Estimation of Acid Value, % of FFA and Cholesterol Content in Groundnut Oil Collected From Local Rural Farmers in Sangli

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Abstract: In the present investigation, an attempt has been made to analyze acid value, total free fatty acid and cholesterol content on which quality of groundnut oil is dependent. Also, farmers in the rural area of Sangli are unaware of quality of oil and hence this investigation could be guideline for local farmers, to understand the quality of oil samples by comparing its acid value, % FFA & cholesterol content using Liebermann-Burchard reagent.

Index Terms: Acid Value, % FFA and Cholesterol Content

I. INTRODUCTION

Sangli district is the southernmost district of Maharashtra and is one of the industrially and agriculturally developed districts. In present investigation samples of crude groundnut oil collected from local rural farmers in the different zones of Sangli. Groundnut (Peanut or Arachis hypogaea) is one of second largest source of vegetable oil in the world. India is rated as the third largest producer of groundnut in the world with annual production of over 5-6 million tons [1]. Gujarat, Andhra Pradesh, Tamil Nadu and Karnataka are the leading producers in the country and accounts for nearly 75% of the total output. Nearly 75% output occurs in June-September and the rest during November-March known as khariff and rabbi seasons respectively. Groundnut oil is traditionally used for deep frying, as it preserves the natural aroma of food. A crystal clear oil is light, easy to consume and is the preferred oil for many consumers. Filtered Groundnut Oil comes with the goodness of unique high smoke point which makes it best option for sautéing and frying. Which means that the food cooked in it absorbs less oil. Groundnut Oil contains the goodness of monounsaturated fats (MUFA) and polyunsaturated fats (PUFA), which improves blood cholesterol levels, can decrease the risk of heart related diseases. It also helps to control insulin levels, blood sugar levels and can be especially helpful if you have type2 diabetes. One type of polyunsaturated fat, omega-3 fatty acids, may be especially beneficial to your heart. Omega-3s, found in some types of sources of food, appear to decrease the risk of coronary artery disease. They may also protect against irregular heartbeats and help lower blood pressure levels [2-5].The present investigations include determination of acid value, % FFA (% free fatty acids) and cholesterol content in groundnut oil using UV-visible spectrophotometer by Liebermann-Burchard [6,7,11]. In Liebermann-Burchard test, acetic acid reacts with cholesterol in oil sample and gives a green colour whose absorbance, can be determined by UV-visible Double Beam Spectrophotometer AU-2701 Systronics Equipment at 640 nm.

2. MATERIALS AND METHODS

2.1 Chemicals: Cholesterol (Sigma-Aldrich), Liberman-Burchard reagent (is a mixture of Acetic anhydride & Sulphuric acid and it is commercially available), Chloroform etc.

2.2 Instrument: UV –Visible Double Beam Spectrophotometer AU-2701 Systronics equipment,
Working mode: Photometry at λmax = 640 nm

2.3 Standard Cholesterol Solution [6-7]: 10 mg of standard cholesterol dissolved in 10 ml chloroform, shaked well.

2.4 Liberman- Burchard Reagent [6, 7, 11]: 0.5 ml of sulphuric acid dissolved in 10ml of acetic anhydride. Covered and kept in ice bucket. Commercially it is available.

2.5 Oil Sample Collection and Preparation: Different samples of crude groundnut oil (500mL per sample) were collected from local rural farmers in the four different zones of Sangli and labelled as N (from north zone), S (from south zone), E (from east zone) and W (west zone).These four samples were stored in air-tight plastic containers and kept at room temperature. These four oil samples were separately weighed to 1g and taken into four test tube labelled as N, S, E and W. Further in each test tube 10ml chloroform were added and further diluted to 10 times. 3ml of diluted sample solution of each test tube were mixed with 2ml of Liberman-Burchard reagent and 6ml of chloroform. These test tubes were covered with black carbon paper and kept in ice-bath in dark place for 15 min. Liberman-Burchard reagent react with the sterol to produced characteristic green colour, their absorbance were determined on spectrophotometer at 640nm.

2.6 Methods:

2.6.1 Evaluation of % Free Fatty Acid (FFA) by determining acid value by titrimetric method [7-9]: Each oil sample (W=1.0g) was weighed and dissolved with 50ml of ethanol in a conical flask. The flask was then heated on water-bath for 30min. Two drops of phenolphthalein indicator were added after cooling and titrated to pink end point (which persisted for 15min) with 0.1N KOH.

2.6.2 Determination of Cholesterol content using Liberman-Burchard regent [6, 7, 11] by colorimetric method: For preparation of various known concentration of Standard cholesterol solution, the volume of standard cholesterol solution (2mg/ml) was taken as 0.4, 0.6, 0.8, 1.0, 1.2 ml in five test tubes whereas one test tube was kept blank and marked as S_1, S_2, S_3, S_4, S_5 and S_0 respectively. Then, 2 ml of the Liberman-Burchard regent was added to all six tubes and final volume was made equal (10ml) in each test tube by adding chloroform as shown in Table no. 2.The test tubes were covered with carbon black paper and kept in dark for 15minutes in ice-bath. The absorbance of all standards (six tubes) was determined on spectrophotometer at λmax = 640nm and standard graph was plotted.

3. Result and Discussion:

3.1 Determination of Acid value and % FFA of Groundnut and Sunflower oil :

Acid value is defined as the number of milligrams of caustic potash required to neutralize the acid in 1 g of the sample. Acid value indicates the proportion of free fatty acid present in an oil or fat. The normal acid value for most samples lies within 0 to 5. If any titrable acid other than a fatty acid is present in the sample, it will be an error. A high acid value indicates a stale oil or fat stored under improper conditions.

a) Acid value was calculated by using formula;[7]

$$\text{Acid Value} = \frac{56.1 \times V \times N}{W}$$

Where, 56.1 = Equivalent weight of KOH,
'V' = Volume (in ml) of standard KOH solution consumed during titration,
'N' = Normality of KOH solution used
'W' = Weight of oil sample

b) % of FFA was calculated by using following formulae; [7]
% Free Fatty Acid (FFA) = Acid Value (i.e. AV) x 0.503

Table-1: Determination of Acid value and % FFA of Groundnut oil

	Oil Sample from	Acid value (mg KOH/g)	% FFA (mg KOH/g)
1	East zone	2.37	1.19
2	West zone	3.18	1.60
3	North zone	2.20	1.11
4	South zone	3.56	1.79

From this observed analytical data, it is clear that acid value and % of FFA of groundnut oil collected from south zone is highest as compared to other zone whereas it is least in oil sample taken from north zone of Sangli.

Determination of Cholesterol Content using Liebermann-Burchard reagent by colorimetric method [6,7,11]

The analytical data for acid value and % of FFA of different groundnut oil samples are shown in table-1. Whereas Table-2 represents series of standard cholesterol solutions and Table-3 & 4 represents absorbance of standard cholesterol sample solution (S_0 to S_5) as well as unknown samples labelled as N, S, E and W.

Table-2: Preparation of Standard Cholesterol Solution

Reagents	S_0	S_1	S_2	S_3	S_4	S_5
Volume of std. cholesterol solution	0.0	0.4	0.6	0.8	1.0	1.2
Liebermann-Burchard reagent (in ml)	2.0	2.0	2.0	2.0	2.0	2.0
Solvent Chloroform (in ml)	8.0	7.6	7.4	7.2	7.0	6.8
Concentration of std. cholesterol solution (mg/L)	Blank	80	120	160	200	240

Table-3: Absorbance of Standard Cholesterol Solutions for Calibration Curve at different concentrations at 640nm

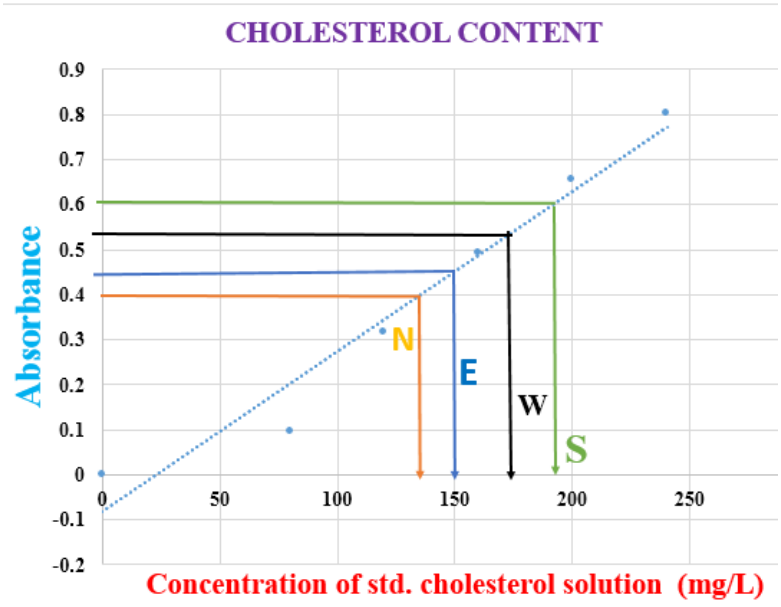
Std. cholesterol solution	Concentration of std. cholesterol solution (mg/L)	Absorbance
S_0 (Blank)	00	0.000
S_1	80	0.095
S_2	120	0.298
S_3	160	0.462
S_4	200	0.652
S_5	240	0.902

Table-4: Absorbance for Cholesterol Content in Oil Samples at 640nm

Unknown oil Sample	Diluted oil Sample solution (mg/L)	Absorbance	Concentration. cholesterol in diluted oil solution (mg/L)
E	Oil sample from East zone	0.448	150

W	Oil sample from West zone	0.520	175
N	Oil sample from North zone	0.405	138
S	Oil sample from South zone	0.602	185

4. Conclusion:



From this observed analytical data, it is clear that **cholesterol** content is highest in groundnut oil collecting from south zone as compared to that of other zones whereas it is least in oil sample taken from north zone of Sangli. Cholesterol content has essential functions in the body such as providing essential components of membrane and serving as a precursor of bile acids, steroid hormones and vitamin-D. Consuming cholesterol in our diet increases the level of low density lipoproteins (LDLs) [7-11]. There are so many different varieties of vegetable oil brands in our markets and all of them claim to be cholesterol free. Due to increasing awareness on the health implications of high cholesterol in the diets, most people now prefer to purchase cholesterol free vegetable oils. The observed Cholesterol content in crude Groundnut oil is 150.65mg/L. However, quality of oil further depends upon HDLs (High Density Lipoproteins) and LDL (Low Density Lipoproteins).

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