International Scholars Journals

African Journal of Crop Science ISSN: 2375-1231 Vol. 3 (3), pp. 123-137, May, 2015. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Studies on some nutritional characteristics of the fruit and leaf of *Saba florida* (Benth.) from Ibaji forest

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Accepted 14 November, 2014

Natural sources of nutrients for both humans and animals have become of immense biomedical significance. In this study, some nutrient composition of the fruit and leaf of *Saba florida* (Benth.) from Ibaji forest were evaluated using HPLC. The results showed that the plant parts studied contained significant level of vitamins A and E. Lipids of physiologic and nutritional importance such as lauric, myristic, oleic, linoleic and stearic acids were detected in some parts of the plant. Oleic acid was highest in the fruit pericarp (12.387%).The study also showed that the fruit pulp contain high amount (285.521%) of cholesterol than other parts investigated. The results suggest that *S. florida* (Benth.) is rich in essential fatty acids, vitamins A and E. We therefore conclude that judicious consumption of the fruit and leaf of *S. florida* could play both physiologic and nutritional roles in human and animal body.

Key words: *Saba florida*, lipids, vitamins, Ibaji.

INTRODUCTION

Saba florida (Benth.) belongs to the family Apocynaceae. It grows on other trees in the riparian equatorial rain forest of Africa. This strong forest liana grows up to 20 m long on other trees. The stem is lenticillate and exudes white sticky latex when cut. The ovate leaves are 7 - 16 x 4 - 8.5 cm. The fragrant flowers are borne on many short-stalked terminal or axillary corymbs. The corolla is tubular with a yellow throat and white petals. The fruit is sub-globose 4 - 8 cm long and 3.5 - 6 cm wide, greenish when young, turning orange-yellow when ripe. The yellow flesh contains numerous brown-black seeds which are about 15 - 18 in number depending on the size of the fruit (FAO, 1983). The plant is very abundant in undisturbed forest, coastal areas and around Great Lake regions of Africa from Sea level to 1250 m (Maundu et al., 1999) but rare in open areas. A vine will not flower every year and flowering time is not regular among populations. In Tanzania, flowers occur between February and November with fruits maturing ten months later from December to May and seeds are dispersed by birds and monkeys. The liana regenerates naturally by seeds on fertile moist soil under partial and full shades. It can be propagated by cuttings and the vine can be copied. The seed germinates in about 12 days with a high germination rate in excess of 90% (FAO, 1983).

The plant is found in Ibaji and other parts of Kogi State, Nigeria. The fruit pulp is edible and it makes a refreshing sour drink .The fruit does not abscise and must be harvested when it turns yellow. The stem yields latex that is an inferior rubber. Traditionally, bark decoctions are used to treat rheumatism. The leaves are used in Senegal to prepare sauces and condiments as salty appetizer. In Cote d'Ivoire, the latex is used as an adhesive for poison preparation for arrows as it hardens upon exposure. The inferior rubber produced from the latex is sometimes used to adulterate genuine rubber (FAO, 1983).

In Kogi State the latex is used as trap for birds, rats and smaller rodents. The leaves are eaten as antidote against vomiting and the bark decoction are administered for diarrhea and food poison. The leaves are also used in the treatment of skin ulcer. The fruit is a special delicacy for the Monkeys in the forest and humans are beginning to compete with the Monkeys for the fruits. It appears in the local markets during fruiting season. To the best our knowledge, information is scanty regarding the nutritional profile of this plant.

The aim of this investigation therefore was to evaluate some nutritional composition of the fruit and leaf of *S.*

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Table 1. Fatty acid composition of *Saba florida.*

Plant parts	Fatty acids (%)					
	Lauric	Myristic	Palmitic	Stearic	Oleic	Linoleic
Fruit pulp	0.534	1.266	-	-	-	-
Fruit pericarp	-	-	-	0.155	12.387	-
Leaf	-	2.087	-	-	-	0.189

Fatty acid profiles of *Saba florida* determined using HPLC.

Table 2. Vitamin A and E composition of *S. florida.*

Plant parts	Vitamin A (mg/g)	Vitamin E
Fruit pulp	19.268	0.338
Fruit pericarp	13.376	10.428
Leaf	19.182	2.799

Composition of Vitamin A and E in *Saba florida* as analyzed by HPLC.

florida commonly used as food and medicine in our local community.

MATERIALS AND METHODS

Collection and preparation of plant sample

The plant samples were collected from Igboigbo Unale in Ibaji Local Government Area, eastern part of Kogi State, Nigeria during the rainy season. Dirt was removed from the plant parts by rinsing in clean water. The leaves were air- dried for three weeks and pulverized using motorized blender. The fruit pulp and pericarp were dried in oven at 40°C .The dried materials were then pulverized into powder for HPLC analysis.

Plant identification

The plant was identified in the Botany unit of the department of Biological Sciences, Kogi State University, Nigeria as *S. florida* (Benth.) and a sample was deposited in the herbarium.

HPLC analysis of the plant sample

The method described by Nikolova-Damyarova (1997) was used in the determination of lipids, vitamins A and E. The dried plant portion (1 g) was weighed (metler digital balance - England) out into a conical flask and 10 ml of N-Hexane was added. This was shaken vigorously and allowed to stand for two days for complete extraction. A portion (1ml) of the extract was treated differently and 20 µl of the sample was injected into the HPLC column packed with 4 µm Necleosil-100 C- 18. The HPLC analysis was performed on AKTA HPLC machine (Europe) ODS 2 C-18 column by linear gradient elution. The mobile phase comprised acetonitrile: Acetone (51:49), Acetonitrile: Propanol (3:1), Methanol: H_20 (95:5) for fatty acids, cholesterol and vitamins A and E respectively. The detection wavelength for the lipids was at 215 nm while that of the vitamins A and E was at 290 nm at a flow rate of 1.5 ml/min and 1.0 ml/min respectively. The HPLC grade chemicals used were purchased from BDH (Poole, UK).

Calculations

The nutrient compositions of *S. florida* were calculated thus:

$x/y \times C \times df$ (Nikolova-Damyarova, 1997)

Where x = Peak area of sample
y = Peak area of standard
C = Concentration of standard
df = Dilution factor = 10

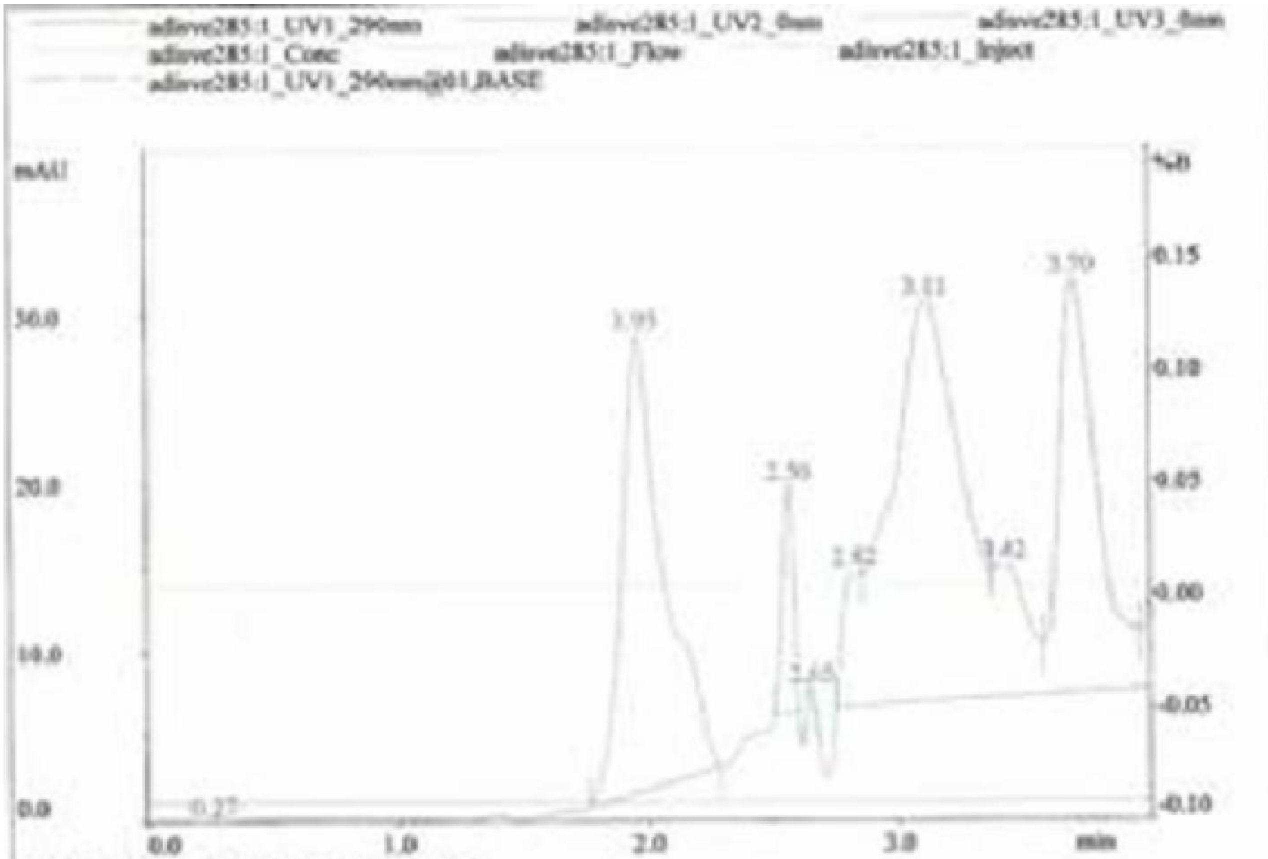
RESULTS

Fatty acid profiles

As presented on Table 1 and Figures 6 - 9, the plant contains many important fatty acids such as lauric, myristic, stearic, oleic and linoleic acids in both the fruit and leaf. From the results, the fruit pulp contains lauric acid (0.534%) and myristic acid (1.266%). The fruit pericarp contains stearic acid (0.155%) and high amount of oleic acid (12.387%) being the highest level of fatty acid detected. On the other hand, the leaf contains a higher level of myristic acid (2.087%) than the fruit pulp and 0.189% of linoleic acid.

Vitamins

Two very important fat soluble vitamins were detected. Vitamin A was dominant in all the plant parts with the highest level in the fruit pulp (19.268 mg/g). Vitamin E was higher (10.428 mg/g) in the fruit pericarp than the other plant parts analyzed (Table 2 and Figures 1 - 5).

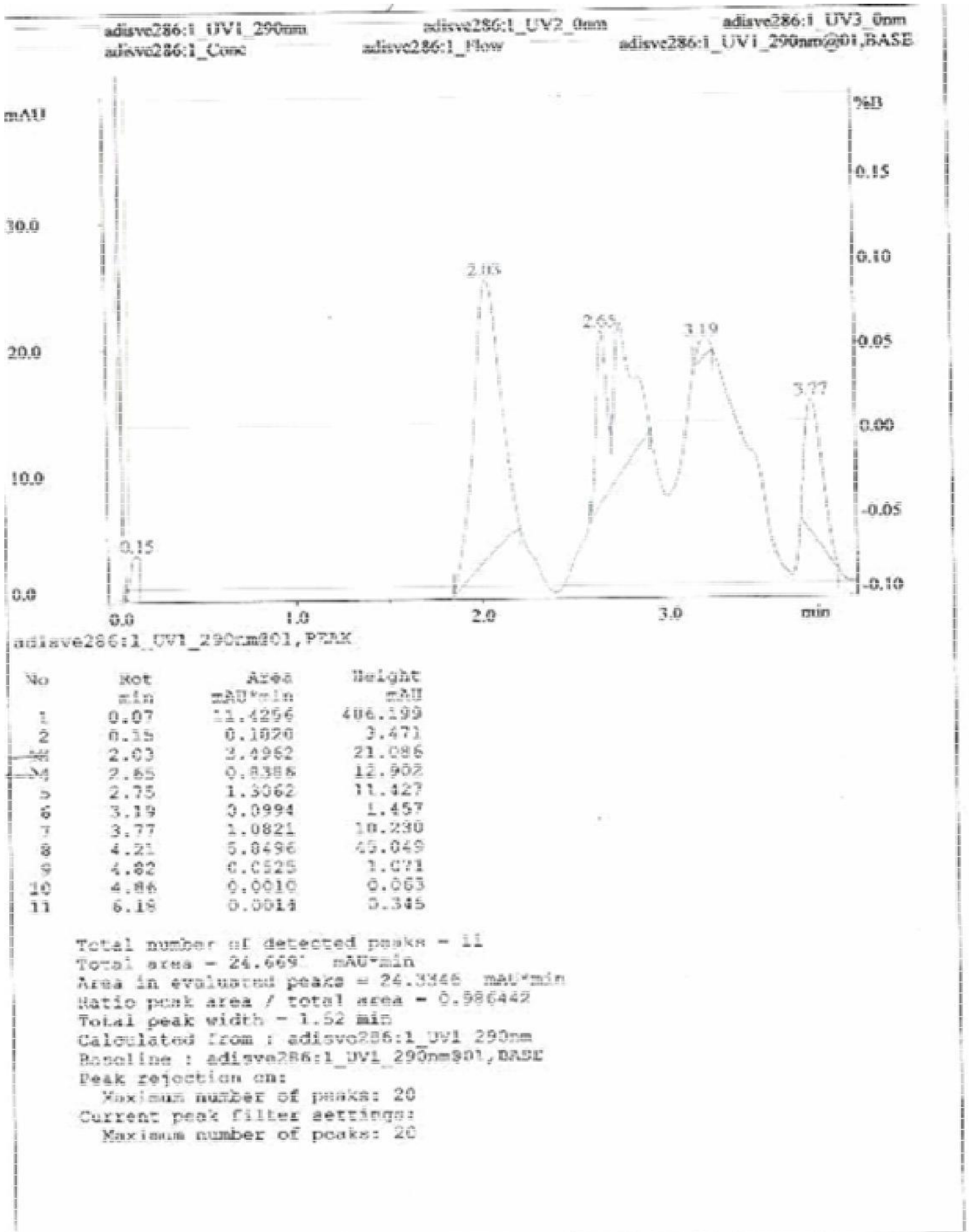


adiave285:1_UV1_290nm@01,PEAK

No	Ret min	Area mAU*min	Height mAU
1	-0.02	8.4500	405.083
2	0.27	0.0009	0.168
3	1.95	5.0364	26.078
4	2.56	0.4598	22.897
5	2.65	0.0272	1.210
6	2.82	0.4113	7.701
7	3.11	7.3126	22.782
8	3.42	1.2033	7.484
9	3.70	4.1444	23.477
10	4.13	51.3147	348.682
11	4.44	5.7354	6.495
12	4.63	0.4788	5.175
13	4.78	1.8936	12.385
14	5.11	0.0021	0.117
15	5.98	0.2136	1.944
16	6.93	0.0305	0.833

Total number of detected peaks = 16
Total area = 82.5797 mAU*min
Area in evaluated peaks = 82.5795 mAU*min
Ratio peak area / total area = 0.999992
Total peak width = 3.28 min
Calculated from : adiave285:1_UV1_290nm
Baseline : adiave285:1_UV1_290nm#01,BASE
Peak rejection on:
Maximum number of peaks: 20
Current peak filter settings:
Maximum number of peaks: 20

Figure 1. HPLC finger print for vitamins A and E in fruit pulp extracts of *S. florida.*



No	Ret min	Area mAU*min	Height mAU
1	0.07	11.4256	406.199
2	0.15	0.1020	3.471
3	2.03	3.4962	21.086
4	2.65	0.8388	12.902
5	2.75	1.3062	11.427
6	3.19	3.0994	1.457
7	3.77	1.0821	10.230
8	4.21	5.0496	45.049
9	4.82	0.0525	1.071
10	4.86	0.0010	0.063
11	6.18	0.0014	0.345

Total number of detected peaks = 11
Total area = 24.669 mAU*min
Area in evaluated peaks = 24.3346 mAU*min
Ratio peak area / total area = 0.986442
Total peak width = 1.52 min
Calculated from : adisve286:1_UV1_290nm
Baseline : adisve286:1_UV1_290nm@01,BASE
Peak rejection on:
Maximum number of peaks: 20
Current peak filter settings:
Maximum number of peaks: 20

Figure 2. HPLC finger print for vitamins A and E in the fruit pericarp extracts of *S. florida.*

Cholesterol

The cholesterol level estimated is presented on Table 3 and Figures 10 - 13. The result showed that the fruit pulp contains more cholesterol (285.521%) than other parts followed by the fruit pericarp (87.424%).

DISCUSSION

The present investigation demonstrates that *S. florida* (Benth.) contains some nutrients of physiological importance such as Vitamins A, E and lipids. From the results obtained and presented on Table 2, the fruit pulp of this plant contains more Vitamin A when compared with the pericarp and leaf. This is the portion that is mostly consumed by man (FAO, 1983). Animals like monkey, however, consume both parts (FAO, 1983). The active form of vitamin A participates in three essential functions: visual perception, cellular differentiation and immune response (Wald, 1968). Vitamin A is essential to normal immune function and regulation (Ross, 1998). Barrier to

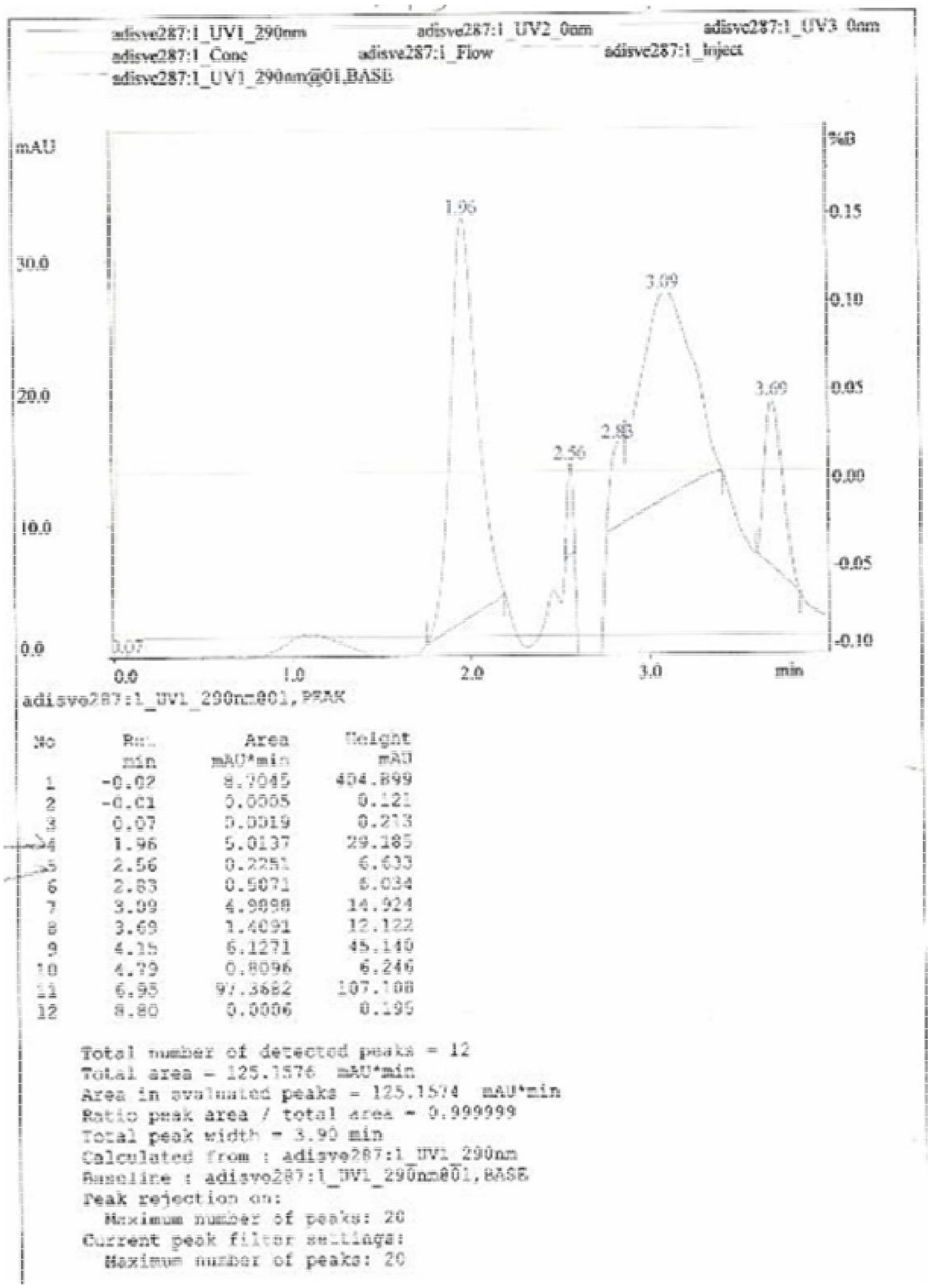
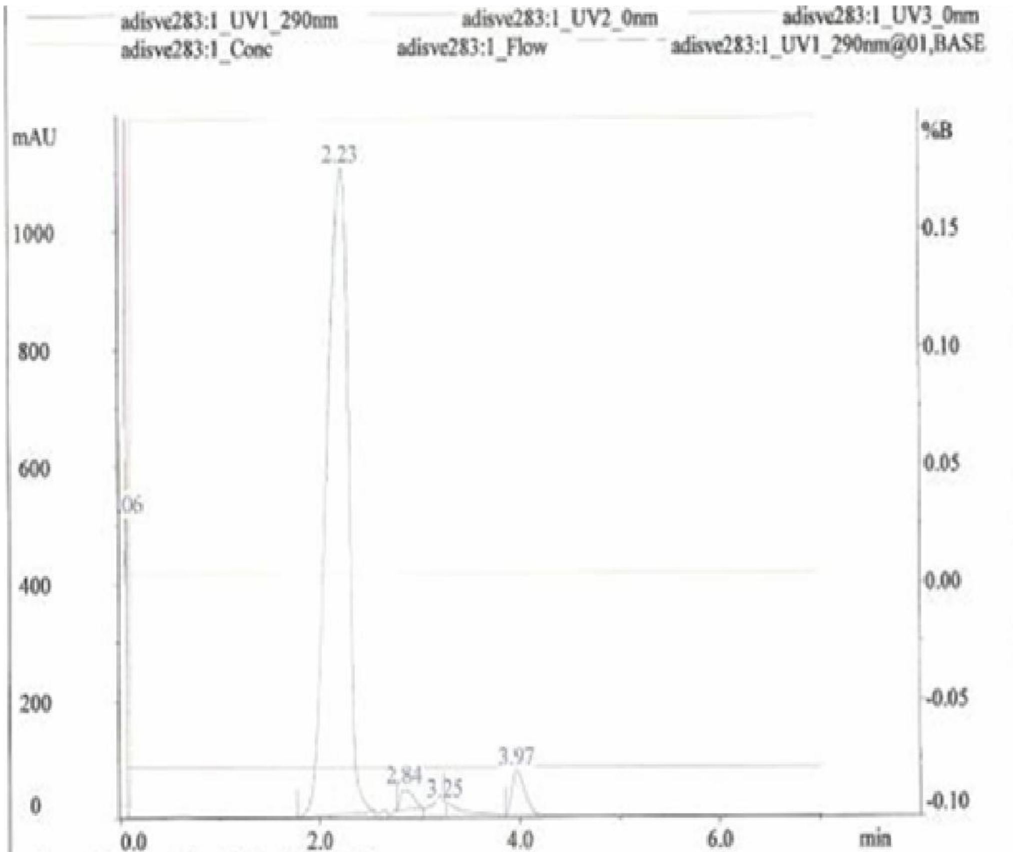


Figure 3. HPLC finger print for vitamins A and E in the leaf extracts of *Saba florida.*

Table 3. Cholesterol composition of *Saba florida.*

Plant parts	Cholesterol (%)
Fruit pulp	285.521
Fruit pericarp	87.424
Leaf	43.764

Cholesterol composition of *Saba florida* as evaluated using HPLC.



adisve283:1_UV1_290nm@01,PEAK

No	Ret min	Area mAU*min	Height mAU
1	0.06	12.2220	492.014
→2	2.23	261.3774	1058.693
3	2.84	4.8820	34.055
4	3.25	0.0012	0.094
5	3.97	10.6827	73.134

Total number of detected peaks = 5
Total area = 289.4876 mAU*min
Area in evaluated peaks - 289.1653 mAU*min
Ratio peak area / total area = 0.998887
Total peak width = 1.43 min
Calculated from : adisve283:1_UV1_290nm
Baseline : adisve283:1_UV1_290nm@01,BASE
Peak rejection on:
Maximum number of peaks: 20
Current peak filter settings:
Maximum number of peaks: 20

Figure 4. HPLC finger print for vitamins A standard.

Barrier to immune function in the form of mucosal mucin secretion is influenced by the vitamin A dependent expression of synthetic enzymes for glycosaminoglycans and epithelial glycoproteins. Both cellular and hormonal responses are depressed in vitamin A deficient animals and humans, and the rapid response to vitamin administration suggest that this is based on signaling or regulation (Ross, 1998). A recent and potentially important insight into Vitamin A's role in immune function is its support of immunoglobin A and T-helper cell 2 cytokine system in the small intestine (Semba, 1999).

The consumption of *S. florida* therefore could boost the

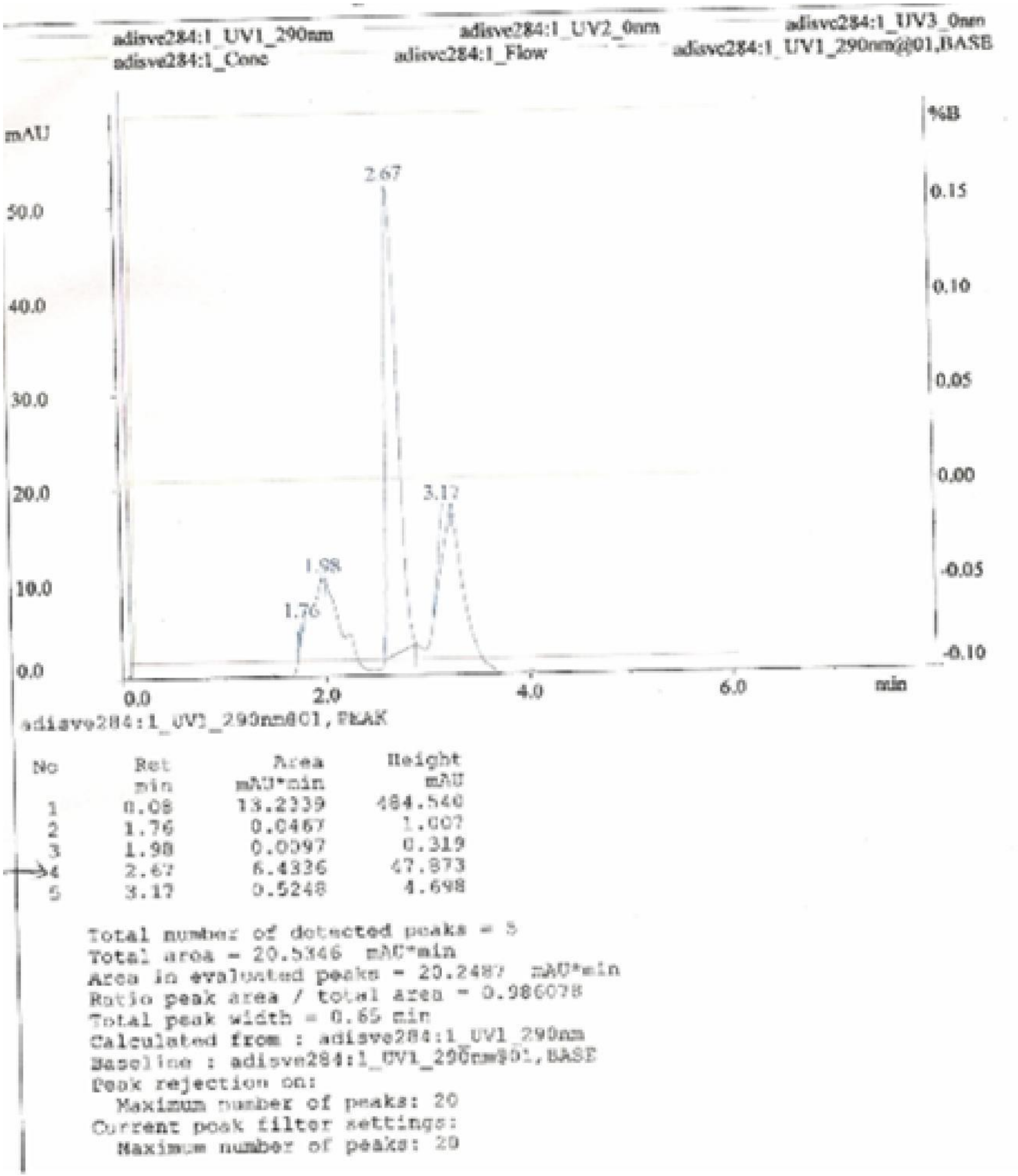


Figure 5. HPLC finger prints for vitamin E standard.

immune system of individuals and lead to effective body resistance to diseases such as malaria, kwashiorkor and measles. Studies on vitamin A-deficient rats and mice showed an increased susceptibility to malaria that was readily reversed by supplementation (Krishnan et al., 1976; Stoltzfus et al., 1989) . Vitamin A has a number of beneficial actions related to human nutrition and metabolism. It has been established from vitamin A supplementation in anemic population that the vitamin plays a role in hematopoiesis (Mejia et al., 1977; Bloem et al., 1990; Nikawa et al., 1999).

From this investigation, it could be inferred that the use of *S. florida* fruit juice as local refreshing drink in our local communities could be beneficent in improving vision and body immunity as this is rich in vitamin A. The result obtained could also prompt further investigation into the possibility of using the fruit pulp as a component of industrial snacks and biscuits as a source of vitamin A.

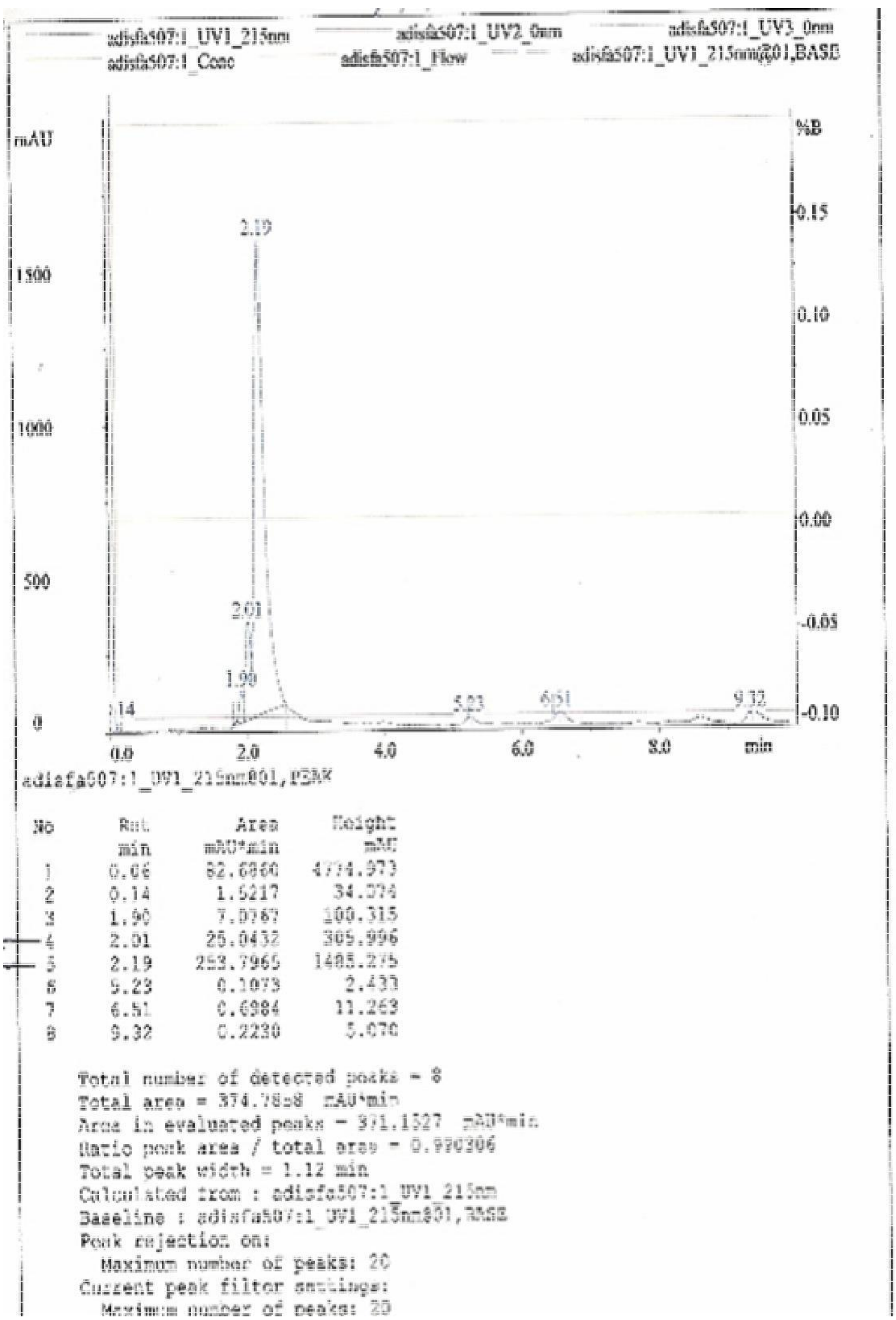


Figure 6. HPLC finger prints for fatty acids in the fruit pulp extracts of *Saba florida.*

Table 2 shows that the fruit pulp also contains some amount of vitamin E. The bulk of the vitamin was, however, found in the fruit pericarp. Vitamin E contents of foods vary widely depending on storage, processing and preparation procedures, and vitamin E activity varies for different isomers (National Research Council, 1989).

Vitamin E is the most important fat-soluble antioxidant present in humans, animals and plant tissues. Evidence indicates that natural source vitamin E has approximately twice the bioactivity in humans than all synthetic vitamin doses (Burton et al., 1998). *S. florida* therefore could be an important source of natural antioxidant as it contains

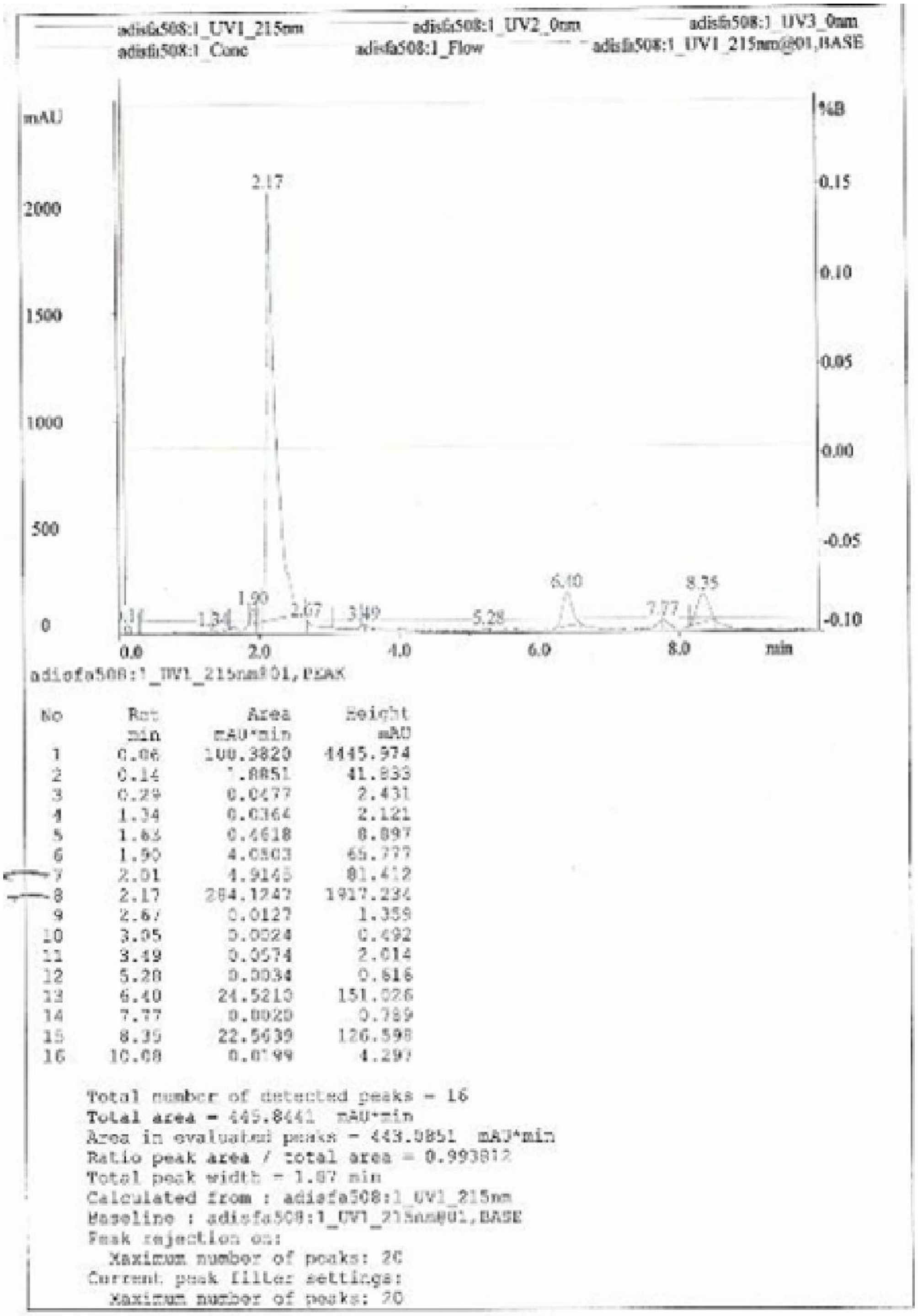
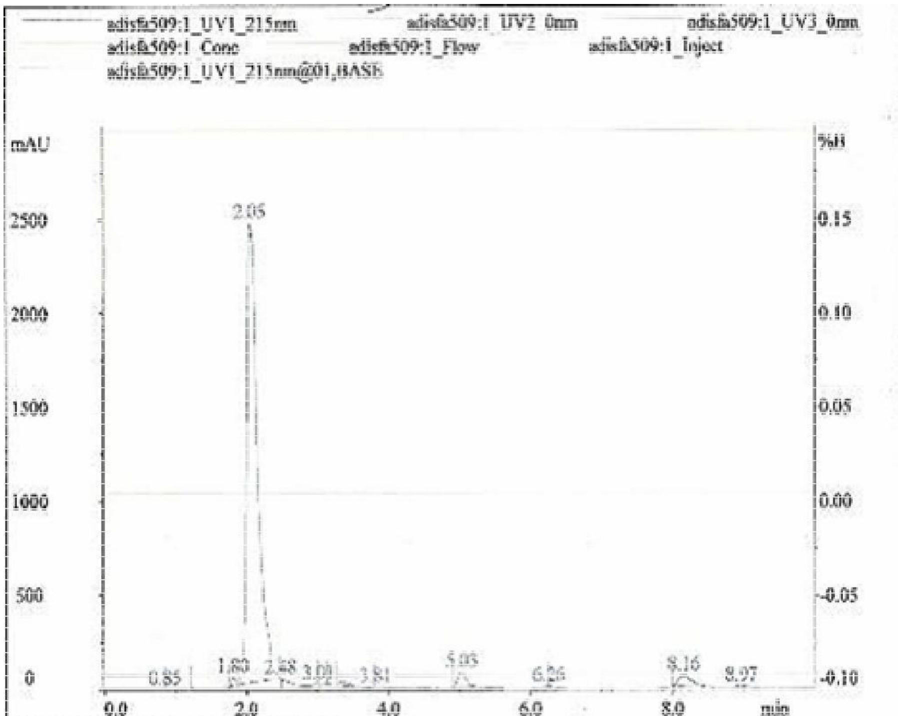


Figure 7. HPLC finger prints for fatty acids in the fruit pericarp extracts of *Saba florida.*

vitamin E. It could be a useful food supplement considering the level of vitamin E and could be useful in the management of oxidative stress and related diseases.

Animals on vitamin E-deficient diets and subjected to oxidative stress conditions such as high ozone levels (Pryor, 1991) are protected by supplemental vitamin E. In recent years, it has become clear that oxidative events play a crucial role in the pathogenesis and patho-physiology of several major cardiovascular diseases such as arthersclerosis, hypertension, heart failure, stroke, coronary heart diseases (CHD), myocardial infarction



adisfa509:1_UV1_215nm@01,PEAK

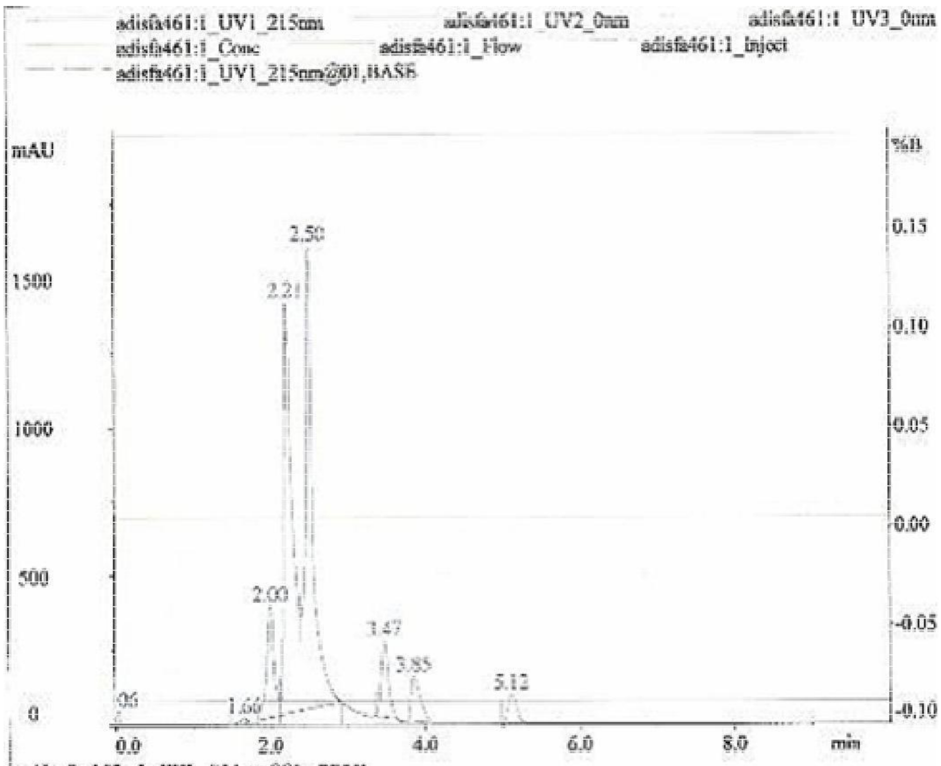
No	Ret min	Area mAU*min	Height mAU
1	-0.02	81.5289	3388.116
2	0.85	0.0169	1.674
3	1.23	0.0019	0.403
4	1.80	2.9521	42.323
5	2.05	418.3287	2345.956
6	2.48	0.0049	0.714
7	3.01	0.0029	0.418
8	3.16	0.1140	3.522
9	3.35	3.1060	22.640
10	3.81	0.0435	1.558
11	5.03	10.2950	78.006
12	6.26	0.0057	0.738
13	8.16	10.5518	56.823
14	8.97	0.0012	0.310

Total number of detected peaks = 14
Total area = 526.9613 mAU*min
Area in evaluated peaks = 526.9534 mAU*min
Ratio peak area / total area = 0.999985
Total peak width = 1.85 min
Calculated from : adisfa509:1_UV1_215nm
Baseline : adisfa509:1_UV1_215nm@01,BASE
Peak rejection on:
Maximum number of peaks: 20
Current peak filter settings:
Maximum number of peaks: 20

Figure 8. HPLC finger prints for fatty acids in the leaf extracts of *Saba florida.*

(MI) and diabetes (Young and Woodside, 2001; Heistad, 2006) and the plausibility of a role for vitamin E in preventing heart disease has been generally accepted (Steimbrecher et al.,1984; Cathcart et al.,1985; Sparrow et al.,1989). From the results presented on Table 2, it could be stated that *S. florida* might be a useful source of natural antioxidant that could be used in stemming the morbidity and mortality due to atherosclerosis and heart diseases as well as obesity that are associated with oxidative stress and depletion of antioxidant reserves like antioxidant reserves like vitamin E (Gaziano, 2005).

The finding that the plant is rich in cholesterol especially



adisfa461:1_UV1_215nm@01,PEAK

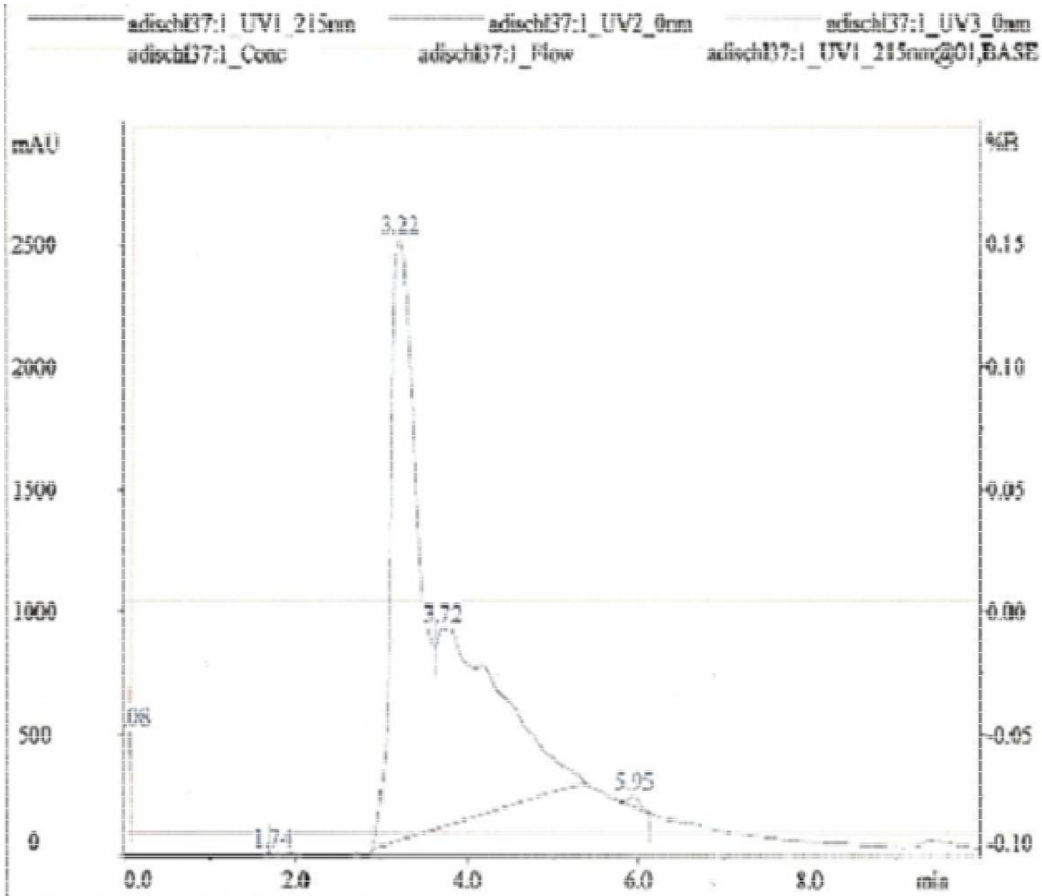
No	Ret min	Area mAU*min	Height mAU
1	-0.04	84.1039	3545.207
2	5.06	2.4315	43.511
3	1.66	2.1753	16.937
4	2.00	38.9256	357.706
5	2.21	166.3434	1329.700
6	2.50	163.5555	1492.784
7	3.47	26.3981	246.020
8	3.85	19.0378	142.760
9	5.12	13.6372	98.077

Total number of detected peaks = 9
Total area = 516.8404 mAU*min
Area in evaluated peaks = 516.6082 mAU*min
Ratio peak area / total area = 0.999551
Total peak width = 2.36 min
Calculated from : adisfa461:1_UV1_215nm
Baseline : adisfa461:1_UV1_215nm@01,BASE
Peak rejection on:
Maximum number of peaks: 20
Current peak filter settings:
Maximum number of peaks: 20

Figure 9. HPLC finger prints for fatty acids standards.

the fruit pulp indicates that care should be taken in its utilization as food. Although not essential in the diet due to its association with atherosclerosis (Williams and Tabas, 1995), it is needed as an integral component of membranes to increase their fluidity. Biochemically, cholesterol is converted to bile salts through hepatic hydroxylation and conjugation. Bile salts are required for normal digestion and absorption of dietary lipids (Field et al., 1985).

Additionally, cholesterol serves as a precursor to steroid hormones, including sex hormones and adrenocorticoid hormones. Cholesterol as 7-dehydrocho-lesterol, is the precursor of vitamin D formed at the skin surface through the action of ultraviolet irradiation (Field et al., 1985). Despite the fact that some benefits might be achieved through the consumption of this fruit, it should be noted that high consumption could pose serious health hazards owing to its high level of cholesterol.



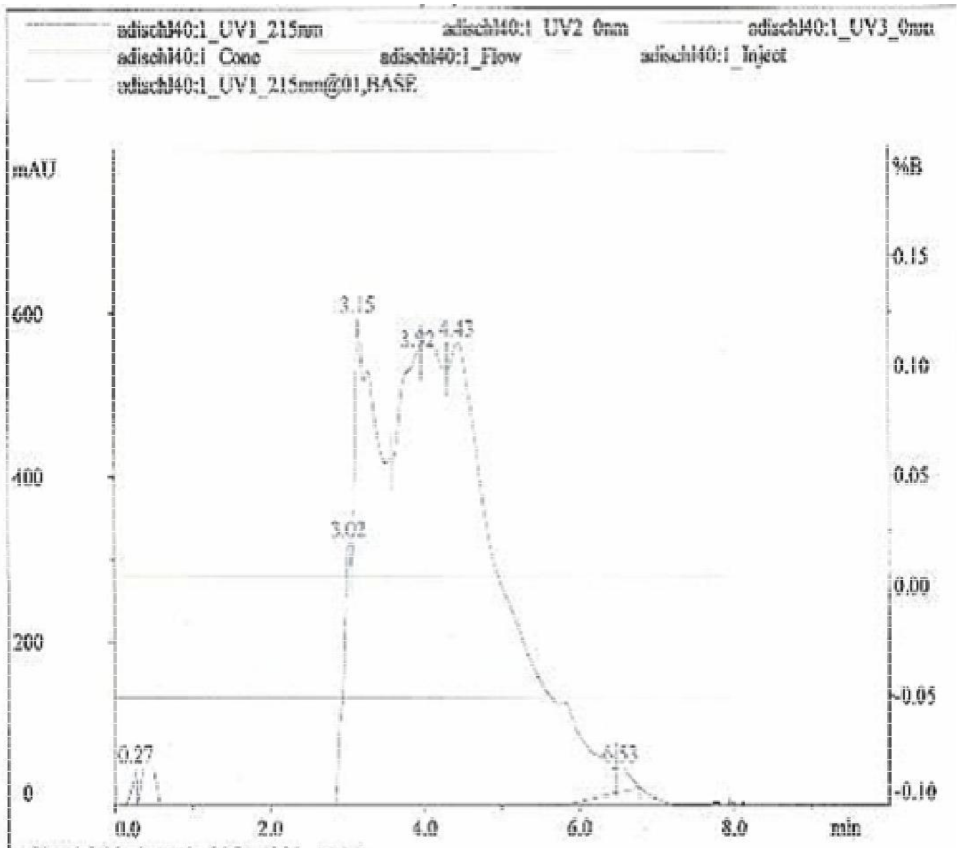
adischl37:1_UV1_215nm@01,PEAK

No	Ret min	Area mAU*min	Height mAU
1	0.08	11.5584	487.980
2	1.74	0.0825	1.264
3	3.22	863.3019	2357.360
4	3.72	690.6888	776.136
5	5.95	6.5517	41.066

Total number of detected peaks = 5
Total area = 1572.4607 mAU*min
Area in evaluated peaks = 1572.1632 mAU*min
Ratio peak area / total area = 0.999824
Total peak width = 3.01 min
Calculated from : adischl37:1_UV1_215nm
Baseline : adischl37:1_UV1_215nm@01,BASE
Peak rejection on:
Maximum number of peaks: 20
Current peak filter settings:
Maximum number of peaks: 20

Figure 10. HPLC finger prints for cholesterol in the fruit pulp extracts of *Saba florida.*

Lipid constituents ar e required for panoply of intracellular processes. Polyenoic fatty acids provides hydrophobic moiety of phospholipids which are critical for membrane structure and serves as precursor for eicosanoids, which regulate cellular activity (Wahle and Rotondo, 1999). Fatty acids also play a pivotal role in providing fuel for adenosine triphosphate (ATP) and reducing equivalents, and generating heat. Fat contains more than twice the energy per gram as does carbohydrates or protein, which explain why humans preferentially store fat as the primary energy



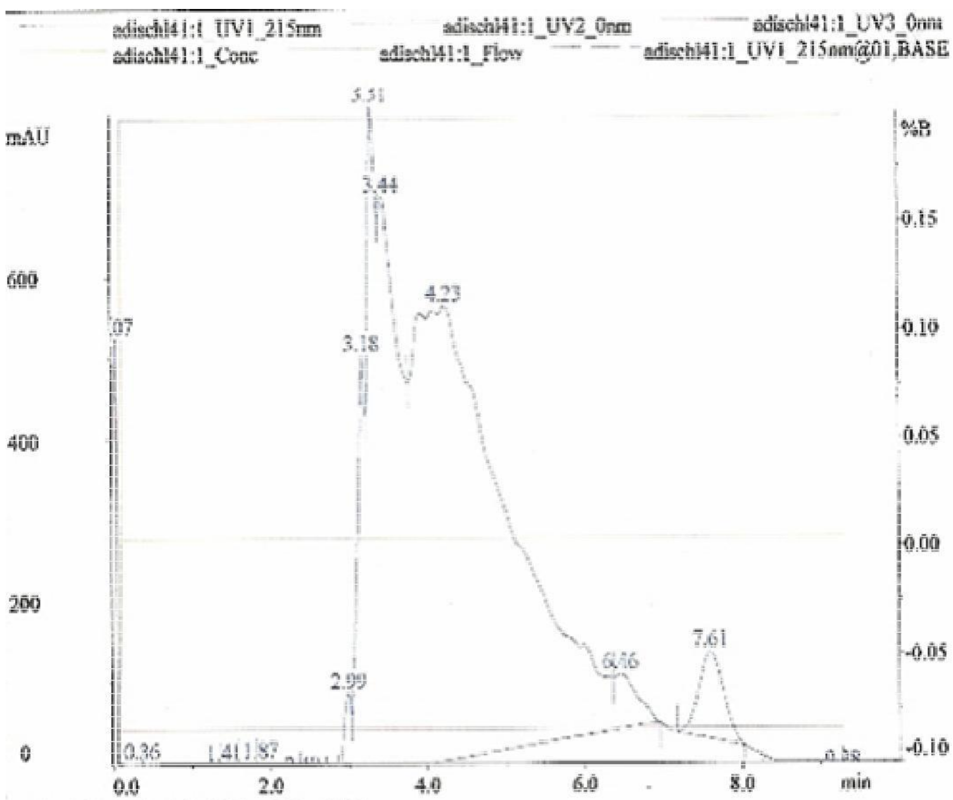
adischl40:1_UV1_215nm@01,PEAK

No	Ret min	Area mAU*min	Height mAU
1	-0.02	9.4918	393.308
2	-0.01	0.4468	11.818
3	0.27	7.0239	68.613
4	0.44	22.8700	93.587
5	2.61	0.0016	0.130
6	3.02	49.0265	366.496
7	3.15	264.3340	625.893
8	3.92	202.1466	569.268
9	4.07	190.6023	587.083
10	4.43	497.1755	570.457
11	6.53	5.5704	28.876
12	7.94	0.0000	0.018

Total number of detected peaks = 12
Total area = 1248.6935 mAU*min
Area in evaluated peaks = 1248.6895 mAU*min
Ratio peak area / total area = 0.999997
Total peak width = 4.87 min
Calculated from : adischl40:1_UV1_215nm
Baseline : adischl40:1_UV1_215nm@01,BASE
Peak rejection on:
Maximum number of peaks: 20
Current peak filter settings:
Maximum number of peaks: 20

Figure 11. HPLC finger prints for cholesterol in the fruit pericarps extracts of *S. florida.*

The finding that the plant contains some essential fatty acids including linoleic acid (LA) which is the parent fatty acid of the family of the n -6 PUFA family indicates that more of the n-6 PUFA may be present. Its utilization in diet



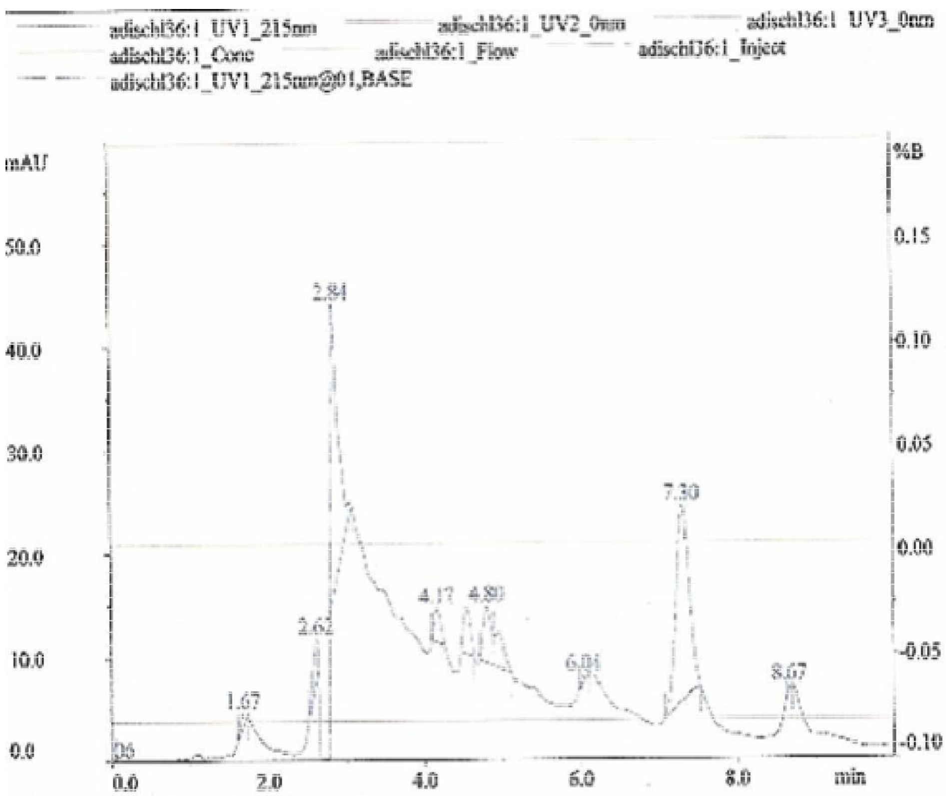
adischl41:1_UV1_215nm@01,PEAK

No	Ret min	Area mAU*min	Height mAU
1	0.07	10.1542	500.486
2	0.36	0.0031	0.241
3	1.41	0.1099	1.479
4	1.62	0.0008	0.054
5	1.87	0.0839	1.299
6	2.40	0.0743	1.883
7	2.77	0.1925	3.349
8	2.99	10.6089	100.888
9	3.18	60.6723	497.381
10	3.31	105.1132	791.522
11	3.44	213.8938	681.170
12	4.23	761.1168	538.561
13	6.46	21.2951	63.919
14	7.61	37.3263	102.265
15	9.28	0.0070	1.180

Total number of detected peaks = 15
Total area = 1221.1027 mAU*min
Area in evaluated peaks = 1220.7520 mAU*min
Ratio peak area / total area = 0.999713
Total peak width = 5.44 min
Calculated from : adischl41:1_UV1_215nm
Baseline : adischl41:1_UV1_215nm@01,BASE
Peak rejection on:
Maximum number of peaks: 20
Current peak filter settings:
Maximum number of peaks: 20

Figure 12. HPLC finger prints for cholesterol in the leaf extracts of *Saba florida.*

diet as food and medicine play a wide range of roles including improving heart disease related outcomes, decreasing tumor growth in cancer cases, metastasis and favorably modifying insulin sensitivity (Breanne and



adischl36:1_UV1_215nm@01,PEAK

No	Ret min	Area mAU*min	Height mAU
1	-0.02	8.8970	377.545
2	-0.01	0.0033	0.479
3	0.06	0.0013	0.135
4	0.07	0.0031	0.258
5	1.67	0.1069	1.312
6	2.62	0.2936	4.013
→7	2.84	3.0236	27.082
8	4.17	0.2971	3.127
9	4.54	0.4276	4.232
10	4.80	0.6386	5.183
11	4.96	0.4224	3.268
12	6.04	0.0495	0.565
13	7.30	3.5797	18.011
14	8.67	0.0261	0.498

Total number of detected peaks = 14
Total area = 17.7698 mAU*min
Area in evaluated peaks = 17.7698 mAU*min
Ratio peak area / total area = 0.999997
Total peak width = 2.07 min
Calculated from : adischl36:1_UV1_215nm
Baseline : adischl36:1_UV1_215nm@01,BASE
Peak rejection on:
Maximum number of peaks: 20
Current peak filter settings:
Maximum number of peaks: 20

Figure 13. HPLC finger prints for cholesterol standards.

David, 2009) . It could therefore be used as a source of energy. The fatty acid composition of a diet alters the composition of membrane phospholipids, which in turn changes membrane functions (Field et al., 1985). The plant contains unsaturated fatty acids of physiologic and nutritional significance such as oleic and linoleic acids which could be contributory to the nutritional needs of the consumers.

In conclusion, the results of this study suggest that *S. florida* contains important nutrients such as vitamin A and E, lipids of physiologic and nutritional significance. These plant parts evaluated could serve as food supplements. Further work is needed to assess other nutritional profiles as well as its bio-safety as it is widely consumed as food and medicine in our local communities.

ACKNOWLEDGEMENTS

The authors are grateful to Mr. Friday T. Emmanuel for his technical expertise in sample preparation as well as Mr. Adisa S. A. of the Central Science Laboratory, O.A.U, Ile-Ife for assistance on the HPLC analysis.

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