

## SHORT COMMUNICATION

### Development of a vegetable salad dressing and evaluation of its nutritional, physicochemical and sensory properties

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#### ABSTRACT

The nutritional, physicochemical and sensory properties of a vegetable salad dressing prepared from four oil types that were vegetable oil, sesame oil, soy bean oil and olive oil along with vinegar, wheat flour, curry leaf powder, pepper, salt, sugar, carboxymethyl cellulose (CMC) vitamin E, and egg yolk were explored. Best recipe was selected by conducting a sensory evaluation using nine-point hedonic scale. Vegetable oil incorporated salad dressing was selected as the best recipe. Total soluble solids (TSS), percentage titratable acidity (%TA), pH and microbiological properties of the selected recipe were analysed using standard methods. Sensory parameters including colour, aroma, taste, texture and overall acceptability were evaluated using 10 trained panelists for the selected product for five weeks at two weeks interval. Final product contained 55.2% moisture, 23.3% fat, 8.3% ash and 5.7% crude protein. TSS, %TA and pH of the final product were 18, 0.33% and 4.08, respectively. No significant ( $P>0.05$ ) changes were observed in all the sensory properties and tested physicochemical properties up to the 5<sup>th</sup> week of the storage period. Microbial counts were less than the standard minimum limits. The highest consumer preference was observed in the 3<sup>rd</sup> week after preparation. According to the results, the developed vegetable salad dressing can be safely stored at room temperature for five weeks without chemical preservatives.

**Keywords:** Physicochemical, salad dressing, sensory evaluation, shelf life

#### INTRODUCTION

Salad dressing is a type of sauce used to bind and flavor greens and/or vegetables. Salad dressings add flavor to the vegetables. Eating salads with dressings, is not only tasty, but also add nutrition as well. As most vitamins are fat soluble most of the vitamins in vegetables are much better absorbed in the presence of fat (Paleoleap, 2016). The vegetables in salads are full of important vitamins and nutrients but it does not get much benefit without the right type and amount of salad dressing. In order to utilise more from fruits and vegetables, it is necessary to pair them correctly with fat-based dressings (Wallheimer, 2012).

Every ingredient in a salad dressing is important. A good tasting oil, a flavourful vinegar and a balanced mix of herbs, spices and other ingredients all make for a quality dressing (Esorin, 2009).

Commercial salad dressings are oil-in-water (o/w) emulsions frequently used by the food industry to enhance the attractiveness and tastiness of different products (Bortnowska, 2014). In recent years, salad dressing products have received growing attention in the food industry due to increased consumer demand for salad as a healthy food option (de Melo, 2015). Taken together, the present work aims towards the development of a vegetable salad dressing for Sri Lankan origin with acceptable physicochemical, sensory and microbial properties.

## **MATERIALS AND METHODS**

### **Materials and reagents**

Ingredients used to prepare the salad dressing formulation: olive oil/vegetable oil/sesame oil/soy bean oil, coconut vinegar, egg yolk, starch paste (wheat and water), salt, pepper stabilisers, thickeners, carboxy methyl cellulose, pectin and vitamin E were purchased from a market in Kandy, Sri Lanka. All the ingredients used were food grade.

### **Preparation of salad dressing**

Ingredients were measured accurately according to the recipe. Following ingredients were used and expressed as w/w basis: oil (35%), coconut vinegar (6%), wheat flour (9%), potable water (35%), egg yolk (4.5%), salt (1%), sugar (3.5%), pepper (4.5%), curry leaf powder (1%) and carboxymethyl cellulose (0.5%).

Salad dressing was prepared according to the method describe by Ma *et al.* (2013) with slight modifications. First, starchy paste was prepared by mixing wheat flour and water. Then, salt, sugar and vinegar were added to the paste in stainless steel sauce pan and mixed well while heating up to 90 °C. Next, pepper, CMC and curry leaf powder were added to the mixture after reducing the temperature to 36 °C. Along with this egg yolk was added. Then the mixture cooled to 12 °C and the oil (olive oil/vegetable oil/sesame oil/soy bean oil) was added and mixed well. This mixture was then heated up to 32 °C. Thereafter, it was well grinded using a blender. The mixture was again heated up to 50 °C. Finally, it was poured in to sterilised glass bottles, sealed, labeled and kept at room temperature. Best salad dressing recipe was selected through a sensory evaluation using trained panelists. The selected salad dressing was further analysed.

### **Determination of proximate composition**

Moisture, fat, protein, fiber and ash contents of the salad dressing were determined in accordance with AOAC methods 934.01, 920.39, 984.13, 962.09 and 942.05, respectively.

### **Determination of physicochemical properties**

Physicochemical properties of the salad dressing were determined according to the methods described by Bortnowska *et al.* (2014) with slight modifications. pH,

total soluble salts (TSS) and %TA were evaluated as physicochemical properties of the final salad dressing in two weeks interval for seven weeks. pH was measured using a pH meter (BP3001 Professional Bench top pH meter, USA). TSS was measured using a hand held Refractometer (30° BRIX, USA). Titratable acidity of the final product was measured according to the SLS 347.

### **Sensory analysis of salad dressing**

Sensory analysis for the salad dressing formulations was performed using effective acceptance and preference test with 10 trained panelists to select the best recipe out of four formulations. The selected salad dressing was used to evaluate the sensory attributes for further five weeks and the sensory evaluations were carried out at two weeks intervals. The sensory analyses were performed under controlled temperature and lighting conditions. Each panelist received four samples with a vegetable salad. They were served on disposable white cups coded with random three-digit number. The panelists were asked to drink water between the samples to avoid aftertaste. Colour, taste, aroma, texture and overall acceptability were evaluated using a nine-point structured hedonic scale where 1 – strongly dislike and 9 – strongly liked. To evaluate the consumer acceptance of the selected product with storage time, sensory evaluations were conducted for five weeks at two weeks intervals.

### **Determination of peroxide value**

Peroxide value of the final product was tested after five weeks of production according to the methods described by Lee *et al.* (2014) and AOCS with some modifications.

### **Microbial analysis**

Total plate count and *Escherichia coli* tests were performed (SLS 516 part 3).

### **Statistical analysis**

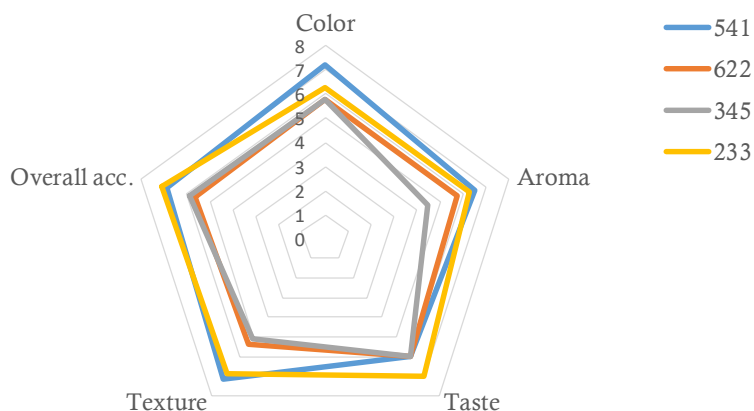
Statistical analyses were performed using non-parametric, Freidman test and one-way ANOVA to determine significant differences ( $P \geq 0.05$ ) between treatments using computer software MINITAB 17.

## **RESULTS AND DISCUSSION**

### **Selection of the best recipe**

Best recipe was selected after conducting a sensory evaluation. Figure 1 shows the result of the sensory evaluation.

According to the results, there is no significant difference ( $P > 0.05$ ) in terms of colour, taste and overall acceptability among four treatments. This implies that different types of oil incorporate to the vegetable salad dressing may not affect the colour, taste and overall acceptability of the four samples.



**Figure 1:** Web diagram of sensory evaluation of four salad dressing formulations. 541: olive oil incorporated salad dressing, 622: sesame oil incorporated salad dressing, 345: soybean oil incorporated salad dressing, 233: vegetable oil incorporated salad dressing.

In terms of aroma and texture, at least one treatment is significantly different ( $P < 0.05$ ) among the four treatments. This implies that different oil types incorporate for the salad dressing has an effect for the aroma and texture of the four samples. The highest median value for taste and overall acceptability were gained by salad dressing incorporated with vegetable oil and the highest median value for the colour, aroma and texture were gained by the olive oil incorporated salad dressing. Since the prime objective of the study was to develop a vegetable salad dressing for Sri Lankan origin, salad dressing incorporated with vegetable oil was selected for further studies.

### Proximate composition of the vegetable oil incorporated salad dressing

Table 1 shows the proximate composition of the vegetable oil incorporated salad dressing.

**Table 1:** Proximate composition of the vegetable oil incorporated salad dressing.

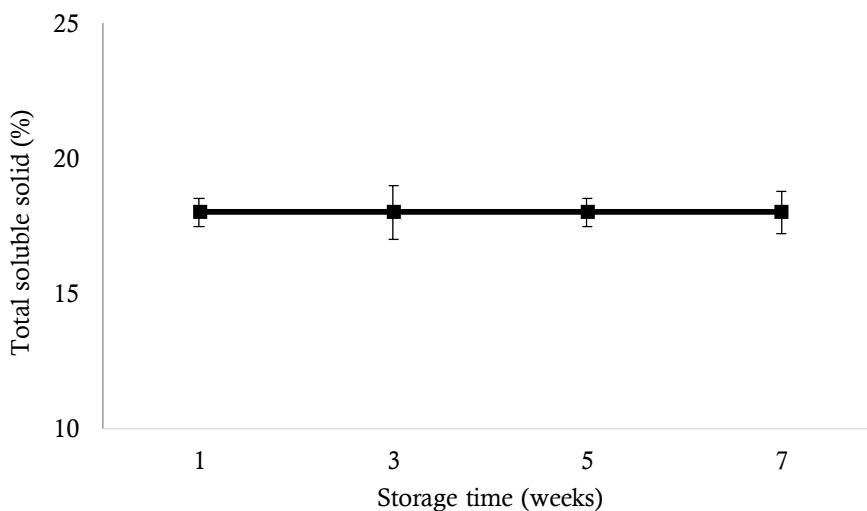
Constituent	Percentage value
Moisture	52.2 ± 1.1
Crude fat	23.3 ± 0.5
Ash	8.3 ± 0.4
Crude protein	5.7 ± 0.2
Crude fiber	2.1 ± 0.3

Values are mean ± standard deviation of three determinations

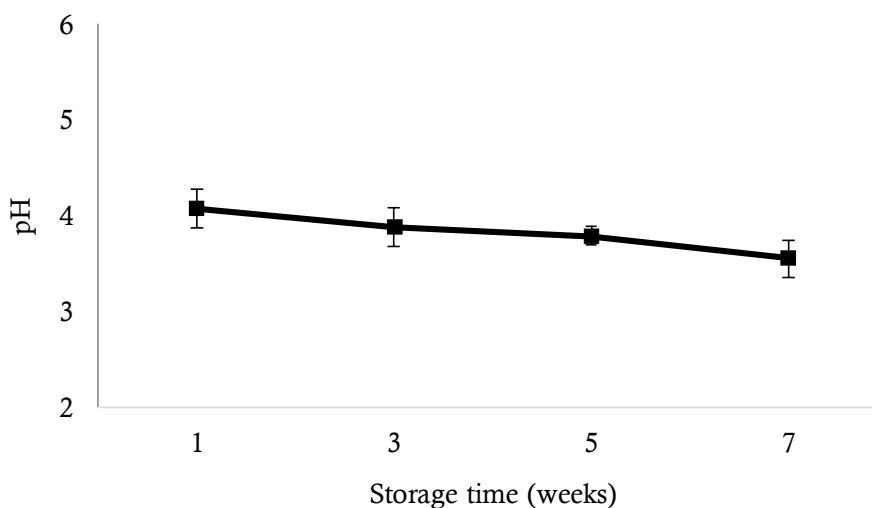
### Physicochemical properties of the vegetable oil incorporated salad dressing

As shown in the Figure 2, % TSS of the product remained same during the storage period. However, slight reduction of the pH (Figure 3) and increment of titratable acidity (Figure 4) were observed with the storage. Hence, the product became

sour in taste towards the 7<sup>th</sup> week of the storage period. These deviations typically occurred with non-commercially prepared products that lack of the proper control of pH (Food and Drug Administration, 2016).



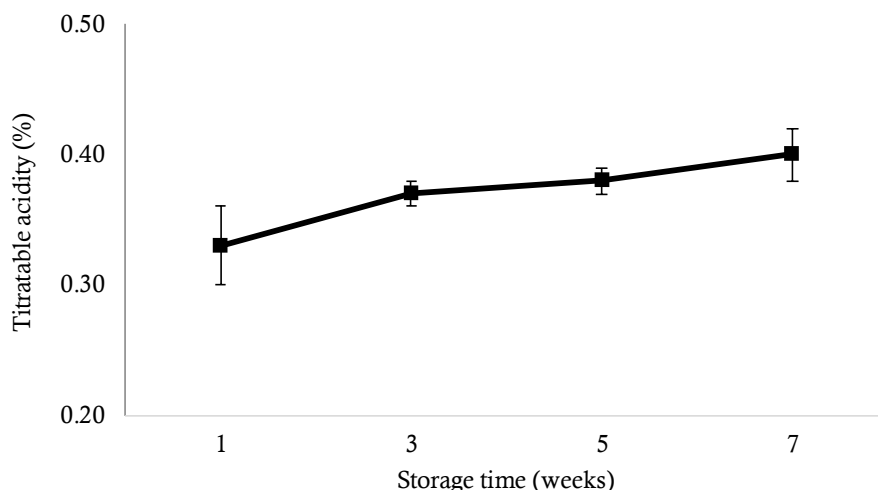
**Figure 2:** Change in total soluble solid content of vegetable oil incorporated salad dressing during storage period. Values are mean  $\pm$  standard deviation of three determinations.



**Figure 3:** Change in pH value of vegetable oil incorporated salad dressing during storage period. Values are mean  $\pm$  standard deviation of three determinations.

### Microbial properties of the vegetable oil incorporated salad dressing

Mean total plate counts of the final product in the 1<sup>st</sup>, 3<sup>rd</sup> and 5<sup>th</sup> week were  $7 \times 10^3$ ,  $30 \times 10^3$  and  $80 \times 10^3$ , respectively, and it was not detected any *E. coli* count in the final product during the study period.



**Figure 4:** Change in titratable acidity of vegetable oil incorporated salad dressing during storage period. Values are mean  $\pm$  standard deviation of three determinations.

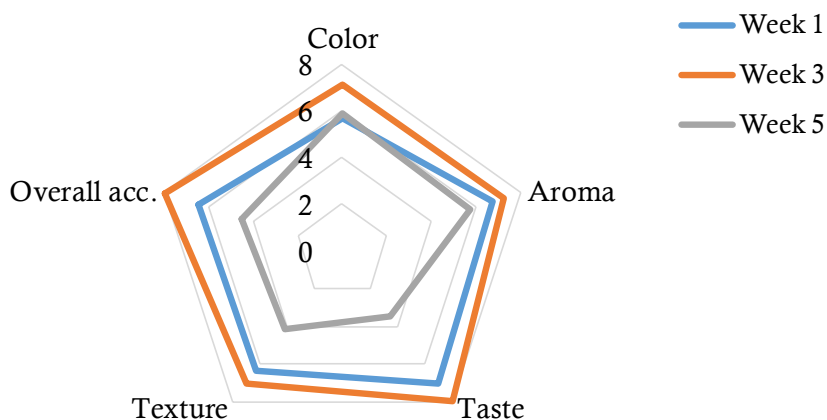
The form of water in oil emulsion in salad dressing, particularly the chemical composition of water phase, plays a key role in their microbial stability. The pH range of a salad dressing is 3.2 to 4.0 due to its acetic acid. Pourable dressings have a pH in the range of 3.5 to 3.9. Microbial stability is largely related to the maximum preservation effect of acetic acid at those pH levels. Further, according to the literature, salad dressings do not support the growth of *Clostridium botulinum* because of the low pH and  $a_w$  (Food and Drug Administration, 2016).

### Sensory attributes of the vegetable oil incorporated salad dressing

According to the Figure 5, the highest values for sensory attributes were observed at the 3<sup>rd</sup> week. However, colour and aroma of the vegetable salad dressing did not change significantly ( $P > 0.05$ ) during five weeks storage time. During five weeks, the product had almost same colour and aroma. Taste, texture and overall acceptability of the vegetable salad dressing changed significantly ( $P < 0.05$ ) during five weeks storage time. Possibly these changes occurred due to the variations of pH and acidity of the product.

### Peroxide value of the vegetable oil incorporated salad dressing

Peroxide value of the final product after five weeks of preparation was 24 mEq kg<sup>-1</sup>. According to the results, the vegetable salad dressing started to develop rancidity, after five weeks of production. Vegetable oils tend to be less stable and turn rancid more quickly than animal fats. They can also become several times more rancid than animal fats, even before the human sense of smell can detect it. Unsaturated fats are more susceptible to oxidation than saturated fats. This is given by the more unstable double bonds which allow more oxygen to react at those points. Oils do not suddenly go rancid; they tend to slowly become more oxidised over time.



**Figure 5:** Changes in the sensory attributes of the vegetable oil incorporated salad dressing during storage period.

### CONCLUSION

Salad dressing which is incorporated with vegetable oil is the best out of four salad dressing recipes. pH of this final product decreases with the time while acidity of the product increases. The final product has started rancid after five weeks of production. Consumer preference of the final product shows the highest value in the third week after the preparation. Shelf life of the developed salad dressing at room temperature is five weeks.

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