



## Microbial, nutritional and sensory analysis of choco-milk and choco-tableya

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### Abstract

Cacao products are becoming more popular not only in the Philippines but all throughout the world. Cacao beans are processed to produce chocolate products. In this study, the researchers produced two chocolate products namely, choco-milk and choco-tableya. This study aims to give details to these products in terms of its nutrient value and microbial analysis. Aflatoxin test was also conducted in order to determine the harmful or poisonous substances from the products. Furthermore, a sensory analysis was also conducted in order to determine its acceptability in terms of appearance, texture, aroma, taste and overall acceptability. To represent different age brackets, teachers and students were used as respondents. Findings of the laboratory test result that the chocolate products are safe to consume since the aflatoxin component of cacao choco milk is below the maximum regulated limit. Proximate Analysis result showed that both chocolate products contain nutrients that are helpful to our body. For the sensory evaluation, the data showed that the products are acceptable in all the given attributes. With the given results, choco-milk and choco-tableya are safe to consume and is beneficial to our health.

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## Introduction

In the recent years, the Cacao Industry has been gaining recognition in the domestic and export markets as the supply and demand gap of cocoa beans is increasing. The world demand for cacao has nearly tripled since 1970 growing at an annual rate of 3% with China and India growing at 7.9%. One of the primary drivers of this increase is the growing middle class, increasing discretionary household income in developing countries, new and innovative uses of cocoa in the food, cosmetics and pharmaceutical industries, and the positioning of cacao as health food. [In Philippines, most small scale producers process their cocoa beans into “tableya”, a native chocolate confection. Thus, its diversified use as food and non-food warrants a sustainable marketing opportunity. (Piñol et al., 2022). The Cagayan State University-Lasam Campus venture into cacao production and processing which answer other concerns such as environmental protection and socio-economic aspects through the participation of cacao growers in improving their economic status made possible through microenterprise development. This will not only increase farmers’ income and lift their lives, but also for our province to be known as the chocolate capital of the country.

The cacao, as part of the wonderful nature, provides the mankind a wide variety of valuable food products and health benefits. The most known and universally relished product derived from this fruit is chocolate, an amazing and unique food for the human nutrition with records of consumption of similar products dating to 1000 years B.C. In fact, the cocoa is a complex food that includes over 300 different components. (Agdeppa, I., 2015) Some experts explain that consuming cocoa beans processed products (and product derivatives) that contain antioxidants can provide health benefits. Antioxidant procyanidin (a dimer of catechin) of cocoa has been shown to have biological activity relevant to defense against free radicals (oxidants), vascular health, prevention of tumor, and immune function, as well as demonstrate protection against protein damage peroxynitrite-mediated vitro. Other benefits are the

improvement of cardiac function and relief of angina pectoris, nervous system stimulation, facilitate digestion and kidney and improve bowel function. (Akonor, PT, et al., 2017).

This study aims to promote sustainable processing and marketing of cacao with the goal of distributing to and improving socio-economic status conditions of farmers. This will provide opportunities to secure a more stable economic status where income will be derived out of the different products and by-products creating a small business for rural household. Furthermore, this study aims to introduce a product that can boost the immune system of the consumers.

### Objectives of the Study

The general objective of the study is to determine the acceptability and proximate analysis of choco milk and choco tableya.

Specifically, it aims to:

1. determine the nutrient value of Choco milk and choco tableya;
3. assess the microbial component of the product; and
4. identify the sensory acceptability in terms of:
  - a. appearance;
  - b. texture;
  - c. aroma; and
  - d. taste.

## Materials and methods

### Research Design

This study was aimed to determine the proximate analysis of choco-milk and choco-tableya along with its sensory evaluation and acceptability among consumers. The researchers have utilized experimental design for this study.

### Locale of the study

The proximate analysis of the food products was conducted at Department of Agriculture, Regional Government Center, Carig Sur, Tuguegarao City. The microbial Analysis of the food products was conducted at Department of Science and Technology, Regional Standards and Testing Laboratory, Carig Sur, Tuguegarao City.

In gathering the data for sensory evaluation, the students and teachers of Cagayan State University-Lasam and Lasam Academy Incorporated were selected as respondents.

*Proximate Composition*

Kjedahl method was used in determining the crude protein content of the food products, Filter Bag Technique (ANKOM) was used to determine the crude fiber and crude fat, and Gravimetric method was used for Moisture and Ash content. For the aflatoxin Analysis, Enzyme-Linked Immunosorbent Assay (ELISA) Reader was used.

*Microbial Analysis*

For Aerobic Plate Count, Pour plate method was used, following the Bacteriological Analytical Manual Online, January 2001, Chapter III: Aerobic Plate Count.

Multiple-Tube Fermentation Technique following the procedure of Standard Method for the examination of

Water and Wastewater, 23<sup>rd</sup> edition 2017 (SMEWW) part 9000 Microbiological Examination 9221 Standard Total Coliform Fermentation Techniques was used for Total Coliform Count/*Escherichia coli* Count.

Pour Plate Method Decimal dilution following the Bacteriological Analytical Manual Online, January 2001 was used in detecting the Yeast and Mold Count.

*Sensory Evaluation*

The 9 point Hedonic scale (1representing dislike extremely and 9 Like extremely) was used for the evaluation. The evaluation was given to the fifty (50) teachers from Cagayan State University-Lasam and Lasam Academy Incorporated and fifty (50) students from Cagayan State University-Lasam Campus.

*Analysis of the Data/ Statistical treatment*

Data obtained from the study were treated using Mean, Standard Deviation and T-test. Under T-test, the alpha used was 0.05.

**Results and discussion**

**Table 1.** Proximate Analysis of cacao choco-milk.

Lab. No.	Sample code	Sample Description	Crude Protein, %	Crude Fibre, %	Crude Fat, %	Moisture, %	Ash, %
FT-2020-142	A	Cacao Choco milk	4.75	2.50	42.27	2.36	1.11

The results indicate that in every 25 g serving size of the cacao choco milk, it contains the following: Crude protein- 4.75%, crude fibre - 2.50%, crude fat-42.27%, moisture-2.36% and ash-1.11%. Based on the Recommended Energy Intakes per day, given by Food and Nutrition Research Institute, Department of Science and Technology, the suggested protein intake should be 10-15%, crude fibre should be 2.5 to 3.0%, and crude fat should be 20-30%. With these, the results will further imply that the protein and crude fibre passed the said standard. For the crude fat content, the result showed that it is relatively high as compared to the suggested intake per day. Since fat is an unavoidable constituent of chocolate, a good quality of fat is always beneficial to the health. Moisture is necessary for the biochemical changes that may influence the sensory and shelf quality of the cocoa products. Based on the American Journal Food and Nutrition, the suggested

moisture content ranges from 5.62 – 6.20%. Ash is an indication of mineral contents of foods. The average ash content should be 2.15-5.81%. This shows that the moisture and ash content of the cacao choco milk also passed the said standard.

**Table 2.** Nutrient Content Analysis of cacao choco-milk.

		% Reni
Calories per serving(kcal)	147	6
Calories from Fat	95	
Fat, g	10.6	-
Protein, g	1.2	1
Crude fiber, g	0.6	-
Carbohydrates, g	11.8	2

Table 2 shows the Nutrient Content Analysis of cacao choco-milk. The calories per serving (kcal) is 147, calories from fat is 95, Fat content in grams is 10.6, Protein content in grams is 10.6, Crude Fiber and

Carbohydrates in grams is 0.6 and 11.8 respectively. Based on Food and Drug Administration, these are the acceptable intake per day: calories-2000, fat-78 grams, protein-56 grams, crude fiber-30 grams and carbohydrates-130 grams. This would imply that the nutrient content of the product is acceptable.

**Table 3.** Aflatoxin Analysis of Cacao choco-milk.

Lab. No.	Sample Description	Aflatoxin, ppb	Remarks
FT-2020-0142	Cacao Choco milk	3.20	Below Maximum Regulated Limit

**Table 4.** Proximate Analysis of cacao choco-tableya.

Lab. No.	Sample code	Sample Description	Crude Protein, %	Crude Fibre, %	Crude Fat, %	Moisture, %	Ash, %
FT-2020-143	B	Tableya	14.96	9.60	47.32	2.44	3.94

The results indicate that in every 50 g serving size of the tableya, it contains the following: Crude protein-14.96%, crude fibre – 9.60%, crude fat-47.32%, moisture-2.44% and ash-3.94%. Based on the Recommended Energy Intakes per day, given by Food and Nutrition Research Institute, Department of Science and Technology, the suggested protein intake should be 10-15%, crude fibre should be 2.5 to 3.0%, and crude fat should be 20-30%.

With these, the results will further imply that the protein passed the said standard. For the crude fibre and crude fat content, the result showed that it is relatively high as compared to the suggested intake per day. Since fat is an unavoidable constituent of chocolate, a good quality of fat is always beneficial to the health.

Moisture is necessary for the biochemical changes that may influence the sensory and shelf quality of the cocoa products. Based on the American Journal Food and Nutrition, the suggested moisture content ranges from 5.62 – 6.20%. Ash is an indication of mineral contents of foods. The average ash content should be 2.15-5.81%. This shows that the moisture and ash content of the cacao choco milk also passed the said standard.

Aflatoxins are a family of toxins produced by certain fungi that are found on agricultural crops such as maize (corn), peanuts, cottonseed, and tree nuts. Aflatoxins are poisonous substances produced by certain kinds of fungi (moulds) that are found naturally all over the world; they can contaminate food crops and pose a serious health threat to humans and livestock. The table showed that the aflatoxin component of cacao choco milk is below the maximum regulated limit. This would further imply that the products are made in a hygienic manner and in a clean environment.

**Table 5.** Nutrient Content Analysis of choco-tableya.

		% Reni
Calories per serving(kcal)	286	11
Calories from Fat	213	
Fat, g	23.7	-
Protein, g	7.5	8
Crude fiber, g	4.8	-
Carbohydrates, g	10.9	2

Table 2 shows the Nutrient Content Analysis of cacao choco-tableya. The calories per serving (kcal) is 286, calories from fat is 213, Fat content in grams is 23.7, Protein content in grams is 7.5, Crude Fiber and Carbohydrates in grams is 4.8 and 10.9 respectively.

Based on Food and Drug Administration, these are the acceptable intake per day: calories-2000, fat-78 grams, protein-56 grams, crude fiber-30 grams and carbohydrates-130 grams. This would imply that the nutrient content of the product is acceptable.

**Table 6.** Aflatoxin Analysis of choco-tableya.

Lab. No.	Sample Description	Aflatoxin, ppb	Remarks
FT-2020-0143	Tableya	9.20	Below Maximum Regulated Limit

Table 6 shows the Aflatoxin content of cacao choco-tableya. Result showed that the aflatoxin component of choco-milk is 9.20 and below the maximum

regulated limit. This would imply that cacao choco milk does not contain poisonous substances and safe to intake. This would further indicate that the food product was done in a hygienic manner.

**Table 7.** Microbial Analysis of cacao choco-milk.

Sample Code	Sample Description	Test Method	Result
MIC-0838	Choco-milk	Escherichia coli count	<3.0 MPN/g
		Aerobic Plate Count	<25x10 <sup>1*</sup> CFU/g
		Total Coliform Count	<3.0 MPN/g
		Yeasts and Molds	<10x10 <sup>1*</sup> CFU/g

Table 7 shows the Microbial Analysis of cacao choco-milk. According to FDA (Circular No. 2013-010) Microbial Quality of Foods, the microbial content cacao Choco milk is below the maximum regulated limit. This would further imply that cacao choco milk is processed in hygienic manner and safe to consume.

**Table 8.** Microbial Analysis of cacao choco-tableya.

Sample Code	Sample Description	Test Method	Result
MIC-0838	Choco-tableya	Escherichia coli count	<3.0 MPN/g
		Aerobic Plate Count	<25x10 <sup>1*</sup> CFU/g
		Total Coliform Count	<3.0 MPN/g
		Yeasts and Molds	<10x10 <sup>1*</sup> CFU/g

Table 8 shows the Microbial Analysis of cacao choco-tableya. According to FDA (Circular No. 2013-010) Microbial Quality of Foods, the microbial content cacao Choco milk is below the maximum regulated limit. This would further imply that cacao choco milk is processed in hygienic manner and safe to consume.

**Table 9.** Computed Mean, Standard Deviation and T-test Result.

**Table 9.1.** Choco-milk.

Attribute	Mean		Standard Deviation		T-test
	Teachers	Students	Teachers	Students	
Appearance	8.68	8.46	0.58103	0.69886	0.05
Texture	8.24	8.18	0.73648	0.90973	0.36
Aroma	8.38	8.4	0.86925	0.72111	0.44
Taste	8.38	8.66	0.82195	0.55172	0.03
Overall Acceptability	8.58	8.44	0.75073	0.6375	0.16

Table 9.1 shows the Computed Mean, Standard Deviation and T-test Result for cacao choco-milk.

For the computed mean, data shows that both teacher and student respondents answered 8 with an interpretation of like very much in all attributes. This would imply that the choco milk was acceptable in terms of appearance, texture, aroma, taste and overall acceptability. For the standard deviation under appearance and texture, it shows that the students have a higher computed SD. Having a higher SD the students' responses are more spread than the teachers' responses in these attributes. For aroma, taste and overall acceptability, data shows that the teachers' responses are higher than the students' responses. This would imply that the teachers' responses are more spread than the students' responses in these three attributes.

Using the alpha at 0.05, the data shows that there is a significant difference between the students' and teachers' responses under appearance and taste attributes. For texture, aroma and overall acceptability, the data shows that there is no significant difference since the t value is less than 0.05.

**Table 9.2.** Choco-tableya.

Attribute	Mean		Standard Deviation		T-test
	Teachers	Students	Teachers	Students	
Appearance	8.4	8.28	0.74833	0.77563	0.16
Texture	8.28	8.22	0.89532	0.90089	0.37
Aroma	8.2	8.2	0.93402	1.07703	0.38
Taste	8.26	8.2	0.93402	1.07703	0.38
Overall Acceptability	8.38	8.18	0.79725	0.86464	0.12

Table 9.2 shows the Computed Mean, Standard Deviation and T-test Result for cacao choco-tableya .

For the computed mean, data shows that both teacher and student respondents answered 8 with an interpretation of like very much in all attributes. This would imply that the choco tableya was acceptable in terms of appearance, texture, aroma, taste and overall acceptability. For the standard deviation in all attributes, it shows that the students have a higher computed SD. Having a higher SD the students' responses are more spread than the teachers' responses.

Using the alpha at 0.05, the data shows that there is no significant difference between the students' and teachers' responses in all the attributes. This would further imply that the respondents' answers are relatively closed with each other.

### Conclusion and recommendation

Cacao choco-milk and choco tableya are products that can be introduced to the market. These products could benefit both cacao farmers and cacao processors. Results of the nutrient analysis showed that both products show beneficial nutrients and makes it a good food source for energy. The sensory analysis of the study also showed positive responses from both teacher and students respondents. After conducting the study, the following recommendations are hereby suggested: (1) another study could be conducted to test the acceptability of the product for younger age; (2) test the shelf life of the product; and (3) secure a License to Operate and FDA approval.

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### References

- Agdeppa I.** 2015. Philippine Dietary Reference Intakes (PDR).  
**Akonor PT, Tortoe C, Buckman ES, Hagan L.** 2017. Proximate composition and sensory evaluation of root and tuber composite flour noodles.  
**Araujo Q, Gattward J, Almoosawi S.** 2013. Cacao and Human Health: from Head to Foot- A Review.  
**Califf R.** 2018 Daily Value on the New Nutrition and Supplement Facts Labels.  
**D'Aoust JY.** 2018. Bacterial Pathogens in Chocolate-Based Confectionaries- April 1, 2016 to March 1, 2018. Food microbiology-Targeted surveys-Final report.  
**Hannum S, Erdman Jr.** 2000. Emerging Health Benefits from Cocoa and Chocolate.  
**Kris Gunnars.** 2020. Protein Intake-How much Protein Should you eat per day.  
**Piñol.** 2022. Philippine Cacao Industry Road map by Department of Agriculture and Department of Trade and Industry  
**Tamayo F, Tamayo P.** 2020. Sensory Evaluation, Acceptability and Proximate Analysis of *Bambusa blumeana* as Bamboo shoot Cupcake: A product Development.