PRODUCT VARIATION, FORMULATION AND MARKETABILITY OF FRESH STEVIA (*Rebaudiana bertoni*) LEAF EXTRACT AS ORGANIC SWEETENER FOR BREAD AND PASTRY

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Abstract - This study determined the Product Variation, Formulation and Marketability of Fresh Stevia (Rebaudiana bertoni) Leaf Extract as Organic sweetener for bread and pastry. It looked into the level of acceptability (appearance, taste, aroma, texture, and color) of a product using the different formulations in terms of the following: 50% stevia leaf extract; 75% stevia leaf extract; 100% stevia leaf extract; and 100% refined sugar in the baking of Stevia Baked Siopao, Stevia Chiffon Cake, and Stevia Pandesal; and the potential marketability of the bread and pastry products with fresh stevia as an alternative organic sweetener The data shows there is no significant difference in Appearance (F=0.748NS), Aroma (F=1.056NS), Taste (1.898 NS), and over-all acceptability (F=2.346NS) and with highest level of acceptability in product formulation with fresh stevia leaf extract when grouped according to Stevia Baked Siopao in 50%, Stevia Basic Chiffon cake with 75%, and Pandesal with 50% fresh stevia leaf extract formulations. The data further shows there is a significant difference in color (F=4.218*), and highly significant difference in texture (F=5.095**). The marketability of bread and pastry products made from organic fresh stevia leaf extract as alternative sweetener using cost benefit analysis and business feasibility study shows very high projected customer acceptance. It is recommended that Fresh stevia leaves extract be used as alternative sweetener for bread and pastry products as it provides the awareness and inspiration to use healthy alternatives for consumers with diabetes to enjoy sweetened bread and pastry products without adverse consequences.

Keywords - Fresh Stevia (Rebaudiana bertoni) Leaf Extract, Sweetener

I. INTRODUCTION

Stevia is a type of plant that has very sweet leaves, and the leaves have been used to sweeten drinks and as sugar substitute in Central and South America (Mark Stibich, 2017). Also, the fresh leaves of the stevia plant can be used in hot or cold drinks or on their own as an herbal tea. Processed as a natural sweetener, the leaves are dried to form a powder, which in baking - two tablespoons of stevia powder is equal to one cup of sugar (Jo Lewin, 2015).

It is important to note that stevia does not caramelize and stevia-based sweeteners have been commercially used as they are found in products including yogurts, chocolates, and fizzy drinks. With no calories, no sugar and no carbohydrates, stevia's glycemic index (GI) score is 0. This means that consuming stevia will not raise your blood sugar. In tests, pure stevia extract has been found not to affect blood glucose levels and may even improve your bodies' ability to metabolize glucose. However, pure stevia extract has a bitter aftertaste, which means that stevia-based sweeteners are often blended with other sugars and artificial sweeteners to improve taste.

Other research suggests stevia may be useful in the treatment of hypertension and management of Type 2 diabetes and it is also recognized for having some anti-inflammatory properties. Further, it contains no calories so it can be beneficial for weight loss with those looking for an alternative to sugar (Margaret Ashwell, 2015).

The World Health Organization (November 2016) report reveals that the number of people with diabetes has risen from 108 million in 1980 to 422 million in 2014. The global prevalence of diabetes among adults over 18 years of age has increased from 4.7% in 1980 to 8.5% in 2014. In addition, Diabetes prevalence has been rising more rapidly in the middle- and low-income countries. In 2012, an estimated 1.5 million deaths were directly caused by diabetes, and another 2.2 million deaths were attributable to high blo od glucose. Furthermore, almost half of all deaths due to high blood glucose occur before the age of 70 years. The World Health Organization believes that diabetes will be the 7th leading cause of death in 2030.

In the Philippines, Vaughn Alviar (2012) of Philippine Inquirer stated that last 2008 survey was alarming enough to conclude that one out of every five Filipinos have diabetes. This means that around 20% of the population has diabetes and this has significantly increased from only 4% in 1998.

Another cause for alarm is that Filipinos diagnosed with diabetes are getting younger. Children as young as 5-years old are diagnosed with type 2 diabetes. With this trend, the country is expected to belong on the top 10 states with the most people with diabetes, 15 years from now. While the diabetic statistics in the Philippines is relatively low compared to Scandinavian countries, it nevertheless showed a drastic increase that is alarming as it is projected that over 7 million Filipinos will have diabetes by 2030. Because of this unpleasant consequence of excessive consumption of sugar-based products, there is a need

to provide an alternative organic sweetener in food production on the whole of bread and pastry products. In addition, there has been no significant amount of studies conducted on the use and benefits of fresh stevia leaf extract on regular food items for daily consumption of the public, to which I hope to address this gap.

II. METHODS

Research Design

The experimental method of research was used in conducting the study including the sampling scheme, sensory evaluation, acceptability of the products by the consumers according to varied formulations and its potential for co-preneurship with stakeholders.

The study was conducted at the University of Science and Technology of Southern Philippines, Lapasan, Cagayan de Oro city. There were four (4) trials in food preparation done before coming up with a final recipe of products with formulations. Experiments were performed inside the culinary arts laboratory of the said institution.

Qualitative data are used to enhance, complement, and in some cases follow up on unexpected quantitative findings. In this approach, the focus was on interpreting and explaining relationships among variables that may or may not be guided by a particular theoretical perspective.

Quantitative data were collected and analyzed first, followed by the collection and analysis of qualitative data. This means that qualitative and quantitative data were not combined (mixed) in the data analysis; instead, integration took place when the findings were interpreted. In general, results were interpreted in ways that usually gave more weight to the quantitative component. The separate phases of design, data collection, and reporting for qualitative and quantitative data were considered strengths because this arrangement was relatively easy to implement.

In this study, these perspectives were captured on the level of acceptability of Fresh Stevia (*Rebaudiana bertoni*) as Alternative Organic Sweetener in Bread and Pastry Products. This study secondarily used Qualitative data analysis through Marketability; Marketing Plan, Production Plan, Organizational Plan and Financial Plan as the evaluative perspective to qualitatively measure the feasibility of the product in the market..

Research Setting

The study was conducted at University of Science and Technology of Southern Philippines. The production and sensory evaluation of the fresh stevia leaves and products as an alternative sweetener to bread and pastry were all done in the Culinary Arts Laboratory in the University.

The Respondents of the Study

The actual compositions of evaluators were mostly coming from the University of Science and Technology of Southern Philippines, specifically: (80) students, (15) Teachers and (5) Food Experts from Cagayan de Oro Hotel and Restaurant Association (COHARA). The 95 respondents were served with samples in the culinary arts laboratory, while the five (5) experts at their respective workplace.

Research Instrument

In this study, the researcher adapted the nine (9) point hedonic scale research instrument on the level of acceptability of the innovated product through the following subcategory: - Appearance, Taste, Flavor, Texture, and Color. The scale was developed by David Peryam and his colleagues in 1954 and was quickly adopted by the food industry and for measuring the acceptability of foods and beverages (Society of Sensory Professionals, 2018). Further, the scale's relevance is reinforced on a recent study by Wichchukit, S. and O'Mahony, M. (2015) entitled "The 9-point hedonic scale and hedonic ranking in food science: some reappraisals and alternatives.. The food attributes of the finished products were the five (5) parameters of giving evaluation as to their liking. Specifically, the instruments used were the 9-point hedonic scale score sheets for Stevia Chiffon Cake, Stevia Pandesal "Bread of Salt", and Stevia Baked Siopao, and a master sheet of 100 respondents as judge of the sensory evaluation. A minimum of 100 respondents were required to authenticate the findings of the study.

III. RESULTS AND DISCUSSIONS

Problem 1. What is the level of acceptability (appearance, taste, aroma, texture, and color) of the product, Stevia Baked Siopao, Stevia Basic Chiffon Cake and Stevia Pandesal "Bread of Salt" using the different formulations in terms of the following: 50% stevia leaf extract; 75% stevia leaf extract; 100% stevia leaf extract; and 100% refined sugar?

Table 1 Distribution of statistics Frequency, percentage distribution, mean and standard deviation of 50% fresh stevia in Bake Siopao

Response	Range	Frequency	Percentage Distribution
Like Extremely	8.5 - 9.0	16	16.00%
Like Very Much	7.5 - 8.4	26	26.00%

Like Moderately	6.5 - 7.4	29	29.00%
Like Slightly	5.5 - 6.4	20	20.00%
Neither Like or Dislike	4.5 - 5.4	5	5.00%
Dislike Slightly	3.5 - 4.4	2	2.00%
Dislike Much	2.5 - 3.4	1	1.00%
Dislike Very Much	2.5 - 2.4	1	1.00%
Dislike Extremely	1.0 - 1.4	0	0.00%

Mean 7.10 (like moderately)
Standard Deviation 1.30

Response	RATE	Color	Appearance	Aroma	Taste	Texture
Like Extremely	9	18	25	28	27	19
Like Very Much	8	21	26	23	27	25
Like Moderately	7	29	25	19	17	19
Like Slightly	6	18	12	8	20	24
Neither Like or Dislike	5	2	4	9	3	6
Dislike Slightly	4	8	5	5	1	4
Dislike Much	3	2	1	3	3	2
Dislike Very Much	2	1	1	3	1	1
Dislike Extremely	1	1	1	2	1	0

The data shows that (55%) fifty five percent of the respondents rated the Stevia Baked Siopao with 50% stevia as “like moderately” to “like very much”. The over-all rating is like moderately (mean=7.10). However, the standard deviation of 1.30 indicates that their responses vary a lot from each other.

Though the data shows that (9%) nine percent rated the Stevia Baked Siopao with 50% stevia as “dislike very much” to neither like nor dislike. Sixteen percent (16%) responded that they “liked extremely” the Stevia Baked Siopao with 50% stevia.

Different people have different preference, what is important is that majority like it. And most of the respondent- evaluators state that different formulations in bake Siopao as “like moderately” to “like very much”.

On Qualitative data: One respondent stated that the Stevia Baked Siopao was very good because it was not too sweet as compared with those made out of sugar as sweetener. Also, the color was not too dark and not too pale. In contrast one respondent evaluator said that the green color does not look delicious, because it seemed different than usual, but considering that it was nutritious, it was appreciated and preferred as compared to the original Stevia Baked Siopao.

Most of the respondent-evaluators have varying opinions in terms of color and appearance. Simply because it is the first time for them to see a Stevia Baked Siopao that has a new color. But when it comes to taste, aroma and texture, a number of the respondent-evaluators have positive responses. This experience is exciting as a researcher, because of the shift from evaluation in color and appearance which is somehow low, then very positive evaluation in terms of taste, aroma and texture.

Table 2 Distribution of statistics Frequency, percentage distribution, mean and standard deviation of 75% fresh stevia in Basic Chiffon Cake

Response	Range	Frequency	Percentage Distribution
Like Extremely	8.5 - 9.0	15	15.00%
Like Very Much	7.5 - 8.4	37	37.00%
Like Moderately	6.5 - 7.4	27	27.00%
Like Slightly	5.5 - 6.4	16	16.00%
Neither Like or Dislike	4.5 - 5.4	2	2.00%
Dislike Slightly	3.5 - 4.4	1	1.00%
Dislike Much	2.5 - 3.4	1	1.00%
Dislike Very Much	2.5 - 2.4	1	1.00%
Dislike Extremely	1.0 - 1.4	0	0.00%

Mean 7.32 (like moderately)
Standard Deviation 1.23

Response	RATE	Color	Appearance	Aroma	Taste	Texture
Like Extremely	9	36	32	25	24	33
Like Very Much	8	20	23	24	22	23
Like Moderately	7	20	20	23	20	20
Like Slightly	6	14	19	15	16	15
Neither Like or Dislike	5	4	2	10	6	4
Dislike Slightly	4	4	1	2	5	3
Dislike Much	3	1	2	0	1	1
Dislike Very Much	2	0	0	1	3	1
Dislike Extremely	1	1	1	0	3	0

The data shows that (64%) sixty four percent of the respondents rated the Stevia Basic Chiffon Cake with 75% stevia as "like moderately" to "like very much". The over-all rating is like moderately (mean=7.32). However, the standard deviation of 1.23 indicates that their responses vary a lot from each other.
Though the data shows that (5%) five percent rated the Stevia Basic Chiffon Cake with 75% stevia "dislike very much" to "neither like nor dislike". Fifteen percent 15% responded that they liked extremely the Basic Chiffon Cake with 75% stevia.

Table 3 Distribution of statistics Frequency, percentage distribution, mean and standard deviation of 50% fresh stevia in Pandesal

Response	Range	Frequency	Percentage Distribution
Like Extremely	8.5 - 9.0	15	15.00%
Like Very Much	7.5 - 8.4	39	39.00%
Like Moderately	6.5 - 7.4	34	34.00%
Like Slightly	5.5 - 6.4	7	7.00%
Neither Like or Dislike	4.5 - 5.4	3	3.00%
Dislike Slightly	3.5 - 4.4	1	1.00%
Dislike Much	2.5 - 3.4	1	1.00%
Dislike Very Much	2.5 - 2.4	0	0.00%
Dislike Extremely	1.0 - 1.4	0	0.00%

Mean 7.46(Like Moderately)
Standard Deviation 1.07

Response	RATE	Color	Appearance	Aroma	Taste	Texture
Like Extremely	9	27	31	21	28	35
Like Very Much	8	30	23	33	25	28
Like Moderately	7	23	27	17	18	16
Like Slightly	6	13	12	21	18	13
Neither Like or Dislike	5	3	2	4	7	6
Dislike Slightly	4	2	4	2	2	2
Dislike Much	3	0	0	0	1	0
Dislike Very Much	2	2	0	2	1	0
Dislike Extremely	1	0	1	0	0	0

The data shows that (73%) seventy three percent of the respondents rated the Stevia Pandesal with 50% stevia as "like moderately" to "like very much". The over-all rating is like moderately (mean=7.46). However, the standard deviation of 1.07 indicates that their responses vary a lot from each other.
Though the data shows that (5%) five percent rated the Stevia Pandesal with 50% stevia as "dislike much" to "neither like nor dislike". Fifteen percent 15% responded that they "liked extremely" the Stevia Pandesal with 50% stevia.

Problem 3. What is the best formulation of stevia leaf extract among the product formulations that are acceptable in terms of: Appearance; Taste; Aroma; Texture; and Color?

Table 4 Distribution of statistic (ANOVA Analysis of Variance) on highest level acceptability in a recipe terms, appearance, flavour, palatability, texture and color when grouped according highest level of acceptability of different recipe

Category	Groups			F-value	F-value
	Stevia Baked Siopao in 50% stevia	Stevia Basic Chiffon cake in 75% stevia	Stevia Pandesal in 50% stevia		
	n=100 mean	n=100 mean	n=100 mean		
Color	6.92	7.48	**7.49**	4.218	0.056*
Appearance	7.26	7.47	**7.51**	0.748	0.473NS
Aroma	6.99	7.28	**7.30**	1.056	0.348NS
Taste	7.29	6.90	**7.34**	1.898	0.151NS
Texture	7.02	7.48	**7.67**	5.095	0.006**
Over-all Acceptability	7.10	7.32	**7.46**	2.346	0.097NS

**** Highly significant**
***significant**
NS not significant

The table shows the distribution of statistics (ANOVA) Analysis of Variance on level of acceptability when grouped according to highest level of acceptability in product formulation with fresh stevia leaf extract. There were three groups being compared, Stevia Baked Siopao in 50% fresh stevia extract, basic chiffon cake with 75% fresh stevia leaf extract, and Pandesal with 50% fresh stevia leaf extract.

The null hypothesis, there is no significant difference on the level of acceptability with highest level of acceptability in product formulation with fresh stevia leaf extract when grouped according to Stevia Baked Siopao in 50% fresh stevia extract, basic chiffon cake with 75% fresh stevia leaf extract, and Pandesal with 50% fresh stevia leaf extract is ACCEPTED in appearance, aroma, taste and overall acceptability.

The data shows there is no significant difference in appearance (F=0.748NS), Aroma (F=1.056NS), Taste (1.898 NS), and overall acceptability (F=2.346NS) in level of acceptability with highest level of acceptability in product formulation with fresh stevia leaf extract when grouped according to Stevia Baked Siopao in 50% fresh stevia extract, basic chiffon cake with 75% fresh stevia leaf extract, and Pandesal with 50% fresh stevia leaf extract

The null hypothesis, there is no significant difference on the level of acceptability with highest level of acceptability in product formulation with fresh stevia leaf extract when grouped according to Stevia baked Siopao in 50% fresh stevia extract, basic chiffon cake with 75% fresh stevia leaf extract, and Pandesal with 50% fresh stevia leaf extract is REJECTED in color and texture.

The data further shows there is a significant difference in color (F=4.218*), and highly significant difference in texture, (F=5.095**) in level of acceptability with highest level of acceptability in product formulation with fresh stevia leaf extract when grouped according to Stevia Bake Siopao in 50% fresh stevia extract, basic chiffon cake with 75% fresh stevia leaf extract, and Pandesal with 50% fresh stevia leaf extract.

The fresh stevia leaf extract has been a natural sweetener to many a recipe. However, the evaluators were somehow surprised with the unique color of the Stevia Baked Siopao and Pandesal. It was very new to them because of the greenish color. It was their first time to see a Stevia Baked Siopao and a Pandesal with slightly green color. But, based on the data 50% fresh stevia leaf extract in Pandesal has the highest acceptability. In addition, Fresh stevia leaf extract has become a natural food colouring. Which explains why chiffon cake with higher percentage of fresh stevia gained the highest acceptability. The respondents liked the greenish color of the basic chiffon cake as compared to other formulation.

FINDINGS

1. In Baked Siopao, the data shows that fifty five percent of the respondents rated formulation with 50% fresh stevia leaf extract as like moderately to like very much. The over-all rating is like moderately **(mean=7.10**). Sixty-six percent of the respondents rated the formulation with 75% fresh stevia leaf extract as like moderately to like very much. The over-all rating is like moderately (**mean=7.09**). Fifty one percent of the respondents rated the Stevia Baked Siopao with 100% stevia fresh leaf extract as like moderately

to like very much. The over-all rating is like moderately (**mean=6.84**). The data shows that fifty four percent of the respondents rated the Stevia Baked Siopao with 100% refined sugar as like moderately to like very much. The over-all rating is like moderately (**mean=6.99**). The standard deviation of baked siopao in all different formulation indicates that the responses of the evaluators vary a lot from each other.

2. In Basic Chiffon Cake, Sixty three percent of the respondents rated the formulation with 50% fresh stevia leaf extract as like moderately to like very much. The over-all rating is like moderately (**mean=7.16**). Sixty four percent of the respondents rated the formulation with 75% fresh stevia leaf extract as like moderately to like very much. The over-all rating is like moderately **(mean=7.32**). Sixty four percent of the respondents rated the formulation with 100% fresh stevia leaf extract as like moderately to like very much. The over-all rating is like moderately (**mean=7.31).** Seventy two percent of the respondents rated the Stevia Basic Chiffon cake with 100% refined sugar as like moderately to like very much. The over-all rating is like moderately (**mean=7.01**). The standard deviation of Basic Chiffon Cake in all different formulation indicates that their responses of the evaluators vary a lot from each other.
3. In Stevia Pandesal "bread of Salt" Seventy three percent of the respondents rated the formulation with 50% fresh stevia leaf extract as like moderately to like very much. The over-all rating is like moderately (**mean=7.46**). Sixty two percent of the respondents rated the formulation with 75% fresh stevia leaf extract as like moderately to like very much. The over-all rating is like moderately (**mean=7.20**). Sixty three percent of the respondents rated the formulation with 100% fresh stevia leaf extract as like moderately to like very much. The over-all rating is like moderately (**mean=7.17**). Sixty five percent of the respondents rated the pandesal with 100% refined sugar as like moderately to like very much. The over-all rating is like moderately (**mean=7.66**). The standard deviation of Pandesal in all different formulation indicates that their responses of the evaluators vary a lot from each other.
4. The data shows there is no significant difference in appearance (F=0.748NS), Aroma (F=1.056NS), Taste (1.898 NS), and overall acceptability (F=2.346NS) in level of acceptability with highest level of acceptability in product formulation with fresh stevia leaf extract when grouped according to Stevia Baked Siopao in 50% fresh stevia extract, Stevia Basic Chiffon Cake with 75% fresh stevia leaf extract, and Padesal with 50% fresh stevia leaf extract. The data further shows there is a significant difference in color (F=4.218*), and highly significant difference in texture, (F=5.095**)
5. The target market of Sofia's Stevia Bakery are individuals aging 16 years old and above from among the USTP community, male or female, students, utility workers, faculty , walk- in, and staff with a purchasing power that ranges from Php. 6.00 and above, and who are into healthy bread and pastry products. Observation study was conducted to project the existing demand for bread and pastry products in USTP cafeteria. The projected market share of stevia bread products will be 9,000 pcs per month and 1,800 pcs per month for stevia pastry products.
6. The production schedule and cost of Sofia's Stevia Bakery indicates that for the 1st year of production it will cost around Php. 356,994.75 and projected to have an increase of 15% for the next 2 years and 20% on the 4th year of operation.
7. The financial ratios indicate that companies return on sale on the 1st to 4th year of operation ranges from 10% to 13% approximately. Return on assets on the 1st year of operation will be 41.32%, return on investment will be 74.17% on the 1st year of operation and gross profit margin will be 47.08%.
8. Companies break-even point in pesos will be Php.126,474.66 and companies return earnings on the 1st year of operation will be Php.70,409.00

CONCLUSION AND IMPLICATION

The fresh stevia leaf extract has been a natural sweetener to the different recipes. However, the evaluator was somehow surprised with the unique color of the Stevia Baked Siopao and Stevia Pandesal. It was very new to them because of the greenish color. It was their first time to see a Stevia Baked Siopao and a Stevia Pandesal with slightly green color. But based on the data, 50% fresh stevia leaf extract in Stevia Pandesal has the highest acceptability. In addition, Fresh stevia leaf extract has become a natural food coloring. Which explains why, Stevia Chiffon Cake with higher percentage of fresh stevia gained the highest acceptability. The respondents liked the greenish color of the Stevia Basic Chiffon Cake as compared to other formulation.

The said three bread and pastry products in this study were found to be of great potential in business venture, especially on the benefits that they get out of it, the natural sugar for food preparation and production. The marketability of bread and pastry products made from organic fresh stevia leaf extract as alternative sweetener using cost benefit analysis and business feasibility study shows very high projected customer acceptance. It is promising to sell this to the industries and target customers that prefer

these products. Research has shown that the market is strong and successful, with predictions for the industry to continue growing. Further market research supports this information with positive feedback and a demand for a new bread and pastry sweetener from potential customers. Various financial documents have also proved the profitability of the business idea, turning over a good profit in the 2nd year of trading which could provide sufficient funds to consider development within the business.

RECOMMENDATIONS

On the bases of the findings the following recommendations are presented.

Consumers. Through this, providing healthy options gives the opportunity to producers to cater to consumers' food choices that are safe, healthy, and beneficial to their well-being.

Future researcher. That this will serve as available resource that they may use such as the results of this study for more in-depth analysis of the products and services that contribute significantly to the four functions of the university as it may provide avenues for collaboration, both nationally and internationally.

Industry/Entrepreneurs. Strengthen ties between industry-academe linkages by putting their efforts together to help flourish the tourism sector in this area of Southern Philippines and exercise initiative by organizing a venture to take benefit of an opportunity and, as the decision maker, decide what, how, and how much of a goods or services will be produced, maintaining good collaboration with and among stakeholders.

Investors. Bread and pastry products sweetened with fresh stevia leaves are a new business opportunity for investors to provide a market for people who have diabetes but would like to enjoy purified products. It is also a business opportunity to cater to health-conscious consumers and producers. Farmers are the major target producers of this Fresh stevia leaves as organic alternative sweetener for bread and pastry, such as Stevia Baked Siopao; Stevia chiffon Cake; and Stevia Pandesal. That they may have collaboration with the academe and vice versa to work hand-in-hand and produce said plants in the production of bread and pastry products that later on be commercialized as the mission of the university have highly emphasized.

School Administrators. That this study may be considered as a start-up business of the concerned programs to showcase the relevance of its application to the national development goals. That this study may be considered as a start-up business of the concerned programs to showcase the relevance of its program to the national development goals.

Students. This paper will serve as a source of inspiration for all students as thought leaders and game changers towards the new research paradigm, from conceptualization to commercialization.

Teachers. The teachers and students may act as a team player in the development of products and services to sustain its Vision and mission of the institution thru instruction, research, extension, and production.

These stevia bread and pastry products provide a boulevard for consumers who have diabetes to enjoy sweetened products.

University. The academe may provide management of knowledge for the education of farmers thru its community extension and involvement programs division.

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