



Uses Of Chickpea Flour In The Preparation Of Vegetarian Tlaxcalli

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ABSTRACT

Shifting consumer trends toward healthy, plant-based foods are driving the development of food products that utilize plant-based protein sources. One such ingredient is chickpea flour (*Cicer arietinum*), which can be used in the production of Vegetarian Tlaxcalli. This study aims to develop a chickpea flour-based formulation for Vegetarian Tlaxcalli and to determine panelists' acceptance of the product's sensory characteristics compared to Original Tlaxcalli. The study employed an experimental method involving several stages of formulation testing until a final formulation was obtained. Testing was conducted through organoleptic and hedonic evaluations covering appearance, taste, color, texture, aroma, and likability, involving 43 panelists comprising academics, culinary industry practitioners, and general consumers. The results showed that the chickpea flour-based Vegetarian Tlaxcalli received positive ratings from the panelists, with the highest rating percentages of 71% for appearance, 65% for taste, 61% for color, 45% for texture, and 53% for aroma. The results of the One-Way ANOVA test showed a significance value of 1.000 (>0.05), indicating that there was no significant difference in the acceptance levels between the chickpea flour-based Vegetarian Tlaxcalli and the Original Tlaxcalli. Thus, the acceptance level of the chickpea flour-based Vegetarian Tlaxcalli was not significantly different from that of the Original Tlaxcalli.

Keywords: *Chickpea, tlaxcalli, vegetarian, plant-based food.*

Background

The growing trend toward healthy lifestyles and increased awareness of food sustainability are driving a rise in the consumption of plant-based foods. Plant-based foods are not only viewed as alternatives to animal-based foods but also have the potential to provide nutritional benefits and support a more sustainable food system [1], [2]. One plant-based food ingredient with significant development potential is the chickpea (*Cicer arietinum*), which contains protein, dietary fiber, minerals, and bioactive compounds such as polyphenols. The use of chickpea flour in food

products is known to enhance nutritional value—particularly protein and fiber content—and has the potential to increase the products' antioxidant activity [3], [4]. In food product development, product quality is determined not only by taste but also by attributes such as texture, appearance, presentation, and product characteristics that shape the consumer experience [5]. Therefore, sensory characteristics are a crucial aspect that must be considered in food product development.

Chickpeas have also been widely developed as an ingredient in composite flours for various food products. The addition of chickpea flour to cereal-based products, such as pasta and tortillas, has been reported to improve nutritional quality while maintaining the products' sensory characteristics at an acceptable level [6]. One corn-based food product with potential for development through the use of chickpeas is tlaxcalli. Tlaxcalli is a traditional Mesoamerican food made from corn that is processed through nixtamalization and has characteristics similar to tortillas. Corn-based products generally have a high carbohydrate content but are relatively low in protein and certain essential amino acids, making it necessary to improve them by combining them with plant-based protein sources [7] [8].

Partially substituting corn flour with chickpea flour has the potential to increase the protein content and improve the nutritional profile of tlaxcalli. Several studies have shown that the use of chickpea flour in cereal-based products and flatbreads can increase protein and fiber content without significantly reducing sensory acceptability [9], [10]. A study by Shakya et al. [11] showed that using up to 30% chickpea flour in tortillas resulted in an adequate level of sensory acceptance. Meanwhile, a study by Benayad et al. showed that substituting 25–30% of the flour with chickpea flour in tortillas increased protein and mineral content while maintaining sensory characteristics that were still acceptable to consumers [12].



Although research on the use of chickpea flour in corn-based products has been conducted, studies specifically focused on developing chickpea flour as the main ingredient in the production of Vegetarian Tlaxcalli remain limited, particularly in terms of formulation development and consumer acceptance testing. Therefore, this study was conducted to develop chickpea flour-based Vegetarian Tlaxcalli through formulation development and to determine panelists' acceptance levels of the product's sensory characteristics compared to Original Tlaxcalli. This study is expected to produce a plant-based food alternative with sensory characteristics acceptable to consumers and to support food diversification through the use of chickpea flour.

Literatur Review

Chickpea Flour

Chickpeas (*Cicer arietinum*) are a type of legume with potential as a plant-based food ingredient. Chickpeas contain protein, dietary fiber, minerals, and bioactive compounds that can add value to food products. Their relatively high protein content makes them a viable alternative ingredient for improving the nutritional quality of cereal-based products, which generally have lower protein content [4]. In flour form, chickpeas can be used as a substitute or fortification ingredient in various food products, including corn-based products. The use of chickpea flour also has the potential to increase protein and fiber content without causing significant negative changes to the product's sensory characteristics when used in appropriate proportions [3].

Tlaxcalli

Tlaxcalli is a traditional Mesoamerican food product made from corn that resembles a tortilla. It is traditionally made using corn that has undergone the nixtamalization process before being shaped into thin sheets and baked [8]. As a cereal-based product, tlaxcalli has a relatively high carbohydrate content, but its protein content is lower than that of legume-based foods. Therefore, the use of substitutes with higher protein content, such as chickpea flour, has the potential to improve the product's nutritional value [9].

Plant-Based and Vegetarian Foods

Plant-based foods are products that use plant-derived ingredients as their main components. The growing trend

toward healthy and sustainable consumption patterns is driving the increased development of plant-based food products as alternatives to conventional foods. The development of vegetarian products takes into account not only health considerations but also sustainability and the utilization of alternative food sources [2]. The use of chickpea flour in making vegetarian tlaxcalli is one form of food diversification that combines a carbohydrate source from corn with a plant-based protein source from legumes [3].

Substitution of Chickpea Flour in Cereal-Based Products

The substitution of chickpea flour in cereal-based products has been extensively studied because it can increase the protein and fiber content of the products. A study by Shakya et al. showed that the use of chickpea flour in tortilla formulations can result in products with adequate sensory acceptability [10]. Research by Benayad et al. also showed that the use of chickpea flour in tortilla products can increase protein and mineral content while maintaining sensory characteristics that are acceptable to consumers [12]. Based on these studies, the use of chickpea flour in the production of vegetarian tlaxcalli has the potential to yield products with sensory characteristics that are acceptable to consumers.

Research Method

This study employed an experimental method with a product development approach to create a chickpea flour-based vegetarian Tlaxcalli as an innovative food product. The study was conducted in several stages, namely formulation development, product manufacturing, and organoleptic and hedonic testing to determine the panelists' level of acceptance of the developed product.

Research Design

This study employed a quantitative method with an experimental approach to develop a chickpea flour (*Cicer arietinum*)-based tlaxcalli product as a vegetarian *appetizer* and to determine the panelists' level of acceptance of the resulting product. The research was conducted through the following stages: recipe analysis, product testing, final formulation determination, and acceptance testing using organoleptic and hedonic tests.

Product development was carried out using a single final formulation obtained through several rounds of testing. Chickpea flour was used as the primary flour ingredient, without the addition of cornstarch or wheat



flour. Since chickpea flour is gluten-free, the formulation included supporting ingredients such as *psyllium husk*, egg whites, milk, yeast, and *baking powder* to help create an elastic dough structure that does not easily break apart.

The research was conducted from January to May 2026 in Bandung, West Java. The product development and testing processes were carried out at the author's residence.

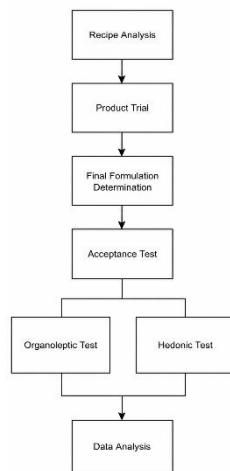


Figure1 . Research Flowchart
 Source: Compiled by the author, 2026

Materials and Equipment

The ingredients used consist of base ingredients, supporting ingredients, and complementary ingredients. The base ingredient used is chickpea flour, while the supporting ingredients include *psyllium husk*, *baking powder*, yeast, egg whites, milk, sugar, salt, and oil. The complementary ingredients used in serving the product include *young jackfruit*, *lettuce*, *red cabbage*, *cucumber*, *onion*, *yogurt*, *edible flowers*, *tuil*, *lemon*, *cumin*, *paprika powder*, *mayonnaise*, *garlic*, and *Italian herbs*.

The tools used in the production process include a spatula, *frying pan*, stove, spoon, *ring cutter*, *rolling pin*, *mixing bowl*, digital scale, *strainer*, *water jug*, knife, and *cutting board*.

1 Table. Ingredients for Chickpea Flour-Based Tlaxcalli

Ingredients	Function
Chickpea flour	Main ingredient
Psyllium husk	Helps bind the dough

<i>Baking powder</i>	Helps the dough rise
Yeast	Helps the dough rise
Egg Whites	Helps bind and form the dough's structure
Milk	Helps form the dough
Sugar	Adds and balances the flavor
Oil	Helps with the preparation process and prevents the dough from sticking
Salt	Adds and balances the flavor

Source: Compiled by the Author, 2026

Panelists and Research Instruments

Panelists for this study were selected using *purposive sampling*, a method of sample selection based on specific considerations and criteria tailored to the research objectives.

Table 2. Research Participants

Panelist Groups	Number
Academics	8
Culinary Industry Practitioners	3
General Consumers	32
Total	43

Source: Compiled by the Author, 2026

The research instruments consisted of questionnaires for organoleptic and hedonic tests, using a 1–5 rating scale. The organoleptic test was conducted to evaluate the sensory characteristics of the product, including taste, color, aroma, texture, and appearance. Meanwhile, the hedonic test was used to measure the panelists' overall acceptance or preference for the product.

Table 3. Evaluation Attributes

Parameter	Scale
Taste	1 = very unpleasant to 5 = very tasty
Color	1 = very unappealing to 5 = very appealing
Aroma	1 = very unpleasant to 5 = very pleasant
Texture	1 = very rough to 5 = very smooth
Appearance	1 = very unappealing to 5 = very appealing
Overall (Hedonic)	1 = very dislike to 5 = very much like

Source: Compiled by the author, 2026

Data Analysis

The data from the organoleptic and hedonic tests were quantitatively analyzed using the mean value for each evaluation parameter. The mean value was calculated by dividing the total score obtained from all panelists by the number of panelists. The results were used to describe the sensory characteristics and the panelists' level of acceptance of the chickpea flour-based tlaxcalli product. The evaluation results were interpreted based on a 1–5 scale. The higher the mean score obtained, the better the panelists' acceptance and preference for the product.

Table 4. Evaluation Interpretation Intervals

Score Interval	Interpretation
1.0–2.0	Low
2.1–3.0	Moderate
3.1 – 4.0	Good
4.1–5.0	Very good

Source: Compiled by the author, 2026

Next, the data were analyzed using SPSS to test for differences in acceptance levels between chickpea flour-based Vegetarian Tlaxcalli and Original Tlaxcalli. The research data were first tested for normality using the *Shapiro-Wilk* test and for homogeneity using *Levene's test*. Data that met both assumptions were then analyzed using *one-way ANOVA* at a significance level of 0.05.

The research hypothesis was used to determine whether there was a difference in the panelists' acceptance levels between chickpea flour-based Vegetarian Tlaxcalli and Original Tlaxcalli.

H₀: There is no significant difference in the mean acceptance levels of the panelists between the chickpea-flour- -based Tlaxcalli and the Original Tlaxcalli.

H₁: There is a significant difference in the mean acceptance ratings of the panelists for chickpea flour-based Vegetarian Tlaxcalli and Original Tlaxcalli.

Results and Discussion

Development of a Chickpea Flour-Based Vegetarian Tlaxcalli Formulation

The development of Vegetarian Tlaxcalli was carried out by utilizing chickpea flour as the main ingredient in the production of Tlaxcalli wrappers. The use of chickpea flour is a modification of the base ingredients of the original Tlaxcalli, which generally uses corn-based flour.

Based on the results of the formulation development,

the ingredient composition deemed most suitable for producing the Vegetarian Tlaxcalli wrapper was determined.

Table2 . Final Formula

Ingredients	Amount
Chickpea flour	214 g
Yeast	¼ g
Psyllium husk	22 g
Baking powder	1 tsp
Milk	200 ml
Salt	¼ tsp
Egg white	1
Cornstarch	1 tbsp
Oil	2 tbsp

Source: Compiled by the Author, 2026



Image2 . Final Product Appearance

Source: Author's Documentation, 2026

Results of Organoleptic and Hedonic Testing

Organoleptic and hedonic tests were conducted with 43 panelists, including academics, culinary industry professionals, and general consumers. The evaluation focused on two products: Tlaxcalli Vegetarian, made with chickpea flour as the innovative product, and Tlaxcalli Original as the control product. The aspects evaluated included taste, color, aroma, texture, appearance, and overall likability. The evaluation results are presented as percentages based on the rating scale used.

Table 3 . Percentage Results of Organoleptic and Hedonic Testing

Attribute	Vegetarian Tlaxcalli	Tlaxcalli Original
Taste	65% very tasty, 33% tasty,	48% very tasty, 45% tasty,



	1% somewhat tasty, 1% not tasty	6% not tasty, 1% very not tasty
Appearance	71% very interesting, 28% interesting, 1% somewhat interesting	57% very interesting, 17% interesting, 16% somewhat interesting, 5% not interesting, 5% very uninteresting
Color	61% very appealing, 32% appealing, 4% somewhat appealing, 2% unappealing, 1% very unappealing	48% very appealing, 39% appealing, 6% somewhat appealing, 1% unappealing, 6% very unappealing
Texture	45% very soft, 31% soft, 17% somewhat soft, 6% not soft, 1% very not soft	34% very soft, 33% soft, 21% somewhat soft, 6% not soft, 6% very not soft
Aroma	53% very fragrant, 33% fragrant, 12% somewhat fragrant, 2% not fragrant	41% very fragrant, 35% fragrant, 14% somewhat fragrant, 6% not fragrant, 4% very not fragrant

Source: Compiled by the Author, 2026

Statistical Test Results

To assess the suitability of the data before conducting hypothesis testing, normality and homogeneity tests were performed first. Next, an ANOVA analysis was conducted to determine whether there were significant differences between the ratings of the chickpea flour-based Tlaxcalli Vegetarian product and the Tlaxcalli Original.

The normality test was performed using the *Shapiro-Wilk* method at a significance level of 0.05. Based on the test results, the p-values obtained for the chickpea flour-based Tlaxcalli Vegetarian group and the Tlaxcalli Original group were 0.172, respectively. Since both p-values were greater than 0.05, the data in both groups were deemed to be normally distributed.

Next, a homogeneity test was conducted using

Levene's Test. The test results showed a p-value of 1.000. Since this value is greater than 0.05, the data variances were deemed homogeneous. Thus, the data met the assumption of homogeneity and could proceed to the ANOVA analysis stage.

Hypothesis testing was then performed using a one-way ANOVA with a significance level of 0.05.

Table4. SPSS One-Way ANOVA Analysis

ANOVA					
values	Sum of Squares	df	Mean Square	F	Sig. ^a
Between Groups	.000	1	.000	.000	1.000
Within Groups	303.467	28	10.838		
Total	303.467	29			

a. Confidence Interval: 95%

Source: SPSS 2026 Data Analysis Results

The results of the *one-way ANOVA* analysis showed a p-value of 1.000 (>0.05). Based on these results, H_0 is accepted and H_1 is rejected; therefore, it can be concluded that there is no significant difference in the panelists' acceptance levels between the chickpea flour-based Vegetarian Tlaxcalli and the Original Tlaxcalli. Thus, based on the test results, the use of chickpea flour as the main ingredient in the development of Vegetarian Tlaxcalli does not show a significant difference in acceptance compared to the original product.

Conclusion

Based on the research results, Tlaxcalli Vegetarian, made from chickpea flour (*Cicer arietinum*), was successfully developed through the formulation process using chickpea flour as the main ingredient. The results of organoleptic and hedonic tests conducted on 43 panelists showed that the product received positive ratings on all tested attributes, namely appearance, taste, color, texture, and aroma. The percentage of ratings in the highest category reached 71% for appearance, 65% for taste, 61% for color, 45% for texture, and 53% for aroma.

The results of the statistical tests indicate that the data meet the assumptions of normality and homogeneity. The *one-way ANOVA* test yielded a significance value of 1.000 (>0.05), indicating that there was no significant difference between the chickpea-flour-based Vegetarian Tlaxcalli and the Original Tlaxcalli across all test parameters. This means that, statistically, the panelists rated the two products as equivalent or not significantly different; therefore, the



chickpea flour-based Vegetarian Tlaxcalli can be considered equivalent to the original product and has the potential to be developed as an alternative.

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