

## Proximate Composition, Rheology and Sensory Qualities of Corn-Cocoyam Salad Cream

*J.M. Babajide and O.O. Olatunde*

Department of Food Science and Technology,  
University of Agriculture, PMB 2240, Abeokuta, Nigeria

**Abstract:** The proximate composition, rheology and sensory properties of corn-cocoyam salad cream prepared from varied percentage of corn starch (Cs) and cocoyam starch (Cy) (100Cs, 75Cs: 25Cy, 50Cs:50cy, 25Cs:75Cy and 100Cy) were determined and compared with that of commercial Heinz salad cream. Varied quantities of corn-cocoyam starch in salad cream did not affect the moisture and protein contents of the cream compared to Heinz salad cream which varied from 48.80-49.79 and 2.62-3.28%, respectively. The carbohydrate, fat and ash contents of corn-cocoyam salad cream (18.96-19.95, 27.04-27.99 and 0.59-0.79 %, respectively) were significantly different ( $p < 0.05$ ) from that of Heinz salad cream (17.92, 29.68 and 0.64 %, respectively). As the percentage of cocoyam starch in the salad cream increased, the carbohydrate content gradually increased, while the fat and ash contents reduced gradually. Also, replacement of corn starch with cocoyam starch up to the level of 50 % in salad cream will not negatively affect the rheology and sensory attributes of salad cream.

**Key words:** Proximate • Rheology • Sensory • Corn-cocoyam • Salad cream

### INTRODUCTION

Salad cream is a creamy yellow viscous sauce condiment similar in ilk to mayonnaise. As the title suggests, this underrated sauce is a cream for adding to salads [1]. Commercially, produced salad cream is usually made from distilled vinegar, vegetable oil, water, sugar, mustard, salt, egg yolks, modified corn flour / starch, xanthan gum and guar gum as stabilisers and riboflavin for colouring [2]. Some other ingredients such as different types of pepper, garlic, different types of oil source (olive oil, walnut oil, avocado oil, pumpkin seed oil, grapeseed oil and more), low-fat buttermilk, cream and milk can be added both for commercial and home made creams, depending on the favourite taste of the producer or the consumer.

Salad dressing is oil in water emulsion whereas oil, is the discontinuous phase and water is the continuous phase. According to Food and Drug Administration (FDA), Salad dressing is defined as a semisolid emulsified food with the same, ingredient and optional ingredients as mayonnaise with the exception of cooked starch paste [3-5]. There are two types of salad dressing; pour-able and spoon-able dressing which vary in flavour, chemical and physical properties (especially viscosity).

The example of spoon-able salad dressing is mayonnaise and the pour-able one is salad cream.

Salad dressings and sauces have a long and colourful history dating back as far as 5000 years ago when the Chinese were using soy sauce as a topping for fresh vegetables and nearly 2000 years ago when the Babylonians used oil and vinegar for salad dressing [3-5]. From the early 1990s until 2000 the popularity of salad cream waned for a cultural reason rather than of one of taste and perception [2,6].

In the United Kingdom, the H. J. Heinz Company remains the primary commercial producer of salad cream in 1914, though it is also produced by other companies and numerous supermarkets under their own brand labels. It soon raised to popularity with the working class masses in Britain throughout the 20<sup>th</sup> century and became almost a part of the staple diet along with potatoes and rice pudding. In Canada, Heinz and Crosse and Blackwell brands are available in most supermarkets across the country; Safeway and the Superstore group being some of them. In the United States, salad cream has generally been unavailable (and unknown); however with the large population of British expatriates, especially in the Northeast, it is becoming more common [7].

In Nigeria, Heinz salad cream have become a popular condiment added to the vegetable salads produced in almost all the eateries and in homes were vegetable salads are taken as one of their favourite dishes. The inclusion of salad cream in vegetable salad improves the taste of the vegetables thus more vegetables could be consumed for more health benefits, asides the nutritional benefits of the cream. Since the salad cream being used in Nigeria is the imported Heinz salad cream which may not be readily available and expensive, there is need to produce salad cream locally using corn and cocoyam starch as part of its ingredient.

The presence of starch in salad dressing serves as a gelling agent, binding agent, thickening agent, emulsifying agent and a stabilizer. The modified food starch develops viscosity and protective colloid characteristics that help to prevent the breakdown of the blend during various processing steps [4]. A recent study has shown the use of starch extracted from one of the root and tuber crop-cassava, as one of the ingredients of salad cream [8]. Another under explored starchy crop is Cocoyam, the cocoyam starch (Taro variety) has been found to give more floury starch suitable for use as composite mixture for food preparation and also when compared with other root crop [9].

This research focused on the determination of the proximate composition, rheological properties of the salad cream made from corn-cocoyam starch and investigation of the acceptability of the corn-cocoyam salad cream was carried out by conducting sensory tests.

## MATERIALS AND METHODS

**Materials:** The material of this investigation included corn starch, cocoyam starch, mustard, sugar, salt, vinegar, water, corn oil and egg yolk powder. The cocoyam starch was extracted from corms of cocoyam purchased from Apata, Ibadan, Nigeria. Corn starch, vinegar, mustard, sugar, corn oil, egg yolk powder and Heinz salad cream (Reference sample) were purchased from grocery store at Dugbe Market, Ibadan, Nigeria.

**Cocoyam Starch Extraction:** The fresh cocoyam roots was washed, peeled, washed again, sliced to about 1-3 cm and transferred into a milling machine. The suspension was filtered using a 0.40 mm sieve and the filtrate was allowed to stand for 4 h to facilitate starch sedimentation while the top liquid was decanted and discarded. The sediment was then washed and dried in a cabinet dryer at 50-55°C for 4 h. The resultant dry starch cake was milled to obtain cocoyam starch powder [10].

**Salad Cream Production:** The method described by Sanni *et al.* [8] was employed with some modifications. The salad cream was produced out of 5 blends formulation of corn-cocoyam starch. The cocoyam starch, corn starch, mustard, sugar, salt and water was weighed into a cooking pot, stirred and brought to boiled at 90°C and then cooled to refrigeration temperature (8°C). The egg yolk and oil was stirred into the slurry followed by the vinegar which was added gradually and boiled for 5 min. The slurry of each blend was then poured into labeled sterilized jars and stored in a refrigerated storage condition before further studies.

### Proximate Composition of Corn-Cocoyam Salad Cream:

Moisture, Ash, Fibre, Fat and Protein contents were determined as described by AOAC [11] while Carbohydrate was determined by difference:

$$\% \text{ Carbohydrate} = 100 - (\% \text{ Moisture} + \% \text{ Ash} + \% \text{ Protein} + \% \text{ Fat} + \% \text{ Fibre})$$

### Rheological (Viscosity) Property of Corn-Cocoyam Salad Cream:

The viscosity of each sample was measured using a digital rotational Brookfield viscometer. A 600 ml beaker was used for measurement with the viscometer guard leg on. The samples were poured into the beaker to reach a level that covers the immersion groove on the spindle shaft. Spindle rotation speeds of 10, 20, 30, 50, 60 and 100 at room temperature (30±2° C) were utilized for viscosity determination. Spindle size 6 was used for all the measurements.

### Sensory Evaluation of Corn-Cocoyam Salad Cream:

Panelists of regular salad cream eaters from University of Agriculture, Abeokuta (UNAAB) were chosen and trained for the sensory evaluation. Six coded samples of salad cream were presented to the panelists, (with one of the sample a regularly consumed Heinz salad cream as the Reference, R). A multiple comparisons test was conducted to compare the appearance, aroma, taste and spreadability of corn-cocoyam salad cream with the reference sample. Numerical scores were assigned to the rating as 9= extremely better than R, 5= not different from R and 1= extremely less than R. A 9 point Hedonic scale test was used to determine the overall acceptability of corn-cocoyam salad cream as 9= like extremely, 5= neither like nor dislike and 1= dislike extremely [9].

**Statistical Analysis:** All the data obtained were subjected to analysis of variance (ANOVA) using SSPS version 10.0 statistical package. Means were separated using Duncan's Multiple Range Test.

## RESULTS AND DISCUSSION

Table 2 shows the proximate composition of salad cream made from varied quantities of corn-cocoyam compared with Heinz salad cream, a commercial product. There was no significant difference in the moisture contents of all the salad cream made from varied quantities of corn-cocoyam starch compared with that of Heinz salad cream. Salad cream sample containing 100% cocoyam (100Cy) had the highest moisture content as 49.79 %, this could mean that substitution of corn starch with cocoyam starch in salad cream could lead to increased moisture but equal amount of corn and cocoyam starch do not have effect on the moisture content of salad cream. Also, there is an indication that cocoyam starch could absorb slightly more water than corn starch. There was no significant difference in the protein contents of all the salad cream made from varied quantities of corn-cocoyam starch in which salad cream made with 100% corn starch (100Cs) had the highest value

of 3.28 % followed by 50Cs:50Cy salad cream. The protein content decreased as the level of substitution with cocoyam increased, thus, salad cream containing 100% cocoyam starch (100Cy) had the lowest protein content of 2.63 % which was not significantly different from that of Heinz salad cream (2.96 %). The protein content reported by McCance and Widdowson [12] was 1.5%. A value which is low as compared to the result of this analysis. The salad cream made from 100 % cocoyam (100Cy) and 75 % cocoyam (25Cs:75Cy) had the highest carbohydrate contents and were not significantly different from each other. There were significant ( $p < 0.05$ ) differences between the carbohydrate contents of all the corn-cocoyam salad creams compared to that of Heinz salad cream, with Heinz cream having the lowest value of 17.92 %. The carbohydrate contents decreased as the substitution of corn starch with cocoyam starch reduced thus, the more the cocoyam starch, the more the carbohydrate content.

Table 1: Recipe Formulation for Salad Cream made from corn-cocoyam starch

Ingredients	Salad cream made from:				
	100Cs	75Cy:25Cs	50Cs:50Cy	25Cs:75Cy	100Cy
Corn starch	45g	33.75g	22.25g	11.25g	-
Cocoyam starch	-	11.25g	22.25g	33.75g	45g
Mustard powder	15g	15g	15g	15g	15g
Sugar	15g	15g	15g	15g	15g
Salt	2.5g	2.5g	2.5g	2.5g	2.5g
Egg yolk powder	36g	36g	36g	36g	36g
Vinegar	120ml	120ml	120ml	120ml	120ml
Water	280ml	280ml	280ml	280ml	280ml
Corn oil	90ml	90ml	90ml	90ml	90ml

Cs = % Corn starch, Cy = % Cocoyam starch

Table 2: Mean values of Proximate Composition of Corn-Cocoyam salad cream

Sample	Moisture %	Protein %	Fat %	Fibre %	Ash %	Carbohydrate %
100cs	48.98 <sup>a</sup>	3.28 <sup>a</sup>	27.99 <sup>b</sup>	Nil	0.79 <sup>a</sup>	18.96 <sup>b</sup>
75cs:25cy	49.30 <sup>a</sup>	3.07 <sup>a</sup>	27.71 <sup>b</sup>	Nil	0.73 <sup>a</sup>	19.19 <sup>ab</sup>
50cs:50cy	48.99 <sup>a</sup>	3.12 <sup>a</sup>	27.66 <sup>b</sup>	Nil	0.77 <sup>a</sup>	19.46 <sup>ab</sup>
25cs:75cy	49.38 <sup>a</sup>	2.78 <sup>a</sup>	27.53 <sup>b</sup>	Nil	0.62 <sup>b</sup>	19.69 <sup>a</sup>
100cy	49.79 <sup>a</sup>	2.63 <sup>a</sup>	27.04 <sup>bc</sup>	Nil	0.59 <sup>c</sup>	19.95 <sup>a</sup>
Heinz salad cream (R)	48.80 <sup>a</sup>	2.96 <sup>a</sup>	29.68 <sup>a</sup>	Nil	0.64 <sup>b</sup>	17.92 <sup>c</sup>

Cs = % Corn starch, Cy = % Cocoyam starch. Values are means of three replicates. Means value followed by different superscript within columns are significantly different ( $P < 0.05$ )

Table 3: Mean values of Rheological properties of Corn-Cocoyam Salad cream

Sample	Viscosity (centipoises)
100cs	7908.33 <sup>f</sup>
75cs:25cy	8215.24 <sup>e</sup>
50cs:50cy	8536.66 <sup>d</sup>
25cs:75cy	8883.33 <sup>b</sup>
100cy	11296.67 <sup>a</sup>
Heinz salad cream (R)	8626.45 <sup>c</sup>

Cs = % Corn starch, Cy = % Cocoyam starch. Values are means of three replicates.

Means value followed by different superscript within columns are significantly different ( $P < 0.05$ )

Table 4: Mean scores of Sensory attributes of Corn-Cocoyam salad cream

Sample	Appearance	Taste	Aroma	Spreadability	Overall Acceptability
100cs	4.8 <sup>a</sup>	5.1 <sup>a</sup>	5.2 <sup>a</sup>	5.2 <sup>a</sup>	7.3 <sup>a</sup>
75cs:25cy	4.9 <sup>a</sup>	5.3 <sup>a</sup>	5.2 <sup>a</sup>	5.2 <sup>a</sup>	7.4 <sup>a</sup>
50cs:50cy	4.7 <sup>a</sup>	5.1 <sup>a</sup>	5.1 <sup>a</sup>	5.3 <sup>a</sup>	7.1 <sup>a</sup>
25cs:75cy	4.3 <sup>b</sup>	4.3 <sup>b</sup>	4.8 <sup>a</sup>	4.1 <sup>b</sup>	6.3 <sup>b</sup>
100cy	3.2 <sup>c</sup>	4.2 <sup>b</sup>	4.8 <sup>a</sup>	4.2 <sup>b</sup>	6.4 <sup>b</sup>
Heinz salad cream (R)	5.0 <sup>a</sup>	5.0 <sup>a</sup>	5.0 <sup>a</sup>	5.0 <sup>a</sup>	7.4 <sup>a</sup>

Cs = % Corn starch, Cy = % Cocoyam starch, Values are means of three replicate

Mean values followed by different superscript within columns are significantly different ( $P < 0.05$ )

Although the fat content of corn-cocoyam salad cream reduced as the substitution of corn starch with cocoyam starch increased, there was no significant difference in the fat content except for that of 100 % cocoyam salad cream. The fat content of Heinz salad cream was the highest (29.68 %) which showed that more oil/fat base (vegetable oil or cream) was used in the production. The fat content of all the corn-cocoyam salad creams and Heinz salad cream were almost the same were not up to the amount reported by McCane and Widdowson [12] as an average of 31 %. The fibre content of the cream was nil thereby showing an effective sieving of the starch before usage. The ash content also reduced as the level of substitution of corn starch with cocoyam starch in salad cream increased. Salad cream with 100 % corn starch (100Cs) had the highest ash content (0.79 %) while 100 % cocoyam salad cream (100Cy) had the lowest value of 0.59 % which was not significantly different from that of Heinz salad cream (0.64 %).

Table 3 shows result of the rheological properties of salad cream prepared from varied quantities of corn and cocoyam starch. There was a clear indication that the viscosities of all the samples were different from each other as there were significant differences ( $p < 0.05$ ) in the values obtained. Salad cream made from 100 % cocoyam (100Cy) had the highest viscosity of 11296.67 centipoise which reduced as the level of cocoyam reduced. Salad cream containing 100 % corn starch (100Cs) had the lowest viscosity (7908.33 centipoise) while that of Heinz was 8626.45 centipoise. It can be inferred that substitution of corn starch with cocoyam starch up to the level of 50 % in salad cream, could give a satisfactory product viscosity as 50Cs:50Cy salad cream had a viscosity of 8536.66 centipoise, a value close to that of Heinz cream.

The mean scores of colour, taste, aroma, spreadability and overall acceptability of the salad cream samples prepared from corn-cocoyam starch compared to that of Heinz salad cream are shown in Table 4. The appearance of 100Cs, 75Cs:25Cy and 50Cs:50Cy salad creams were not

significantly different from that of Heinz salad cream as their value were 4.8, 4.9 and 4.7, respectively while the appearance of 25Cs:75Cy and 100Cy salad creams were slightly different from Heinz salad cream. Likewise the taste and spreadability of 100Cs, 75Cs:25Cy and 50Cs:50Cy salad creams were not different from that of Heinz salad cream, while that of 25Cs:75y and 100Cy salad creams were slightly different from Heinz cream. There were no significant differences in the overall acceptability of 100Cs, 75Cs:25Cy and 50Cs:50Cy salad creams, therefore substitution of corn starch with cocoyam starch up to the level of 50 % in salad cream will not negatively affect the sensory attributes of salad cream.

In conclusion, varied quantities of corn-cocoyam starch in salad cream did not affect the moisture and protein contents of the cream compared to Heinz cream. It can be inferred that substitution of corn starch with cocoyam starch up to the level of 50 % in salad cream, could give a satisfactory product viscosity, as 50Cs:50Cy salad cream had a viscosity of 8536.66 centipoise-a value close to that of Heinz cream. Substitution of corn starch with cocoyam starch up to the level of 50 % in salad cream will not negatively affect the sensory attributes of salad cream.

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