	36.74
6	31.06	37.41
7	34.96	35.37
8	39.73	35.80
<b>Total</b>	285.00	284.88
<b>Average</b>	35.63	35.61
<b>Standard Deviation</b>	3.19	2.54

Table 4 shows that the average fat content of egg rendang in registered industries is 35.63%, while in non-registered industries is 35.61%. The results of statistical analysis (t-test) on the fat content of egg rendang shows no significant difference ( $P > 0.05$ ).

The result of the t-test is because coconut milk used in the making process of egg rendang is thick coconut milk and originated from old coconut types.

Furthermore, it is also due to the similarity in the other material (spices) used in both industries, so that the fat content of egg rendang is almost the same in each industries. The use of spices on the product will create a distinctive taste and aroma for the product.

Egg Rendang contains high fat content. It is found in rendang sauce. Fat absorption occurs through the pores of egg rendang. Oxidative damage to food that contains fat is an important problem as it can reduce organoleptic quality and nutritional value. The main fat damage is the appearance of rancid smell and taste, also called the rancidity process. According to Winarno, the process of rancidity is caused by the autoxidation of unsaturated fatty acid radicals in fat, fat is an integral part of all ingredients, and plays a role in adding calories and improving the texture and taste of food. (Winarno, F. G. 2004)

### Sensory Value

The results of sensory analysis of aroma, taste and texture of egg rendang industries in Payakumbuh for both registered and non-registered are shown in Fig. 3. The results of statistical analysis (t test) on sensory of aroma, taste and texture of egg rendang show no significant difference ( $P < 0.05$ ) between registered and non-registered egg rendang industries. Both industries show the preferred aroma, taste and texture.

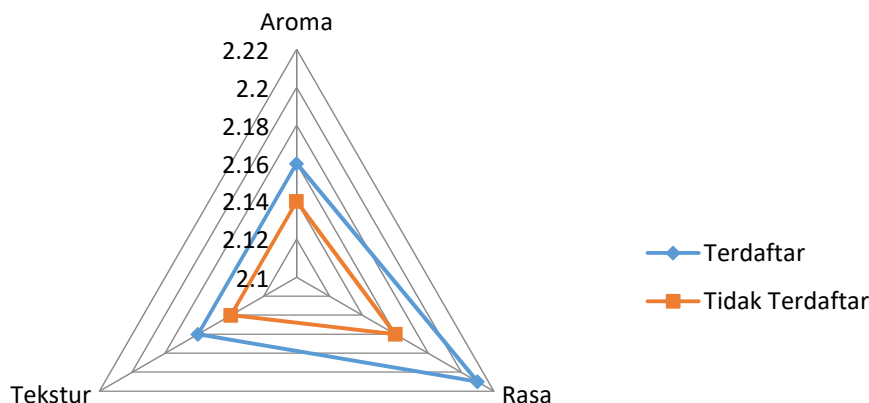


Fig.3 - Sensory test of aroma, taste and texture of egg rendang

From Fig. 3, the average sensory test of the egg rendang aroma ranges from 2.14-2.16 (preferred) on registered industries. The mixture of coconut milk and spices influences the aroma of the egg rendang. The percentage of seasonings and coconut milk based on the results of the questionnaire shows 62.5% on registered industries while 75% on non-registered industries. This is because the product has not undergone oxidation and its subsequent reaction, therefore it does not really affect the unpleasant aroma of egg rendang, especially the peroxide produced in egg rendang is absent. In addition, the samples analyzed are classified as new (one day after production).

Exspres states that in making rendang, aroma is also influenced by the use of spices such as ginger, turmeric, garlic and shallots. (Exspres, P. 2012) Questionnaire data show that in both industries the production process use 100% firewood as fuel, this is what affects the aroma, taste of egg rendang. Besides saving energy, the use of firewood can also create a distinctive aroma on the product. According to Sugitha, a good component of smoke from hardwood will give an interesting distinctive aroma. (Sugitha, I. M, *et al.* 2004). The results of the Rendang study from Payakumbuh have the typical characteristics of the smoke aroma and bitter taste. (Nazir, N., Anggraini, T. & Rahayu. 2018)

Based on Fig. 3, the average sensory of the flavor of egg rendang ranges from 2.16-2.21 (preferred) in registered industries due to the mixture of seasonings and cooking processes. According to Nurmufida rendang taste is influenced by spice mix, control of heat, cooking duration, and stirring technique. (Nurmufida M *et al.* 2017) The taste of cooked food depends on the reaction between reducing sugars and groups of amino acids, producing brown ingredients and various components of taste. (Buckle KA *et al.* 2009)

Fig. 3 shows that the average sensory test of egg rendang texture ranges from 2.14-2.16 (preferred) registered industries. The optimal thickness of egg production from both registered and non-registered industries has the same percentage based on the questionnaire, which is at 2mm (37.5%)

The process of cooking egg rendang, which takes 3-4 hours, can affect the texture of the product. The egg rendang texture is closely related to the water content contained in the egg rendang. According to Winarno, moisture content and water activity are very influential in determining the shelf life of food, as they affect the physical properties of the product (hardness and dryness).(Winarno, F. G.2004) Adding seasonings and spices into a food can affect the texture and taste. The texture and consistency of ingredients affect taste, besides the flavor compounds.

## CONCLUSIONS

The results of statistical analysis (t test) on protein content, fat content, and organoleptic of egg rendang in Payakumbuh show no significant difference ( $P>0.05$ ) between registered and non-registered egg rendang industries. While the water content showed a significant difference ( $P<0.05$ ). The conclusion of this study is that registered industries have an average of water content 2.34%; protein content 10.29%; fat content 35.62%; and organoleptic value of aroma 2.16; taste 2,21; and texture 2.16. While the average for non-registered egg rendang industries are water content 3.17%; protein content 9.66%; fat content 35.61%; and the organoleptic value of aroma 2.14; taste 2.16; and texture 2.14.

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