PJN
ISSN 1680-5194

# PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Pakistan Journal of Nutrition 14 (8): 498-502, 2015
ISSN 1680-5194


# Acceptability and Antioxidant Activity of Vegetable Leather of Soursop Leaves (*Annona muricata* L) and Seaweed (*Eucheuma cottoni*) with Addition of Strawberries (*Fragaria vescal*)

Rina Yenrina[1], Kesuma Sayuti[1], Reno Tisna Maharani[1] and Dini Rasjmida[2]
[1]Facultyof Agricultural Technology, Andalas University, Kampus Limau Manis-Padang-25163, Indonesia
[2]Department of Nutrition, Poltekkes KemenKes RI Padang, Indonesia

**Abstract:** This research was conducted at the Agricultural Biochemistry, Chemistry and Food Nutrition and Agricultural Process Engineering Laboratory, Faculty of Agricultural Technology, Andalas University, Padang. The purpose of this research was to know acceptability and antioxidant activity of vegetable leather. Completely Randomized Design (CRD) with 6 treatments and 3 replications was used to analyze the data. The treatments are strawberry addition of 0, 15, 20, 25, 30 and 35%. The result of this study: (a) Organoleptic: addition 30% strawberry is the most preferred formula with a percentage like and really like of its color is 40%, aroma 30%, taste 65% and texture 50%; (b) Chemical properties analysis: moisture content of 13.52 and 8.75% ash, antioxidant activity 40.04%, alkaloids (+), 1.317% crude fiber. Addition of strawberry in making vegetable leather of soursop leather and seaweed gives a significant effect on the moisture content, antioxidant activity and crude fiber content. Also, it is not significant for alkaloids content.

**Key words:** Acceptability, antioxidant activity, soursop leaves, seaweed, strawberry, vegetable leather

## INTRODUCTION

Vegetable leather is processed products in the form of a sheet where the raw materials are vegetables. Vegetable leather is the result of modification of fruit leather, the difference is just the raw material. According to Ernie and Lestari (1992), Reynold (1993) and Asben (2007) fruit leather shaped of thin sheets with a thickness of 2-3 mm with a water content of 10-15%, has a specific consistency and flavor according to the type of fruit used.

Vegetable leather can be used instantly and for many people it is has a taste that is more interesting than eating vegetables directly. Vegetable leather and fruit leather can be made from plant materials to be used as a source of nutrients and can be classified into functional food.

Indonesia is rich in horticultural commodities. Many of the potential horticultural is still not used optimally. One of them is soursop plant (*Annona muricata* L). According to Rieser *et al*. (1993), soursop leaves have a group of compounds known as *acetogenins*. *Annonaceous acetogenins* from *Annona muricata* L plants was found to be a new anti-tumor and anti-cancer agents as it has been found through many *in vitro* studies. *Acetogenins* have selective way against various types of cancer cells without damaging healthy cells.

Seaweed (Eucheuma *cotonii*) is one of the raw materials contains high levels of iodine and fiber. Seaweed is used in the making of vegetable leather as a texture forming.

Strawberry (*Fragaria vesca* L) owns a variety of vitamins and minerals. According to Astawan (2009), strawberries also have some phyto chemical compounds such as anthocyanins, ellagic acid, catechin, quercetin and kemferol. Judging from the chemical compounds contain in strawberry, it serves as an addition of antioxidants level to vegetable leather of soursop leaves and seaweed produced.

Based on the explanation above, this study focus to determine the best products of vegetable leather with main ingredient of soursop leaves and sea weed with the addition of strawberry.

## MATERIALS AND METHODS

**Materials and equipment:** The materials used for making vegetable leather in this study are the soursop leaves, dried seaweeds, strawberries, sugar, water, distilled water, HCl 6.67%, $H_2SO_4$1.25%, $Na_2S_2O_3$, NaOH 1.25%, alcohol, ethanol 99.8%, acetone, n-hexane, $Na_2SO_4$ Whatman filter paper, methanol, DPPH, potassium chloride (0.025 M) pH 1, sodium acetate (0.4 M) pH 4.5, chloroform, iodine bromide reagent, chloroform ammonia, and other chemicals used for the analysis.

The tools and equipment used are blender, hot plate, electric stove, analytical balance, blade, holder, dedicator, measuring cups, aluminum cup, oven, spectrophotometer, pH meter, furnace, pipette, porcelain cup and other tools used for analysis.

**Corresponding Author:** Rina Yenrina, Faculty of Agricultural Technology, Andalas University, Kampus Limau Manis-Padang-25163, Indonesia

**Research design:** Completely randomized design (CRD) was practiced with 6 treatments and 3 replications. The raw materials used are soursop leaf and seaweed with a ratio of 1: 2. The treatment is the difference percentage of strawberry addition to soursop leaves and seaweed:

1: Formula A: Addition of 15% strawberry
2: Formula B: Addition of 20% strawberry
3: Formula C: Addition of 25% strawberry
4: Formula D: Addition of 30% strawberry
5: Formula E: Addition of 35% strawberry
6: Formula F: Addition of 0% strawberry

**Implementation:** Formula of vegetable leather in this study is 50 g soursop leaves, 100 g seaweed, 15 g sugar, 100 ml water and strawberry addition depends on the treatments (0, 15, 20, 25, 30 and 35%) from amount of soursop leaf and seaweed.

**Preparation of materials:**

1: Prepared dried seaweed *Eucheuma cottonii* soaked in water for 2-3 days. Water then drained after the seaweed has been soaked for ±2-3 days
2: Prepared soursop leaves sorted and separated from the stems. Then soursop leaves washed and water drained
3: Prepared strawberry type *Fragaria vesca* L as the addition in making of vegetable leather
4: Prepared white sugar as a sweetener

**Making of vegetable leather:**

1: Raw materials weighed according to a predetermined formula
2: Soursop leaf blended with the addition of 100 ml of water for 1 min, then the juice squeezed right after blending
3: Seaweed, soursop leaves juice, strawberry and sugar put in a blender
4: Then they were mixed until very smooth. Once completed in the blender, then cooked to temperature of 50°C
5: Then the material was flattened onto a baking sheet with an area of 30 x 15 cm
6: After wrapping, trays placed into the digital oven for 15 h at temperature of 60°C

**Observation:** Analysis that have been done towards vegetable leather are as follows:

1: Organoleptic test (Setyaningsih, 2010): taste, aroma, color, texture
2: Analysis of chemical properties: water content by oven method (Sudarmadji *et al*., 1997), ash (Sudarmadji *et al*., 1997), antioxidant activity by DPPH method (Huang *et al*., 2005), crude fiber (SNI 01-2891-1992), alkaloids qualitatively (Harborne, 1987)

For analysis, crude fiber, alkaloids only for control formulations (treatment) and the best formulation (treatment) based on organoleptic test results.

## RESULTS AND DISCUSSION

**Organoleptic test:** Organoleptic test used as an acceptability parameter, the vegetable leather is serve to panelists after it fried for 1 min at temperature of 85°C. Presentation of panelists who expressed like and really like on color, aroma, taste and texture of vegetable leather of soursop leaves and seaweed is shown in Table 1.

**Color:** The highest percentage of panelists who expressed like and really like of the color is on the formula A and E (addition of 15 and 35% strawberry) with the percentage level of like and really like of 45% (Table 2) .

Vegetable leather of soursop leaf and seaweed produced have different colors according to the treatments. The vegetable leather of soursop leaf and seaweed based on formula F (without the addition of strawberry) have blackish brown color, while the formula A (addition of 15% strawberry) has a slightly reddish black color. The higher the addition of strawberry in vegetable leather of soursop leaf and seaweed the clearer the red color on the product.

Based on the results of the percentage of panelists preference color of vegetable leather of soursop leaf and seaweed, the addition of strawberry does not significantly affect the color of vegetable leather produced. This is because the soursop leaf extract has a brown color, so with the addition of strawberry does not give effect to the color preference of the vegetable leather produced.

**Aroma:** As seen from the Table 1, panelists who give like and really like for vegetable leather ranged from 15-45%. The most preferred product based on organoleptic test is formula A (addition of 15% strawberry) by 45% and the formula C (addition of 20% strawberry) that is equal to 40%. While the lowest for the aroma is formula E (addition of 35% strawberry).

From Table 1, It can be concluded that the addition of strawberry tend to lower the aroma preference value of vegetable leather of soursop leaf and seaweed. This is due to the addition of strawberry that gives a slightly sour aroma (typical strawberry) on vegetable leather produced. The higher the percentage of strawberry addition, sour taste (typical strawberry) is distinctly increased. In accordance with the opinion of

Table 1: Presentation of panelists who express like and really like on color, aroma, taste and texture of vegetable leather of soursop leaf and seaweed

| | Panelist (%) | | | |
|---|---|---|---|---|
| Strawberry addition | Color | Aroma | Taste | Texture |
| F = 0% | 40 | 30 | 30 | 40 |
| A = 15% | 45 | 45 | 10 | 45 |
| B = 20% | 40 | 35 | 50 | 60 |
| C = 25% | 40 | 40 | 45 | 45 |
| D = 30% | 40 | 30 | 65 | 50 |
| E = 35% | 45 | 15 | 35 | 55 |

Table 2: Moisture content in vegetable leather of soursop leaf and seaweed

| Strawberry addition | Moisture content (%) |
|---|---|
| F = 0% | 10.37±0.68[a] |
| C = 25% | 12.59±0.63[b] |
| B = 20% | 12.60±0.20[b] |
| A = 15% | 12.71±0.42[b] |
| D = 30% | 13.52±0.95[b] |
| E = 35% | 14.87±0.70[c] |
| CV = 4.85 | |

Description: Numbers in the same column followed by the same lowercase letter are not significantly different at 5% level according to DNMRT

Table 3: Antioxidant activity in vegetable leather of soursop leaf and seaweed

| Strawberry addition | Antioxidant activity (%) |
|---|---|
| F = 0% | 18.40±0.71[a] |
| A = 15% | 19.92±0.67[a] |
| B = 20% | 37.02±2.08[b] |
| C = 25% | 39.05±0.29[c] |
| D = 30% | 40.04±0.24[c] |
| E = 35% | 44.77±0.77[d] |
| CV = 2.92 | |

Description: Numbers in the same column followed by the same lower case letter are not significantly different at 5% level according to DNMRT

Table 4: Alkaloids test results on vegetable leather without addition of strawberry and with addition of 30% strawberry

| Strawberry addition | Alkaloids test |
|---|---|
| 0% | (+) |
| 30% | (+) |

Description: (+) Indicates that the sample solution contains alkaloids

Winarno (1997), each fruit has a distinctive aroma and additions to a particular material during food processing which may affect the taste and aroma.

**Taste:** From the organoleptic test results in Table 1, the percentage level of like and really like by panelists tends to increase with the increasing of strawberry addition unless the formula E (addition of 35% strawberry). The highest preference value of the taste is formula D (addition of 30% strawberry) at 65%, followed by formula B (addition of 20% strawberry) by 50%. While the lowest value is formula A (addition of 15% strawberry) by 10%. The addition of strawberry as much as 30% is the optimum limit of the number of panelists acceptance of the taste of vegetable leather soursop leaf and seaweed. This is because the sour taste in strawberry noticeably perceived, thereby reducing the taste acceptance of the formula E (addition of 35% strawberry).

**Texture:** Based on the results in Table 1 the highest percentage of panelists who expressed like and really like of the texture is on formula B (addition of 20% strawberry) by 60%. Followed by formula E (addition of 35% strawberry) by 55%, formula D (addition of 30% strawberry) by 50%, formula C (addition of 25% strawberry) and formula A (addition of 15% strawberry) by 45% and the last place is formula F (without the addition of strawberry) by 40%. The results of organoleptic test of the texture preference ranged from 40-60%. The lack of variety is due to vegetable leather sample need to be tested by organoleptic which is done by pan frying first.

The Table 1 further viewed by the organoleptic test radar chart as below.

From Table 1 and Fig. 1 it can be seen that the addition of 30% strawberry (treatment D) provide the highest percentage of acceptance.

## Analysis of chemical properties

**Analysis of moisture content:** Analysis of the moisture content in vegetable leather of soursop leaf and seaweed resulting an average moisture content of 10.37-14.87%. The value of moisture content in vegetable leather of soursop leaf and seaweed can be seen in Table 2.

The results of analysis of variance shows the moisture content in vegetable leather of soursop leaf and seaweed with addition of strawberry significantly different at significance level $\alpha$ = 5%. The highest average value of moisture content found in formula E (addition of 35% strawberry) by 14.87% and the lowest average moisture content found in formula F (without the addition of strawberry) by 10.37% (Table 2).

The moisture content in the products that obtained is directly proportional to the amount of strawberry addition except for the formula A (addition of 15% strawberry). This is because strawberry has a high water content, where in 100 g strawberry contained 89.9 g water (Astawan, 2009).

Currently there is no quality standards from standards agency for vegetable leather or fruit leather. But when compared to the water content in fruit leather, moisture content in vegetable leather soursop leaf and seaweed meet the standard. Where, according to Ernie and Lestari (1992) and Reynolds (1993) in Asben (2007) fruit leather has 10-15% moisture content.

**Analysis of antioxidant activity by DPPH:** Analysis of the antioxidant activity in vegetable leather of soursop leaf and seaweed resulting an average antioxidant activity ranged from 18.40-44.77% at a concentration of 2.500 ppm. Based on the analysis of variance, the difference of strawberry addition in the making of vegetable leather of soursop leaf and seaweed has significant effect on antioxidant activity at significance level $\alpha$ = 5%. Average antioxidant activity value of vegetable leather of soursop leaf and seaweed can be seen in Table 3 as follows.

From the results above, the antioxidant activity in vegetable leather of soursop leaf and seaweed has the highest DPPH in formula E (addition of 35% strawberry) that is equal to 44.77%, while the lowest antioxidant activity present in formula F (without the addition of strawberry) at 18, 40%. From the results of variance above, it can be concluded that the more the addition of strawberry, the higher the antioxidant activity of vegetable leather of soursop leaf and seaweed. When compared with formula F (without the addition of strawberry), antioxidants are still low compared to other formulas given the addition of strawberry in increments. This is because strawberry contains several phytochemicals compounds such as anthocyanins, ellagicacid, catechin, quercetin and kaempferol (Astawan *et al*., 2004).

According to Kardinan (2002), soursop leaves contain active ingredients annonain, saponins, flavonoids, tannins. According to Geum-Soog *et al*. (1998), it is known that soursop contains of a compound named *annonaceous acetogenins*. *Annonaceous acetogenins* area relatively new class of natural products which is a series of fatty acid derivative C-35/37 and is only found in the *Annonaceae* plant.

Free radical is a molecule, atom or group of atoms that has one or more unpaired electrons in their outer orbitals. The molecules or atoms are very labile and easily form new compounds (Muchtadi, 2012). Testing the antioxidant activity using DPPH method, where DPPH was used as a free radical. The more purple color sample dilution, the lower the antioxidant activity, the more yellow color of the sample, the higher the antioxidant activity.

**Alkaloids:** Alkaloids test using qualitative methods on vegetable leather has only been tested on formula F (without the addition of strawberry) and formula D (addition of 30% strawberry) which is the best formula based on organoleptic test. Alkaloid test results can be seen in Table 4.

Alsuhendra and Ridawati (2013), alkaloids are a class of compounds containing nitrogen bases and present in many plants that are toxic in high concentrations, but requires a stimulating effect at low concentrations. Table 4 shows that the addition of strawberry in each treatment did not affect the content of alkaloids contained in vegetable leather of soursop leaf and seaweed.

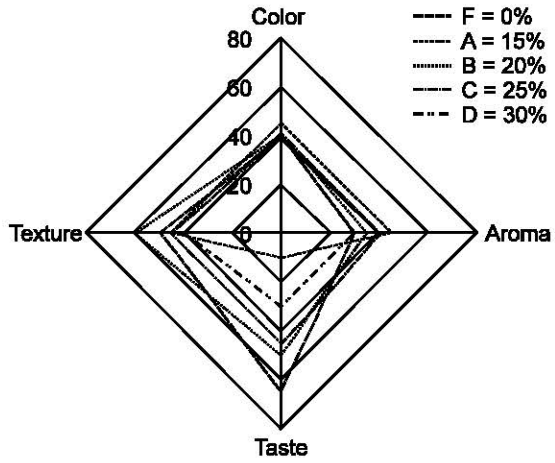


Fig. 1: Organoleptic test radar of vegetable leather of soursop leaf and seaweed

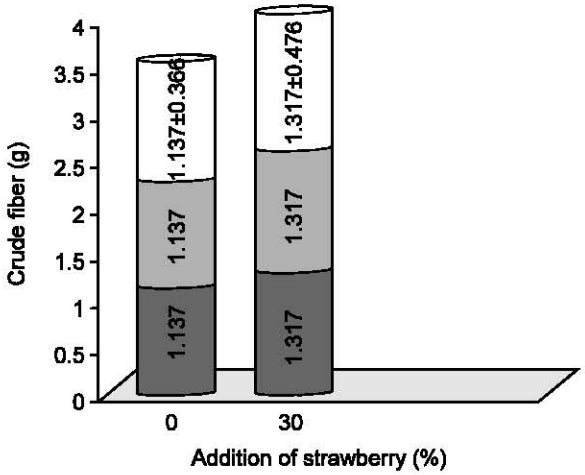


Fig. 2: Comparison of crude fiber analysis result in vegetable leather without addition of strawberry and with addition of 30% strawberry

According to Suhartatik (1989) alkaloids that contained in soursop is *alkaloids hidrokotilina*. It can be concluded that the content of alkaloids in soursop can not be lost by doing processing in making vegetable leather soursop leaf and seaweed.

**Crude fiber:** Analysis of crude fiber in vegetable leather of soursop leaf and seaweed only tested on formula D (addition of 30% strawberry) and F (without the addition of strawberry). The comparison of crude fiber analysis results can be seen in Fig. 2.

Figure 2 shows that the addition of strawberry on vegetable leather increases the crude fiber content of the product. Where the formula D (addition of 30% strawberry) has 1.317 g of crude fiber that is higher than formula F (addition of 0% strawberry) which is has 1.137

g fiber content. In 100 g strawberries contained 0.5 g of fiber (Dep Kes, 1989; Alfia, 2010). This is resulting an increase include fiber content as the high addition of strawberry.

**Conclusions:**

1: Addition of strawberry gives significant effect on moisture content, antioxidant activity and crude fiber content of vegetable leather of soursop leaf and seaweed generated. Also, no significant effect on alkaloid
2: Addition of strawberry gives effect to the levels of antioxidants. Where a product without the addition of strawberry has the lowest antioxidant activity of 18.40%, while the highest addition of strawberry have the highest antioxidant activity which is 44.77%
3: Addition of strawberry affect the organoleptic test on vegetable leather of soursop leaf and seaweed, with the most preferred product is formula D (addition of 30% strawberry)

**Suggestions:**

1: Proposed for the next study to conduct an iodine value test and analysis of the vegetable leather
2: Expected to analyze the bioavailability of nutritions contain in vegetable leather
3: Recommended for subsequent researchers to analyze the shelf life of the vegetable leather of soursop leaf and seaweed products

## REFERENCES


Alfia, R.F., 2010. Efek Pemberian Yoghurt dan Sari Stroberi (*Fragaria chiloensis* L.) Terhadap Kadar Kolesterol Serum Darah Tikus Putih (*Rattus norvegicus*) Hiperkolesterolemi. Padang. Skripsi. Program Studi Ilmu Biomedik: Universitas Andalas. Padang.

Alsuhendra dan Ridawati and Bahan Toksik Dalam Makanan, 2013. Remaja Rosdakarya. Bandung.

Asben, A., 2007. Peningkatan Kadar Iodium dan Serat Pangan Dalam Pembuatan Fruit Leathers Nenas (*Ananas comosus merr*) Dengan Penambahan Rumput Laut (*Ringkasan laporan penelitian dosen muda*) Fakultas Pertanian Universitas Andalas: Padang.

Astawan, M., 2009. Ensiklopedia Gizi Pangan Untuk Keluarga: Jakarta.

Astawan, M., S. Koswara and dan F. Herdiani, 2004. Pemanfaatan Rumput Laut (*Eucheuma cotonii*) untuk Meningkatkan Kadar Iodium dan Serat Pangan Selai dan Dodol. J. Teknologi dan Industri Pangan, XV: 61-69.

Dep Kes, R.I., 1989. Daftar Komposisi Bahan Makanan Indonesia. Jakarta.

Ernie, A.B. and dan N. Lestari, 1992. Pengembangan Produk Buah-buahan menjadi Produk Olahan fruit Leather: BBIHP. Bogor.

Geum-Soog, K., L. Zeng, F. Alali, L.L. Rogers, F.E. Wu, J.L. McLaughlin and S. Sastrodihardjo, 1998. Two New Mono-Tetrahydrofuran Ring Acetogenins, Annomuricin E and Muricapentocin, from the Leaves of Annona muricata. J. Nat. Prod., 61: 432-436.

Harborne, J.B., 1987. Metode Fitokimia Edisi Kedua. ITB: Bandung.

Huang, Yu-Ching, Chang, Yung-Ho, dan Shao and Yi-Yuan, 2005. Effects of Genotype and Treatment on the Antioxidant Activity of Sweet Potato in Taiwan. Food Chem., 98: 529-538.

Kardinan, A., 2002. Pestisida Nabati. Ramuan dan Aplikasi. Penebar Swadaya, Jakarta.

Muchtadi, D., 2012. Pangan Fungsional dan Senyawa Bioaktif. Alfabeta. Bandung.

Reynold, S., 1993. Drying Fruit Leathers. So Easy to Preserve. Bul. 989. University of Georgia.

Rieser, M.J., X.P. Fang and K. Rupprecht, 1993. Bioactive single-ring acetogenins from seed extracts of *Annona muricata*. Planta Med., 59: 91-92.

Setyaningsih, D., A. Apriyantono and M.P. Sari, 2010. Analisis Sensori Untuk Industri Pangan Dan Agro. IPB Press. Bogor.

SNI, 01-2891-1992. Cara Uji Makanan dan Minuman. Badan Standarisasi Nasional. Jakarta.

Sudarmadji, S., B. Haryono and Suhardi, 1997. Prosedur Analisa Untuk Bahan Makanan dan Pertanian. Penerbit Liberty.Yogyakarta.

Suhartatik, S.E., 1989. Pengaruh Infusa Daun Pegagan (Centella asiatica L.) Urban. terhadap Daya Larut Batu Ginjal Kalsium, Skripsi, Fakultas Farmasi, UGM. Jogyakarta.

Winarno, F.G., 1997. Kimia Pangan dan Gizi. PT Gramedia Pustaka Utama. Jakarta.