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Sensory and Nutritional Quality, Shelf-Life, and Microbial Analyses of Hermitically Sealed Chevon Products

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ABSTRACT
Goat meat or chevon is regarded as nutritious food and became popular food for health conscious people. In the Philippines, demand for chevon is growing as noted in the increasing per capita consumption of chevon. However, the price of chevon remains high. With a goal to transform the basis of disposal from per head basis to retail scheme and to make it affordable to consumers, a study was conducted to use canning technology to develop chevon-based products. Using 11-month old male upgraded Boer, local dishes popularly cooked using chevon were innovated and elevated to capture wider market. These dishes include braised chevon in soy sauce and spices (locally known *adobo)*, savory goat stew commonly in tomato stew (locally called *kaldereta)* and goat meat ceviche made with skin, smothered with vinegar and spices (known as *kilawin)* Sensory evaluation and different analyses such as nutritional, shelf-life and microbial were conducted for food safety. On sensory evaluation, *kaldereta* and *adobo* were rated as "like moderately" while *kilawin* was rated as "like slightly". On nutritional analysis, calorie level was found highest for *adobo*, followed by *kaldereta* and *kilawin*; on fat and saturated fat, *kilawin* was found lowest, followed by *kaldereta* and *adobo*; on cholesterol level, *kilawin* was found highest, followed by *adobo* and *kaldereta*. On microbial analysis, the products were found negative on food-borne microorganisms such as aerobic and anaerobic thermophiles and mesophiles, making these products commercially sterile. On shelf-life analysis, *kilawin* can be stored longest at 15months, followed by *adobo* at 12months and *kaldereta* can be stored at 10months. These results suggest that canning can be used to develop products that can be sold to different costumer. These activity can be utilized to make product value-adding more profitable, while transforming the traditional per head basis of selling goat.
Keywords*:* canning, chevon, food processing

I. INTRODUCTION

Goat meat or chevon is regarded as healthy food, known to be high source of protein, [1][2] low cholesterol content at 40mg/100g [3] and has lower fat content as compared to other red meat [4][5]. Because of these, chevon became popular food for health conscious people. In the Philippines, demand for chevon is increasing. In 2010, 3.36 million heads of goats were slaughtered and per capita consumption of chevon increased from 0.36 to 0.44 kilogram in 2010, a comparable data worldwide [6][2]. However, the price of chevon remains high. On the other hand, studies conducted for goat is focused on breeding, production, and productivity and few were conducted on product development [7][8][9], which is vital to transform the basis of disposal from per head basis to retail scheme. With this system goat meat became affordable to consumers.

Canning is a process to hermitically seal cooked food. This method facilitates longer storage and wider distribution of the products. Canning became one of the most successful industry worldwide and one of the features of modern life. In addition, it also facilitates longer storage and wider distribution of products. The objective of this study was to use canning technology to add value and commercialize chevon products.

II. MATERIALS AND METHODS

Upgraded (Boer x Philippine native) male goat at eleven (11) month old was slaughtered for food processing. Three (3) different Filipino dishes such as braised chevon in soy sauce and spices or *adobo*, savory goat stew commonly in tomato stew or *kaldereta*, and goat meat ceviche made with skin, smothered with vinegar and spices or *kilawin* were innovated. The standard ingredients and cooking methods for these dishes were used.

Laboratory scale cooking was conducted followed by a sensory evaluation using Hedonic Test of seven-point scale [10]. In the sensory

evaluation, samples were coded using three-digit numbers and then served to 50 panel members. Attributes of the products such as color, flavor juiciness, tenderness, saltiness, spiciness, thickness of sauce, goaty odor or flavour and general acceptability were evaluated.

After sensory evaluation, processed meat were filled in double-pass tin cans to eliminate corrosion and to prevent post-processing contamination [11]. Each can contained 200g of dish prepared. Thermal process was applied at 15 psi at 220°C for 1 hour. The products were incubated for 3- days to ensure that *Clostridium botulinum* is absent [12].

Analyses such as nutritional, microbial and shelf-life were conducted at Fast Laboratory, Cubao, Quezon City. On the nutritional analysis, the levels of the calories, calories from fat, total fat, saturated fat, cholesterol, sodium, total carbohydrate and protein were analysed.

Raw meats are important sources of *Salmonella* and *Clostridium perfringens*, which are often associated in outbreaks of food-borne disease [13]. Food processing can change the microbial composition of the meat, as it can either kill or prevent growth of pathogens that will help increase shelf-life of the products from a few days to several years [14]. Among the microorganisms that are screened for food safety are aerobic and anaerobic thermophiles and mesophiles such as *Escherichia coli, Salmonella sp., Staphylococcus aureus, Clostridium perfingens, and Clostridium botulinum* [15]. In shelf life testing, the samples were stored at different temperature such as 50°C, 40°C, 30°C, 20°C and 10°C and periodic evaluation were conducted using parameters tested to include physical, microbiological, and sensory characteristics [16].

III. RESULTS AND DISCUSSION

Sensory Evaluation

The developed products were evaluated based on color, flavour, juiciness, tenderness, goaty flavour/odor, general acceptability, and other parameters including saltiness, spiciness, and thickness of the sauce.

The color is influenced by the level and state of myglobin [2] present in the meat. Boer is known to be heavy animals characterized by high muscle formation, a factor that increases color of the meat. Color of *adobo* and *kaldereta* were rated "like very much" can be attributed to the lean meat present, while *kilawin* was rated "like moderately" because lesser lean meat was used in the processing. Meat flavor on the other hand is attributed to palatability [17] and it is determined by the chemical senses of taste and smell, and depends on the quantity and composition of the fat in meat [18]. In this study, the flavor of *kilawin* and *abodo* were rated "like very much", while *kilawin* was rated "like slighty". Meat subjected to thermal treatment affects its flavor as the composition and degree of saturation of fats has changed [19], as such *kilawin* and *abodo* undergo longer cooking period as compared to *kilawin*. Juiciness of chevon is related to quantity and composition of intramascular fat [20] age of the animal [7] and moisture content of the meat [21]. In general, cooking normally changes the composition of the animal fat as lipid component in the meat melts [23] and combines with water. This will increase the energy density of the meat, thus influencing juiciness [24]. In this study, *adobo* and *kilawin* were rated "moderately" while *kaldereta* was rated as "slight". *Adobo* and *kilawin* are both dry dish wherein natural oil from the meat is extracted during cooking, thereby resulting to juicier perception by sensory evaluators. Meanwhile, tenderness is governed by meat's softness to tongue and cheek, resistance to tooth pressure, ease of fragmentation, meatiness, adhesion of the fibers and residue remaining after chewing [23]. On this study, all products developed were rated as "moderate". The result can be attributed to the age of the goat, wherein the collagen in the connective tissue of mature animals decreases ability to gelatinize under the heat and moisture influences [2]. Since the animals used in the study belong to same age group, it did not impart difference in the rate given. The goaty flavor/odor of *kaldereta* and *abodo* were rated "perceptible" while *kilawin* was rated as "slightly". The goaty flavor/odor is attributed to the branched chain fatty acid (BCFA) present in chevon and mutton [25] containing 4-ethyloctanoic acid, also found present in cheeses [26]. It could be noted that bone-in lean meat was used in cooking *kaldereta* and *abodo*, thereby goaty flavor/odor became detectable in these products as compared to *kilawin*. The general acceptability of *kaldereta* and *abodo* were rated as "like moderately", while *kilawin* was rated as "like slightly". Flavor determines overall score of the products [23], thus, similar ratings for flavor and general acceptability was found on this study. Other parameters such as saltiness, spiciness and thickness of the sauce depend on each recipe, thus there are different perceptions from the evaluators.

Table 1. Sensory evaluation results for canned chevon *Kaldereta, Adobo* and *Kilawin*

Sensory Attributes	Average Scores/Descriptive Rating		
	Kaldereta	**Adobo**	**Kilawin**
Color	7.64 (LVM)	7.73 (LVM)	6.9 (LM)
Flavor	7.09 (LM)	7.46 (LM)	6.1 (LS)
Juiciness	3.45 (S)	3.73 (M)	3.85 (M)
Tenderness	4.46 (M)	4.27 (M)	4.05 (M)
Saltiness	2.82 (S)	3.73 (M)	3.2 (S)
Sweetness	2.64 (S)	2.09 (P)	3.0 (S)
Spiciness	2.73 ((S)	--	3.35 (S)
Goaty odor/flavor	4.46 (P)	4.27 (P)	2.8 (S)
General Acceptability	7.09 (LM)	7.28 (LM)	6.2 (LS)

Legend:

LVM – Like Very Much M- Moderately
S – Slight LM- Like Moderately
P – Perceptible LS – Like Slightly

Nutritional Analysis

On nutritional analysis, calories level, calories from fat, total fat content and saturated fat, level of minerals such as sodium and carbohydrate was found highest in *adobo* as compared to *kaldereta* and *kilawin*. Protein level was found highest in *kilawin*, while calcium level was found highest in *kaldereta*, while it was not found on *kilawin*. Iron level was found highest for both *kaldereta* and *kilawin*. There was no trace of dietary fiber, sugar and vitamins A and C in all developed products as shown in Table 2. Results of the nutritional analysis further supports the claim that chevon is a nutritious food. Similar findings of lower saturated fat level of the products as compared to poultry without skin at 40%, beef at 85%, pork at 100% and lamb at 90% (Adam et al., 2010) was found. Furthermore, the products contains lower cholesterol level than the recommended daily cholesterol intake of 300 mg for adult Filipinos [27].

Table 2. Results of the nutritional analysis conducted in three (3) products developed

Nutrients	Adobo	Kaldereta	Kilawin
Calories	220	180	160
Calories from fat	130	110	60
Total fat	15g	12g	7g
Saturated fat	9g	7g	5g
Cholesterol	80 mg	50 mg	200mg
Sodium	530 mg	260 mg	320 mg
Total carbohydrate	4g	8g	3g
Dietary fiber	0	0	0
Sugar	0	0	0
Protein	19g	12g	22g
Vitamin A	0	0	0
Vitamin C	0	0	0
Calcium	6%	20%	0%
Iron	10%	16%	16%

Shelf-Life And Microbial Analyses

The products were sterile as indicated by the absence of *Clostridium botulinum* after 3-day incubation as specified thru swelling of can. On shelf-life analysis, results showed that *kaldereta* can be stored for 7.7 months, while *adobo* can be stored for 12 months and *kilawin* can be stored for 15.6 months. On the microbial evaluation, all products were negative on aerobic and anaerobic thermophiles and mesophiles. On food safety, the canned products passed standard procedure of processing as indicated by the negative result obtained on analysis for food- borne or food-related microorganisms [28]. Thus, it is expected that the products will have longer shelf-life period. Proper handling and storage conditions are recommended to be maintained during product transfer and storing so that the heat-resistant and nontoxic thermophilic spore formers microbes remain dormant.

IV. CONCLUSION

The study reveals that value-adding of product is useful in improving the value of goat meat and in transforming market scheme. The results of the different analyses conducted for the products developed showed that the canned chevon products are nutritious and safe for human consumption. The products are can be used to

develop the market venue for goats with better market share as commercialization is push through.

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