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The use of *Moringa oleifera* oil in the production of a functional dressing

Abstract

Dressing is the most popular and known cold sauce in most worldwide kitchen. It is used to season foods and make them taste nice. It is a sort of oil-water emulsion with a minimum oil content of 40%, the oil phase consists in a vegetable oil and the water phase has an acid nature. This research looks at determining certain physical, chemical and sensorial parameters of a functional dressing made with Moringa seed oil. The use of Moringa oil was evaluated at the rates of 25, 50, 75 and 100% with soybean oil. The analyzed parameters were: pH, Acidity index, Total free acidity, microbiological and sensorial analysis. During the production process of the dressing, it was observed that till the concentration of 75%, Moringa oil in the blends of Moringa and soybean oils, the emulsion was stable, with an adequate consistency. pH values of such blends were between 3,2 - 4,02. Acidity index were determined between 4,11 – 5,46 mg KOH/g and the total acidity figures between 4,44 - 0,58% w/w of acetic acid. The dressing, with a formulation of 35% Moringa oil recorded the highest acceptance in the categories of "I like it very much" with 66,25% and 31,25% for the category "I like it", followed by the formulation of 75%, that for such categories, reached 36,25% and 6,25%, respectively. This research showed the potential of Moringa seed oil to be use as oil ingredient of natural origin in the production of dressing as functional food, with acceptance criteria in tasting and physico-chemical and microbiological parameters.

Keywords: dressing, Moringa seed oil, functional food

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Introduction

Looking forward to prevent chronic diseases associated to a high fat consumption, in recent years, the production of mayonnaise and dressing with a low fat content have increased.[1] The seeds of *Moringa oleifera* (Figure 1) contain from 35 to 40% of its weight in a low-viscous oil that, due to its high quality, is one of the usable and beneficial parts of the plant.[2] Moringa seeds are considered to be bitter in flavor, sometimes unpleasant; but its oil portion has physico-chemical characteristics very similar to olive oil and shows different proven biological effects.[3]

Figure 1 *Moringa oleifera* seeds.

On the other hand, the use of the seed cake resulting from the cold-pressed oil extraction is suggested as fertilizer for crops, in some cases, it is used for animal feeding. There is a large quantity of information regarding its use as natural flocculant to reduce water turbidity, and it is classified as the best natural coagulant to purify cloudy waters.[4]

The sterol content of Moringa seed oil marks the difference with most of the conventional oils.[2] The cold-pressed method to extract oil from Moringa seeds, allows the extraction of a high content of monounsaturated fats, oleic and behenic acids. Oleic acid is the predominant fatty acid in the Moringa oil, with moderate quantities of gadoleic, palmetto acid and also of stearic acid.[5]

The main components of Moringa oil are triglyceride esters of the oleic acid. Oleic acid is an unsaturated fatty acid, it is mainly found in vegetables and has the capacity of reducing blood pressure and the level of high-density cholesterol in the human body.[6] Likewise, it can protect against damages caused by free radical and some degenerative diseases, performs healing on the skin and lesions on the stomach mucosa. It can also be used in antioxidant therapies to reduce the genotoxicity of arsenic and other heavy metals whose acting mechanisms of carcinogenic action are related to reactive species of oxygen.[3]

Despite the Moringa oil has been used for centuries, its beneficial properties have not been deeply studied to help curing skin diseases, gout, joint disorders, scurvy, inflammation, stomach ache, rheumatism and many other disorders.[7]

Taking all the above as a premise, this research looked at determining certain physico-chemical parameters like pH, Acidity index (AI) and Total free acidity (TA) as acetic acid (% w/w), to evaluate the use of Moringa seed oil in the production of a functional dressing.

Materials and methods

Dressing production

Dressing production used the formulation of mayonnaise products from Findy, made by the Papa´s & Co., enterprise, Havana, Cuba. The ingredients included: 54% of the base formula made up of starch, Xanthan gum, citric acid, sorbitol and mustard (in quantities not shown), 6% of dehydrated egg yolk and 40% of oil. Commercial soybean oil, Moringa dry seed oil from India by the cold-pressed method, were used. The use of Moringa oil blended with soybean oil was evaluated, at the 25, 50, 75 and 100% (the first three were identified as A-25%, A-50%, A-75%, respectively), that in each case matched 75, 50, 25 and 0% soybean oil. As control dressing (CD)

the production with 100% soybean was used, that is, commercial mayonnaise Findy. The experiment included three repetitions.

Determination of pH in dressing

The pH was determined with a pH meter (CRISON, GLP 21, model PH3), previously calibrated at pH = 4,0 and 7,0. The average pH Reading of the three repetitions was recorded.

Determination of the Acidity index and Total acidity

Using an Erlenmeyer of 250 mL, 5 grams of dressing were weighed with a precision of 0,0001 g pm a technical balance (Model U6100, SARTORIUS). With a serological pipette of 50 mL, 50 mL of absolute ethylic alcohol were added and 1 mL of phenolphthalein at 1% p/v in ethanol. Inside the Erlenmeyer a magnetic bar of 39 x 7 mm was introduced and the flask was placed on the magnetic agitator Orbital (IKA KS 501-D), agitation lasted 5 minutes to have a homogeneous solution. Then, the homogeneous blend was titrated against a standardized solution of potassium hydroxide at 0,1 N using a burette of 25 mL with Teflon tap. During the addition of the titrating agent agitation was applied, but the proximity of the equivalence point the potassium hydroxide solution was added by drops and the Erlenmeyer was heavily agitated manually. The final titration point was established when it showed up, and the rose color provided by the phenolphthalein was kept for one minute.[8]

The Acidity index (AI) was calculated applying the following equation and was expressed in mg KOH/g of oil:

$$Acidity\ index\ (AI) = \frac{(N)(V)(56{,}11)}{(P)}$$

Where:

N: Normality of the KOH solution used in the titration of the sample.

V: Volume of the KOH solution, consumed in the titration of the sample (in millilitres)

56,11: Equivalents of KOH

P: Sample mass (in grams)

Total free acidity or Acidity degree, expressed as the percentage of acetic acid, was calculated with the following formula:

$$Total\ free\ acidity = \frac{(N)\ (V)\ (0{,}060)}{(P)}\ \text{as \% of acetic acid}$$

Where:

N: Normality of the KOH solution used in the titration of the sample

V: Volume of the KOH solution, consumed in the titration of the sample (in millilitres)

0,060: Milliequivalents of acetic acid

P: Sample mass (in grams)

Microbiological analysis

In order to determine the microbiological quality of the dressing, a recounting of colonies in culture plates was made, according to the Cuban standard, at the facilities of the Research Center on Protein Plants and Bionatural Products, Havana, Cuba.[9]

Sensorial analysis

A sensorial evaluation was made with the participation of 80 tasters, considered as non-trained potential consumers of dressing. The group was composed of workers from Papa´s & Co. Enterprise and from the Research Center on Protein Plants and Bionatural Products, whose ages ranged from 18 to 60 years. The acceptance level was established through a hedonic scale of seven categories (I like it very much, I like it, I like it a little, Neither like nor unlike me, I scarcely like it, I do not like it and I unlike it a lot), that were recorded by a survey.[10]

Statistical analysis

Data from all tests were the result of the mean of 10 repetitions (n = 3). The mean, the standard deviation (SD) and the variation coefficient (VC) of all values were processed with EXCEL 2016.

Results and Discussion

Dressing production

During the production process of the dressing, it was observed that till the concentration of 75%, Moringa oil in the blends of Moringa and soybean oils, the emulsion was stable, with an adequate consistency (Figure 2). Not so when it was produced with Moringa oil alone (100%), and the emulsion lost consistency and divided into two phases. With the Moringa oil increased concentration, the cream yellow color notably increased in the emulsion due to the Moringa oil.

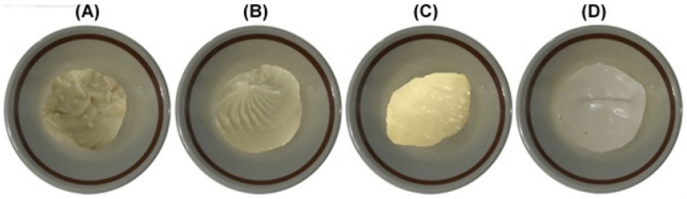

Figure 2 Dressing made with Moringa seed oil blended with soybean oil. (A): 25% Moringa oil and 75% soybean oil; (B): 50% Moringa oil and 50% soybean oil; (C): 75% Moringa oil and 25% soybean oil; (D): Control (mayonnaise Findy, with 100% soybean).

Determination of the pH

Table 1, shows the pH results of dressing. It was observed that emulsions with the presence of Moringa oil, the pH showed lower values than in the control with soybean oil alone. There are no specific studies on the microbiological evaluation of dressing made with Moringa oil, so the results of this research were compared to other food analyses made under similar conditions. When comparing other types of dressing, it was found that the pH was lower than that of Guzmán et al.[11] and Tomala,[12] with a value of 4,0 and 4,2, respectively and higher than that of Ingrassia[13] that was 3,51. According to the chemical analysis, pH values of the dressing under study are within the permitted values in the quality specification, as per the regulating Cuban standards.[11] It is important to remark that pH values were always lower than 4,0; which is a critical value for contaminating microorganisms growth.

Table 1 Descriptive statistics of the Acidity index and Total acidity of dressing made with Moringa seed oil

Dressing	pH	Acidity index (mg KOH/g)			Total acidity (% w/w of acetic acid		
		Mean	SD	VC	Mean	SD	VC
A–25%	3,84	4,11	0,106	2,575	0,44	0,04	8,19
A–50%	3,82	4,22	0,087	2,072	0,45	0,04	8,01
A–75%	3,82	5,46	0,319	5,838	0,58	0,02	4,00
AC	4,02	4,11	0,113	2,742	0,44	0,03	6,01

The acidity of an oil can be represented in two ways: through the Acidity index (AI) defined as the number of milligrams of KOH needed

to neutralize free organic acids present in one gram of fat (mg KOH/g) and Total acidity or Acidity degree (TA), that is the percentage of free fatty acids present on a fat (% w/w of acetic acid).[14] Acidity values were submitted to a descriptive statistical analysis shown in Table 1.

The Acidity index showed the same value for the dressing made with 25% Moringa seed oil regarding the control dressing, while its value increased as the proportion of Moringa seed oil used in the blend did. Acidity index values ranged from 4,11 to 5,46 mg KOH/g and Total acidity values from 0,44 a 0,58% of acetic acid. It proved that these dressings meet the current standard regarding this indicator (≤ 1,02% w/w of acetic acid).[14]

When comparing the Acidity index values with those from other research that analyzed commercial dressing, it was found that Rodriguez et al.[8] and Rodriguez et al.,[15] showed values from 8,75 – 12,23 and 5,25 – 6,70 mg KOH/g, respectively, which are above those reached in the present study.

In relation to the Total acidity values expressed in percentages (% w/w) of acetic acid recorded by other studies, it was seen that Kammar et al.[16] showed values of 0,59 and Tomala,[12] 0,58% of acetic acid. Both were higher than those of the current research for 25 and 50% of Moringa seed oil in dressing (0,44 and 0,45% of acetic acid, respectively) and very similar to that containing 75% of Moringa seed oil (0,58% of acetic acid). On the other hand, studies made by Rojas et al.[17] and Guzmán et al.[11] showed values of 0,35 and 0,4% of acetic acid, respectively, lower values than those of the current study. However, Rodríguez et al.[15] and Rodríguez et al.,[8] exhibited values from 0,94 - 1,31 and 0,56 - 0,72% of acetic acid, respectively.

For those food containing oils and fats in their preparation, the Acidity Index is of great importance since it allows testing their conservation status. This is a criterion of the composition degree of fatty acids to chemical reactions of hydrolysis or lipolysis, in which, free fatty acids are consequently formed activating the hydrolytic rancid process that affects the product.[18]

Acidity values in mayonnaises or dressing can increase for different reasons like fat hydrolysis, the microbial fermentation and the lipid oxidation. Fats hydrolysis can be catalyzed by the lipase present in the egg yolk, which produces free fatty acids that can increase acidity values during storage time for mayonnaises or dressings containing it.[17]

Microbiological analysis

The microbiological quality of dressings showed a low frequency of contaminating microorganisms (Table 2).

Table 2 Microbiological determinations of dressings made with Moringa seed oil

Determination	Microbial limit	A–25%	A–50%	A–75%	AC
Yeasts	≤103 cfu g^{-1}	5 cfu g^{-1}	6 cfu g^{-1}	3 cfu g^{-1}	5 cfu g^{-1}
Coliforms	≤102 cfu g^{-1}	3 cfu g^{-1}	2 cfu g^{-1}	1 cfu g^{-1}	2 cfu g^{-1}
E. coli	0 cfu g^{-1}	0 cfu g^{-1}	0 cfu g^{-1}	0 cfu g^{-1}	0 cfu g^{-1}

Source: Personal data. (cfu – colony forming unit)

Dressings are classified as a prepared food without thermal treatment so they turn into a potential source of contamination due to multiple pathogenic microorganisms. Through the values reached in microbial recounts for evaluated dressings, it was indicated that any of them surpassed permissible limits as per Cuban regulatory standards. It showed that all of them had an acceptable quality. Therefore, this product met the established specifications and it is classified as a food with no risk for human health.[14]

Diseases transmitted by contaminated foods are a public health issue at present and they have turned into a health threat for world population. Many diseases originate in the contamination caused by a faulty handling of foods in any of the stages of the food chain. The microbiological control allows detecting the presence of pathogens responsible of the main changes foods have.[19] The most frequent reasons causing food contamination is the lack of adequate conservation and failures in the food handling process.[20]

Sensorial analysis

All dressings that achieved a stable emulsion (25, 50 y 75% of Moringa oil) showed a slight nut aroma of cream yellow color that increased with the highest presence of Moringa seed oil and its characteristic flavor (Figure 2). An important parameter in the acceptance of any food, new or modified, is the sensorial issue; a meaningful indicator to check if it is indeed viable to replace an active ingredient by another one when preparing new foods.[18]

It is necessary to take into account visual features, they are a new element in the food industry that can induce consumers to expect a certain flavor and possibly the fact of not being used to dressings appearance.[21] Consumers reaction to physical, chemical and textural properties of a product, that is, its sensorial evaluation is the consequence of the intrinsic acceptance of the product.[22]

The results of the sensorial evaluation of dressings through the hedonic scale applied to non-trained personnel are shown in Table 3.

Table 3 Sensorial acceptance of dressing made with Moringa oil blended with soybean oil

Category of acceptance	Acceptance (%)			
	A–25%	A–50%	A–75%	AC
I like it very much	31,25	3,75	6,25	10,00
I like it	66,25	23,75	36,25	33,75
I like it a little	1,25	55,00	33,75	35,00
Neither like nor unlike me	0,00	10,00	18,75	11,25
I scarcely like it	1,25	2,50	2,50	3,75
I do not like it	0,00	3,75	0,00	3,75
I unlike it a lot	0,00	1,25	2,50	2,50

Dressing with the formulation of 25% Moringa seed oil was the one with the highest acceptance in the categories "I like it very much" with 66,25% and 31,25% for "I like it", followed by the one formulated with 75%, that reached for those categories 36,25% and 6,25%, respectively. For the sensorial analysis, panels of trained tasters, non-trained tasters or tasters unknowing the food, can be used.[23] Some authors point out that a consumer-taster is a person without special abilities to taste, if he/she works with foods like researchers or workers of food factories that have not made periodic sensorial evaluations. In general, they are chosen at random or with criteria to perform satisfaction tests (panels of 30 - 40 judges, minimum).[24–26]

In the consulted literature, no papers with information on the use of Moringa seed oil to prepare functional foods for human consumption were found. The same is true for its use in the production of dressings, so the results of this research are the first for this investigation topic. The beneficial properties of Moringa seed oil turn it into a functional dressing for which it is worth evaluating the corresponding biological effects already proven for Moringa oil.[3]

Conclusion

Dressing made with Moringa oil is a quality nutritional product that meets the physical, chemical and microbiological parameters and can be introduced into the food market. This technology replaces the commercial oil by the domestically produced Moringa oil that enjoys acceptance as for its flavor.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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