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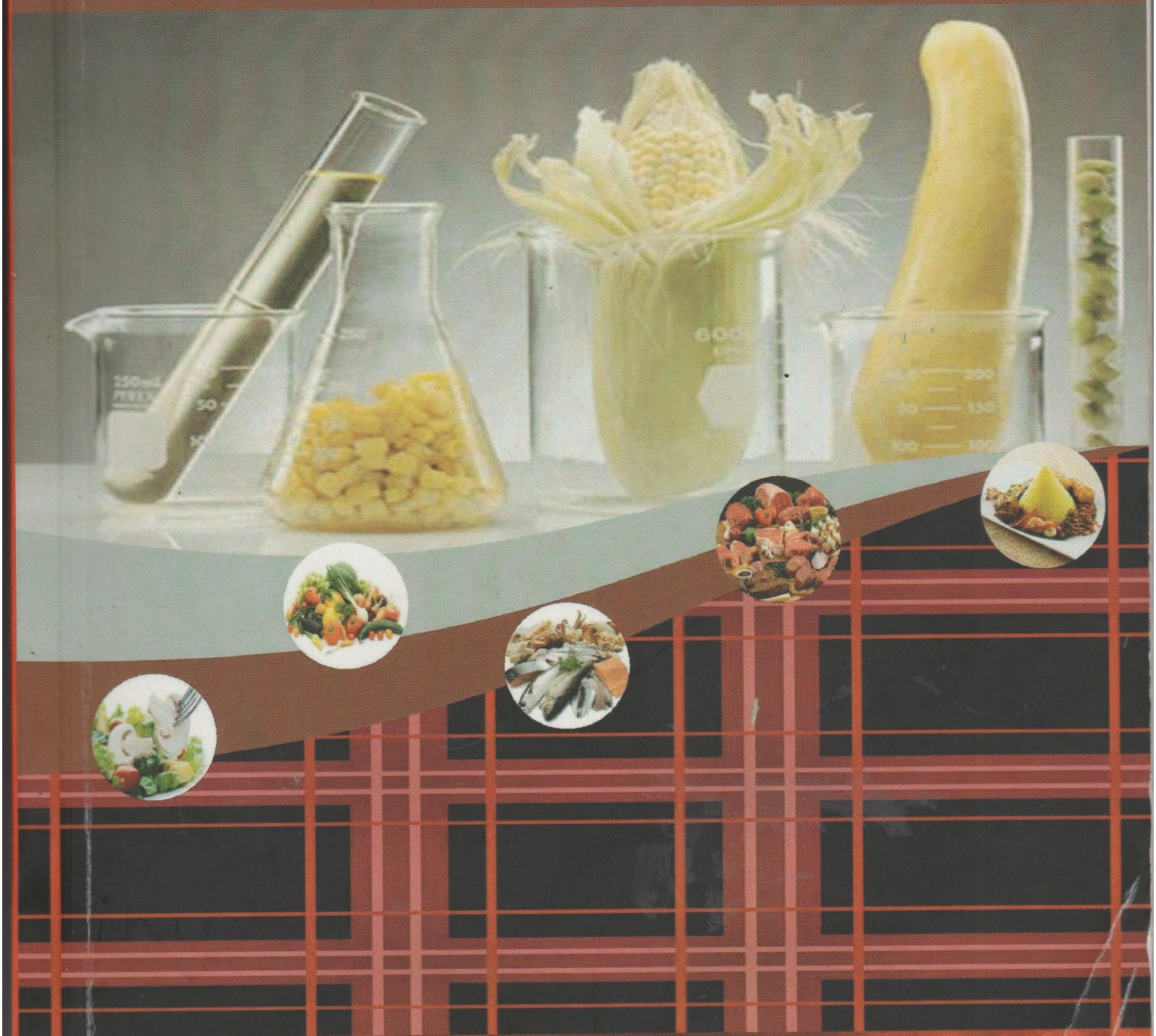
The Indonesian Association of Food Technologists Chapter KALTIM
Present

PROCEEDING

INTERNATIONAL CONFERENCE ON FOOD, AGRICULTURE AND CULINARY TOURISM



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Preface

The greatest regards should be expressed only to God the Almighty, Allah SWT. We have finished the Proceeding of The 1st International Conference on Food, Agriculture and Culinary Tourism (ICFACT) in six months after the conference which was held on 4-6 August 2015. This conference is in coherence with a grand agenda of increasing national and local food security and also improving nutritional statuses of the people. The conference focused on food, agricultural products and culinary that support food security, safety, processing advancement and their aesthetical aspects.

This conference proceeding volume contains the written version of most of the contributions presented during the conference, as oral and poster presentation. During the conference there were 6 keynote speakers, 37 oral presenters and 15 poster presenters who gave their speech, presentations and posters of their recent research. This conference presented international speakers from Chulalongkorn University, Associate Professor Saiwarun Chaiwanichsiri, University Putera Malaysia, Associate Professor Azmawani AbdRahman, and a leading presenter, Prof. Dr. Dato Othman Yatim from University Brunei Darussalam. Also, this conference featured fellow professors and scientists from UMS, IPB, LIPI, Balitbang Pertanian, Unpad, Manado, Papua, Mataram, Denpasar, Samarinda, and other places.

All papers presented in this proceeding have been through a series of reviewing process by the Editorial Team. Some paper presented in ICFACT will be published as a special edition of a Scopus Indexed Journal and will be processed through a more in-depth scientific review.

We would like to thanks and appreciate all authors, The Samarinda city government, Food Security and Agricultural Executive Counseling Board of Samarinda, PT Pupuk Kaltim, Food Review Indonesia, and Kulinologi Indonesia, The Editorial Team, The Proceeding Team, The Head of IAFT Chapter Kaltim, and the entire committee member who have been contributed in ICFACT and the proceeding publication.

See you in the next ICFACT at Bumi Etam.

Samarinda, February 2016

Editor

Welcome Speech

Welcome Speech from The ICFACT 2015 Committee
Assalamu'alaikum Warrahmatullahi Wabarakatuh,
A very good morning to you,

Welcome to Samarinda. I, would like to express greatest regard to the Almighty God, Allahu SWT, and also to extend my warmest gratitude to all the audiences, that assist, help, and support this event.

In the light of strengthening Indonesia through development of proficient and professional human resources, food is a major factor transforming to more productive society. This conference is in coherence with a grand agenda of increasing national and local food security and also improving nutritional statuses of the people. Hitherto, the conference will be focussed on food, agricutural products and culinary that support food security, safety, processing advancement and their aesthetical aspects.

We would like to report that about seventy national and international participants are attending the conference. This number is frankly beyond our expectation when we were arranging this at the first time. This suggests Samarinda is attractive and therefore has a potential to be developed as a tourist detination city in Kalimantan. We understand, to access Samarinda requires more effort. In near future, travelling to Samarinda will be less complicated as the new airport is ready to operate.

This conference will present international speakers from Chulalongkorn University, Associate Professor Saiwarun Chaiwanichsiri, University Putera Malaysia, Associate Professor Azmawani AbdRahman, and a leading presenter, Prof. Dr. Dato Othman Yatim from University Brunei Darussalam. Also, this conference will feature fellow professors and scientists from UMS, IPB, LIPI, BATAN, UGM, Widya Mandala, Gorontalo, Papua, Hasanuddin, Mataram, Jember, and other places.

The morning session is designed for keynote speeches and the afternoon session is for parallel sessions. In this regard, the conference will be sectioned in four: (1) food safety as an important factor to food security, (2) functional food development, (3) development of new food products, and (4) natural food production.

The Indonesian Association of Food Technologists chapter East Kalimantan Timur, as an organisation, would like to thank The Samarinda city government, Food Security and Agricultural Executive Counseling Board of Samarinda, PT Pupuk Kaltim, Food Review Indonesia, and Kulinologi Indonesia for their strong support to this conference.

We hope that you will enjoy the tropical climate of East Kalimantan while staying in Samarinda. Without further due, we kindly ask the Rector of Mulawarman University and the Mayor of Samarinda to give speech and also to open this conference, officially.

Wassalamu'alaikum Warahmatulllahi Wabarakatuh,

The ICFACT 2015 Committee,

Anton Rahmadi
Chairman.

Welcome Speech
The Head of Food Security and Agricultural Executive Counseling Board of Samarinda

The honorary, the Mayor of Samarinda city,
Honorary Head of working units of Samarinda
Honorary Rector of Mulawarman University,
Honorary Professors, Academicians, Participants, Invited guests from Indonesia and neighboring countries,
And all the audience.

A very good morning,

In this morning, I would like to thank God for His guidance and blessing. I am also would like to extend my gratitude to my fellow staffs in Food Security and Agricultural Executive Counseling Board of the Samarinda City and our colleagues from all over Indonesia and neighboring countries to attend the first international conference on food, agriculture, and culinary tourism, here in Samarinda, East Kalimantan.

To develop food security is a joint responsibility of government, private sectors, and more importantly the people, themselves. The food security is a condition where sufficient food is provided to a country and individuals. This is reflected by adequate supply of staple food, both in quantity and quality, its safety, diversity, nutritional contents that are accessible and affordable to people. It is also equally important that the provided food supports all religions, believes, and cultures, so that it will produce healthy, active, and subsequently productive society.

The Food Security and Agricultural Executive Counseling Board of Samarinda has responsibility to actively support and assist the successfulness of the program of the Mayor of Samarinda, specifically in the field of food security and agricultural counseling.

The government established Food Security Council in Samarinda with the Mayor regulation number 21, year of 2002. To work towards food security in Samarinda, as an implementation of article 10 of Presidential decree number 18, year of 2006, about the Food Security Council, the function of Food Security Council is further expanded and aligned with the current development.

One highlighted activity of the food security council and agricultural executive counseling board is the International Conference on Food, Agriculture, and Culinary Tourism. This activity is held with an aim to disseminate information and to gather ideas of food security and nutrition practices in ASEAN and Indonesia for further Samarinda development.

Achieving food security and nutrition status is mandated by the Law number 18, year of 2013 and the presidential decree number 17, year of 2015. Of equal importance, it is a necessity to increase quality and quantity of public services to achieve minimum essential standard services as mandated by the Ministry of Agriculture regulation number 65/OT1040/12/2010, and the Interior Minister circular number 100/1023/SJ/2013 dated on 26 of March, 2012 about the acceleration of minimum essential standard services implementation in local governments.

Minimum essential standard services of food security in Samarinda city have achieved above 90 percent in four basic services and seven target indicators in 2015. To illustrate, the people consumption of energy is 1719.8 kilo calories per capita per day. This, however, is below the average daily intake of

2200 calories, as indicated by Widya Karya Pangan dan Gizi, year of 2004 and 2013. On the other hand, the protein consumption is above the national average, achieving fifty-two point four gram per capita per day. The general achievement for food pattern expectation is 81.9 points. In response to reduction of food insecurity region, the case of malnutrition is successfully reduce to less than 0.5 %. It is also noted that food reserves are increased in Samarinda.

This excellent moment of International Conference on Food, Agriculture, and Culinary Tourism is achieved as an excellent collaboration of the Food Security and Agricultural Executive Counseling Board of Samarinda with the Indonesian Association of Food Technologists chapter East Kalimantan, the Department of Agricultural Products Technology, Mulawarman University. We hope that this will produce a fruitful outcome to collect ideas and practices in developing food security and nutrition in Samarinda.

I, with all due respect to the Mayor of Samarinda, would like to ask Bapak Syaharie Jaang to officially open this conference.

Samarinda, 5 August 2015,

Food Security and Agricultural Executive Counseling Board of Samarinda,

Ary Yasir Pilipus

Welcome Speech
The Mayor of The Samarinda City

The honorary Head of National Food Security Council,
All the head of working units, SKPD, in Samarinda,
All professors, participants, and colleagues from foreign countries and Indonesia,
And other invited guests.

Assalamu'alaikum Wr. Wb.

A very good morning and welcome to Samarinda, especially for those who are first time to arrive in Samarinda. We wish you to have a pleasant stay and a good impression of this city.

Samarinda faces rapid development in recent years. This includes upgrading and extending city infrastructures. To further develop the city, it is indispensable to have excellent quality of human resources as programmed already in the development plan of the city.

To talk about food, it is a primary need of every person and its fulfillment is an important part of human rights that is guaranteed by our constitution, UUD 1945. Quality food is a prerequisite to produce highly proficient human resources.

The Samarinda city, that covers 718 kilometer square and is populated by nearly one million people, requires adequate supply of foods. In this regard, the government and the people of Samarinda have a role to maintain stability of food supply. The potential agricultural field is less than ten percent, so Samarinda has to emphasize on its strengths that are services and industrial sectors.

Along with the growth of the population and the economy, the demand for food has also increased from time to time. Therefore, the availability and distribution of foods should be underlined as one priority. The agricultural development, regardless currently having a small contribution, should be further developed to not only in the production capacity but also the distribution and marketability. These require a good collaboration with market players, whether they play direct or indirect role to the availability and stability of food supply.

To assist food security in Samarinda, the government established Food Security Council in Samarinda with the Mayor regulation number 21, year of 2002. Further, as mandated by the article 26 of the Presidential decree number 83, year of 2006 about the Food Security Council, the function of Food Security Council is further expanded and aligned with the current development.

As mandated by the article 47 of Law number 18, year of 2013, paragraph 3, the central government along with local governments are responsible for distribution of foods in their authorities. This is also in conjunction with increasing public services to achieve minimum essential standard services as mandated by the Ministry of Agriculture regulation number 65/OT1040/12/2010, and the Interior Minister circular number 100/1023/SJ/2013, dated on 26 of March, 2012 about the acceleration of minimum essential standard services implementation in local governments.

The achievement of minimum essential standard services of food in Samarinda city includes four basic services and seven target indicators with minimum achievement of 90 percent in 2015. As an illustration, energy consumption for people of Samarinda is 1719.8 kilo calories per capita per day. This is below the average daily intake, as indicated by Widya Karya Pangan dan Gizi, year of 2004 and

2013, that stated 2200 kilo calories. The protein consumption is 52.4 gram, is above the national average. The general achievement for food pattern expectation is 81.9 points.

As a follow up to further develop services to people of Samarinda, according to Law number 32, year of 2004 about the local government, it is mentioned that food security is an essential and obligatory service provided by the provincial and city or municipal governments, mainly due to the fact that food security is basic right along with access to living necessities.

The food security, at the end, is not only in production, but is also affected by quality of human resources in the production, distribution, and services, as mentioned in the Law number 18, year of 2012. The production system upgrade is relentlessly achieved by implementing technology and innovation, with the assistance of all related working units, SKPD. This is quint essential to suffice food security status in Samarinda.

This also highlights the importance of the International Conference on Food, Agriculture, and Culinary Tourism that is jointly carried out by the Indonesian Association of Food Technologists chapter East Kalimantan, the Department of Agricultural Products Technology, Mulawarman University, and Food Security Council of Samarinda. It is expected that the conference will produce ideas and a lot of inputs to further develop food security status in Samarinda and Indonesia.

I, the Mayor of Samarinda city, in the name of the Almighty God, and with high appreciation, officially open the International Conference on Food, Agriculture, and Culinary Tourism, 2015.

Wassalamualaikum Wr Wb.

Samarinda, 5 August 2015
The Mayor of the Samarinda city

Syaharie Jaang

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Carcass Percentage and Abdominal Fat Percentage of Broiler Chickens Fed Pineapple Waste Meal Fermented by "Ragi Tape" in Diet

Jet S. Mandey[1*], Bernat Tulung[1], Jein R. Leke[2], Ivonne M. Untu[1]
[1]Animal Nutrition Department, Animal Husbandry Faculty, Sam Ratulangi University
[2]Animal Production Department, Animal Husbandry Faculty, Sam Ratulangi University
Jl. Kampus Selatan, Manado 95115.
jetsm_fapet@yahoo.co.id

Abstract

In the prospect of pineapple waste that rich in crude fiber and calcium for broiler feedstuff, a study was carried out to determine the effect of pineapple waste meal that was fermented by "ragi tape" (PWF) on carcass percentage and abdominal fat percentage of broilers. "Ragi tape' was a traditional commercial product contained *Candida parapsicosis*, *Candida melinis*, *Hansenula supbeliculosa*, *Hansenula malanga*, *Aspergillus niger*, *A. oryzae* and *Saccharomyces cerevisiae*. Five dietary treatments containing 0, 5, 10, 15 and 20% levels of PWF with four replicates were fed to 100 broiler chickens for 35 days in a completely randomized design. Feed and water were provided *ad libitum*. The results showed that carcass percentage and abdominal fat percentage were highly significant ($P<0.01$) affected by dietary treatments. Carcass percentage was significant decrease in the proportion of 15% and 20% of PWF. However, the carcass percentage in treatments R0 – R4 were still in a good category. Abdominal fat percentage also was significant decrease in the proportion of 15% and 20% of PWF. The higher the levels of PWF the lower the abdominal fat percentage signed that PWF treatments up to 20% resulted good category of broiler carcass. It can be concluded that PWF can be fed to broiler chickens at up to 20% level with a promising good category of broiler carcass.

Keywords: Broiler, Carcass, Fat, Fermentation, Pineapple Waste

Introduction

Nutritionist in recent time have been the focus of research of agro-industrial wastes in animal nutrition especially for monogastric animals. In fact, many feeds that can be fed alternatively at cheaper cost to monogastric livestock are based on the use of agro-industrial waste that are of no food value to humans (Iyayi and Fayoyin, 2005). Onwuka, *et al.* (1997) stated that a major strategy to develop the livestock industry in developing countries could be the use of agricultural by-products like pineapple waste, corn cobs and brewers dry grain. Pineapple waste is agro by-products from pineapple fruit. Pineapple waste occurs as pineapple peels and core, making about 40-50% of the fresh fruit (Buckle, 1989). It contains mainly the sugars of sucrose, fructose and glucose (Krueger, *et al.*, 1992). Also, it contains low amounts of protein, fat, ash (Hebbar, *et al.*, 2008). Pineapple peel is rich in cellulose, hemicellulose and other carbohydrates. Raw pineapple waste (on DM basis) contains about 4% crude protein, 60–72% NDF, 40–75% soluble sugars (70% sucrose, 20% glucose and 10% fructose) as well as pectin, but it is poor in minerals (Muller, 1978; Pereira, *et al.*, 2009), except Ca. It is locally available.

Agro-industrial wastes represents a serious problem to many agro industries since it is usually causes major environmental problems. The process of pineapple to juice and dried pineapple fruits release in significant quantities of by-products, such as: peels, crowns and hearts. Nurhayati (2013) reported that pineapple peel is produced from pineapple fruit processing. Approximately 27% of pineapple fruit is pineapple peel. The accumulation of pineapple waste in the neighborhoods constitutes a source of environmental pollution. If fresh pineapple peels are not consumed, it often gets mouldy and sour, and therefore unlikely to be used as an animal feedstuff. Therefore, some studies were conducted to develop a procedure for converting pineapple waste into animal feed (Makinde et al., 2011; Sruamsiri et al., 2007). Problems related with the fresh form, were overcome by the sun drying technique of pineapple peels developed by Aboh, *et al.* (2013). It gave dried peels of good quality, however, the dried peels are too compact and hard for its ingestion by animals. Researchers reported that pineapple wastes have been described as equivalent to cereal grains for ruminants (Müller, 1978) or as a low-nutrient feed (Hepton and Hodgson, 2003). Pineapple wastes are recommended as tremendous sources of organic raw materials and are potentially available for conversion into useful products such as animal feeds (Hemalatha and Anbuselvi, 2013). However, there is a constraint to use it as poultry feedstuff due to it contains 19.8% of cellulose and 11.7% of hemicelluloses (Bardiya *et al.*, 1996). In any case, the high amount of fibre makes pineapple wastes

more suitable to ruminants than to pigs and poultry. The bulkiness of the fresh products limits intake. Inclusion of 15 percent pineapple bran in chick diets depressed the feed conversion ratio and 20 percent inclusion decreased weight (Hutagalung, *et al.*, 1973). The final average live weight gains and feed conversion rate of growing rabbits significantly reduced as inclusion level of pineapple waste increased (Fapohunda, *et al.*, 2008; Adeyemi, *et al.*, 2010). However, Lamidi, *et al.* (2008) found that broiler chickens could tolerate up to 10% pineapple waste in their diets without any deleterious effect. Olosunde (2010) reported that sheep could tolerate up to 45% pineapple waste but 30% was superior when substituted for corn bran.Therefore, to overcome this constraint, it is significant to explore some treatments to be applied to the peels such as crushing, to improve their ingestion without degrading the feedstuff value.

It has been reported that pineapple waste contains high amounts of crude fiber and suitable sugars for growth of microorganisms. Similar to rice husk, pineapple peel also need pretreatment before offering to the poultry (Hemalatha and Anbuselvi, 2013). Nurhayati and Nelwida (2014) reported that *Trichoderma harzianum* might be used to ferment agricultural by products those rich in fiber content to increase their quality by increasing crude protein content and reducing crude fiber content. Rice husk and pineapple peel had higher quality after fermenting with 12% of *Trichoderma harzianum*. Banana peel was not suggested to ferment with *Trichoderma harzianum*.

The use of microorganisms through fermentation to improve nutritional value of agro-industrial wastes, thereby offering the potential to make dramatic contributions to sustainable livestock production has been well documented (Iyayi and Aderolu, 2004; Fasuyi, 2005; Iyayi and Fayoyin, 2005). The utilization of fungi for nutrient enhancement in agro-industrial waste by fermentation has been studied for years and their efficiency shown in substrates such as lignin, cellulose and hemicellulose polymers found in agro-industrial waste (Howard et al., 2003). *Aspergillus niger* and *Trichoderma viride* have been successfully used in a number of fermentation studies towards solid waste management, biomass energy conservation and production of secondary metabolites in various agro-industrial wastes (Omojasola et al., 2008; Femi-Ola et al., 2009; Kareem et al., 2010).

Some studies were conducted to develop a procedure for converting pineapple waste into animal feed (Makinde, *et al.*, 2011; Sruamsiri, *et al.*, 2007). In studies by Correia, *et al.* (2004), *Rhizopus oligosporous* was used to produce enhanced levels of free phenolics from pineapple residue in combination with soy flour as potential nitrogen source. "Ragi tape" was a traditional commercial product contained *Candida parapsicosis*, *Candida melinis*, *Hansenula supbeliculosa*, *Hansenula malanga*, *Aspergillus niger*, *A. oryzae* and *Saccharomyces cerevisiae*, that was could used to develop a procedure for converting pineapple waste into animal feed. However, there are no reported studies of the dietary of fermented pineapple waste in diet of broiler. This study aimed to investigate the effect of the dietary level of pineapple waste fermented by "ragi tape" on carcass percentage and abdominal fat percentage of broiler chickens.

Materials and Methods

Experimental Diets

Fresh pineapple peels collected were washed and steamed for twenty five minutes. Then cooled and mixed with 30 g "ragi tape"/kg pineapple peels, incubated on three days at room temperature. "Ragi tape' was a traditional commercial product contained *Candida parapsicosis*, *Candida melinis*, *Hansenula supbeliculosa*, *Hansenula malanga*, *Aspergillus niger*, *A. oryzae* and *Saccharomyces cerevisiae*. Part of the fermented pineapple peels then were dried and ground to fine powder using mortar and pestle.

The PWF then incorporated into the experimental diets at five levels of 0, 5, 10 and 15 and 20%. Based diet and PWF were crushed to obtain diets R0, R1, R2, R3 and R4, respectively. The proximate analysis of fermented pineapple waste (PWF) was shown in Table 1. Based diet contain ingredients: yellow corn 55%, fish meal 12%, soybean cake 15%, rice bran 7%, coconut cake 10.5% and top mix 0.5%, and the nutrients composition is shown in Table 2.

A total of 100 unsexed broiler finisher (Cobb CP 707) have been used in this experiment. Birds were weighed and maintained under standar managemental practices. Feed and water were provided *ad libitum* throughout the experimental period, and these treatments were administrated for a 28 days period. Vaccination programme against Gumboro and ND were carried out as per schedule.

Parameters were evaluated: carcass percentage and abdominal fat percentage. At 29 days the experiment, one representative bird from each pen was conventionaly sacrified by cervical dislocation technique, as described in the Report of the AVMA Panel on Euthanasia (AVMA, 2001) and its carcass parameters (ready to cook) including dressing percentage and abdominal fat were determined.

Table 1. Chemical Analysis of Unfermented and Fermented Pineapple Waste

Nutrients	Unfermented PW*	Fermented PW
Crude Protein (%)	0.92	7.87
Crude Fiber (%)	18,25	17.42
Fat (%)	0.80	1.53
Ca (%)	0.58	12.73
P (%)	0.4	0.82
GE (Kcal/kg)	2782	3830

Notes: PW = pineapple waste
*) Mato (2002)

Table 2. Diets and Calculated Analysis

Treatments	R0	R1	R2	R3	R4
Based Diet	100	95	90	85	80
Fermented Pineapple Waste	0	5	10	15	20
Calculated Analysis:					
Protein	21.85	21.15	20.45	19.75	19.05
Crude Fiber	4.86	5.48	6.11	6.74	7.37
Fat	6.32	6.08	5.84	5.60	5.37
Ca	2.31	2.83	3.35	3.87	4.40
P	1.27	1.25	1.22	1.20	1.18
ME (Kcal/kg)	3883	3880	3878	3875	3872

Statistical analysis

The data were subjected to analyze for a variance technique using completely randomized design (CRD) that was employed in one-way analysis of variance, and significant differences compared by honestly significant difference (HSD) test (Snedecor and Cochran, 1967). All of statement of differences were performed at significance levels of 1% and 5%.

Results and Discussion

Data on carcass percentage and abdominal fat percentage of broilers affected by fermented pineapple waste (PWF) in diet is shown in Table 2.

Table 2. Effect of Fermented Pineapple Waste in Diet on Carcass Percentage and Abdominal Fat Percentage of Broilers

Variable	Treatments				
	R0	R1	R2	R3	R4
Feed Intake (g/h/d)	87.25 ± 3.74^{a}	91.28 ± 2.13^{b}	93.09 ± 2.83^{b}	98.69 ± 3.10^{c}	100.21 ± 3.44^{c}
Carcass (%)	75.18 ± 1.73^{a}	73.23 ± 1.61^{ab}	72.82 ± 1.23^{ab}	72.13 ± 1.72^{b}	70.75 ± 1.62^{c}
Abdominal Fat (%)	2.32 ± 0.13^{a}	1.74 ± 0.14^{b}	1.50 ± 0.11^{c}	1.30 ± 0.07^{d}	1.21 ± 0.13^{d}

Notes: g/h/d = gram/head/day; ^{abcd} means with the same letters on the same row are in not significantly difference (P>0.05)

The results showed that carcass percentage and abdominal fat percentage were highly significant (P<0.01) affected by dietary treatments. Carcass percentage was significantly decrease in the proportion of 15% and 20% of PWF. However, the carcass percentage in treatments R0 – R4 were still in a good category. Abdominal fat percentage also was significant decrease in the proportion of 15% and 20% of PWF.

In the case of unfermented pineapple waste, Aboh, *et al.* (2013) reported that final average live weight gains and feed conversion rate of growing rabbits significantly reduced as inclusion level of pineapple peels increased. Moreover, Adeyemi, *et al.* (2010) and Fapohunda, *et al.* (2008) observed the same trend when using pineapple peels in the rabbits feed. The difference may due to the nutrient unbalance, mainly the protein contents of diets, and based on unfermented pineapple peel. In the present study, crude protein value in the fermented pineapple peel obtained was higher than the value recorded (5.11%) by Adeyemi et al. (2010), resulted good category of broiler carcass. Omwango et al (2013) found higher crude protein content in

pineapple waste fermented using the fungi *A. niger* and *T. viride* than in the unfermented pineapple waste for the 48, 72 and 96 h fermentation periods. The post fermentation increase in crude protein content could be attributed to the possible secretion of some extra cellular enzymes (protein) such as amylases, xylanases and cellulases into the pineapple waste mash by the fermenting fungi in an attempt to make use of the carbohydrates in the mash as a carbon and energy source (Raimbault, 1998). *A. niger* has been reported to have high specific activity for cellulases and hemi-cellulases (Howard et al., 2003). Additionally, *T. viride* and *A. niger* have found use in the production of extra cellular enzymes including cellulase, amylase and xylanase (Nair et al., 2008).

Fungi colonize substrates for utilization of available nutrients. They synthesize and excrete high quantities of hydrolytic extra cellular enzymes, which catalyze the breakdown of nutrients to products that enter the fungal mycelia across cell membrane to promote biosynthesis and fungal metabolic activities leading to growth (Raimbault, 1998). Therefore, increase in the growth and proliferation of fungal biomass in the form of single cell protein (SCP) or microbial protein accounts for part of the increase in the protein content after fermentation (Raimbault, 1998).

The decreasing of abdominal fat in the present study may due to th Ca content in diet. Some reports suggest that high dietary Ca can adversely affect the utilisation of fat (Sibbald and Price, 1977), nitrogen and metabolisable energy (Shafey and McDonald, 1991) in broilers. Dietary Ca concentration had a significant effect on apparent fat digestibility. Fat digestibility was reduced by increasing Ca concentrations in all intestinal segments (Mutucumarana, *et al*., 2013). Aboh, *et al*. (2013) got the values of the ash, calcium and magnesium recorded from sun dry pineapple peel indicated that it is a useful mineral source for rabbits. In this experiment, the higher the levels of PWF the lower the abdominal fat percentage signed that PWF treatments up to 20% resulted good category of broiler carcass.

The significant increase in protein content of the pineapple waste after fermentation with "ragi tape" and the decrease in crude fiber concludes that fermentation of pineapple waste by "ragi tape" enriches the nutrient content of the waste and this by product could be good supplement in compounding animal feed provided that it is acceptable and highly digestible.

Conclusion

Carcass percentage was significant decrease in the proportion of 15% and 20% of PWF. However, the carcass percentage in treatments R0 – R4 were still in a good category, and abdominal fat percentage also was significant decrease in the proportion of 15% and 20% of PWF. The higher the levels of PWF the lower the abdominal fat percentage signed that PWF treatments up to 20% resulted good category of broiler carcass. It can be concluded that fermented pineapple waste can be fed to broiler chickens at up to 20% level with a promising good category of broiler carcass.

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