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Comparative Assessment of Some Physicochemical Properties of Different Groundnut Varieties and Oil Yield in Afar Region, Ethiopia

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The experiment was conducted at Werer Agriculture Research Center in Afar region, Ethiopia on sixteen varieties of released and improved groundnut in Ethiopia and were subjected to comparative evaluation of its physicochemical properties. Among these varieties, the highest seed weight was found in "Manipinter" (80.220 g) and the lowest seed weight was found in "Sedi" (35.270 g).The variety "Nc-4x" was contained highest amount of moisture (4.400 %) while lowest amount was found in "Bulki" (3.250%). The variety "Sedi" was contained significantly the highest amount of ash (11.350%) and the least amount of ash contained was found in "Werer-962" (2.810%). In this analysis, significantly highest amount of carbohydrate was found in "Werer-962" (42.210%) and the lowest amount of carbohydrate was found in "Nc-343" (7.290%). Highest amount of protein was obtained from "Manipinter" (26.91%) and the lowest was found in "Werer-962" (15.390%). The variety "Werer-962" had the lowest amount of oil contained (35.850%) while the variety "Nc-343" contained significantly highest amount of oil (56.310%). Substantial genetic variability exists for chemical composition and nutritional traits which could be utilized for various food preparations and selection for breeding purpose. It also shows the utilization of groundnut and suggests the future strategy for the nutritionist, health advisors and dieticians as to how to make best use of the groundnut.

Keywords: Groundnut, quality, physicochemical properties, oil content, crude fat, carbohydrate and protein

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INTRODUCTION

Groundnut or peanut (*Arachis hypogaea* L.) is one of the important edible oil seed crop cultivated in the world. Groundnut plays an important role in the economy of several countries (Mondragón *et al*., 2009). Groundnut (*Arachis hypogaea* L.) is originated from the natural occurs of its genus in

south America. It is also one of growing in the wormer world climate smart grains must play a greater role climate smart innovation to help farmers adapt to warmer and the drier environments (Subrahmanyam *et al*., 1989). Groundnut is also the most important oil seed crop in the world; India has the first place due to various reasons. It can with stand drought and suitable for dry land farming. It is a soil erosion resistance crop and being a legume crop (it can fix the atmospheric nitrogen with the help of nodule bacteria) and thereby improving the soil fertility is used as rotational crop. It contains 48 – 65 % oil, 26-28 % protein and is a rich source of dietary fiber, minerals and vitamins (Aykroyd and Doughty, 1982).

Groundnut is one of a potential sources of oil product and yield in Ethiopia. The oil content of groundnut may vary from 40 to 65% depending upon variety, season and maturity (Jiang *et al.,* 2002). Moreover of these, groundnut seed is a valuable source of protein for human and animal nutrition in India and China alone contribute to nearly 2/3rd of the word production. It is also an important cash crop or is an excellent money comer in Ethiopia (Nile and Park, 2013).

In Ethiopia, groundnut is one of the rain fed and none rain fed region oil seed crop. It is the second important lowland oil seed of warm climate crops, which is relatively new the country. It was introduced in the country at 15th century by Italian and other colonialist in the eastern regions. But, today it spreads in all parts of the county, especially the substantial amount producers of Eastern Hararg includes the great potential area of Gamo Gofa, Iiubabor, Gojam, Shoa, Wello and Wellega. It is also one of the cash crops, excellent and preferable food like as roasted seed consumed as a snack while crushed seeds are added in to different dishes. It is also used in the preparation of peanut butter, candies and other confection products with high quality edible oil extracts from it (Seegeler, 1983).

Seeds are good sources of oil and they are commercially available. These oils are usually sold in drums, tins, glass bottles and plastic containers in the market. The method of processing, storing and handling them affect their shelf life (Oseni *et al.,* 2010). Seed oils are important sources of nutrition oils and industrial raw materials. The characteristics of oils from different sources depend mainly on their compositions; no oil from a single source can be suitable for all purposes thus the study of their constituents is important. Many consumers are looking for variety in their diets and aware of the health benefits of fresh fruits and vegetables and of special interest are food sources rich in antioxidants (Aberoumand and Deokule, 2008).

There are numerous vegetable oils derived from various sources. These include the popular vegetable oils: the foremost oilseed oils -soybean, cottonseed, groundnut and sunflower oils; and others such as palm oil, palm kernel oil, coconut oil, castor oil, rapeseed oil and others. They also include the less commonly known oils such as rice bran oil, tiger nut oil, patua oil, kome oil, niger seed oil, piririma oil and numerous others. Melon seed oil and moringa oil are less commonly known. Their yields, different compositions and by extension their physical and chemical properties determine their usefulness in various applications aside edible uses. The characteristics of oils from different sources depend mainly on their compositions (Warra *et al*., 2011).

A revitalization of groundnut research using modern plant breeding knowledge and new technologies could be of great value in improving the crop. Research in Ethiopia has developed sixteen groundnut varieties but information concerning quality of those released varieties is not available. Therefore this study was undertaken to analyze the physicochemical quality parameters of released and improved groundnut varieties is quite important in increasing value of the varieties.

MATERIALS AND METHODS

Research in Ethiopia has developed sixteen groundnut varieties, but information concerning quality of those released varieties is not available. Therefore this study was undertaken to analyze the physicochemical parameters of released and improved groundnut varieties and compare their quality with Codex standard values for food usage due to increasing the important and value of the varieties. The experiment was laid out in Completely Randomized Design (CRD) with sixteen groundnut varieties and three replications. All the physicochemical analysis were conducted under laboratory condition. The data were recorded on as purity, percent moisture, thousand

seed, ash, protein, carbohydrate, crude fat (oil contents), acid value and saponification value, refractive index, specific gravity/density, ester value and free fatty acid. The parameters under study were as follows.

Chemicals and reagents

Boric acid, NaOH, *n*-hexane, petroleum ether, KOH, Phenolphthalein indicator solution, Standard HCl: approximately 0.5N, Absolute ethyl alcohol, Standard ethanolic KOH 0.1N , Solvent mixture of ethanol, Distilled water, H2SO4, HCl, K2SO4, CuSO4, Antifoaming agent, Deionized water , Na2SO4, H2O2, Bromocresol green and methyl red indicator used in the present study were purchased from Sigma-Aldrich, Germany and Fisher Scientific, UK.

Groundnut seed samples collection and extraction

In this study a total of sixteen groundnut varieties namely, “Shulamith”, “Nc-4x”, “Nc-343”, “Roba”, “Sedi”, “Manipinter”, “Lote”, “Bulki”, “Werer-961”, “Werer-962”, “Werer-963”, “Werer-964”, “Tole-1”, “Tole-2”, “Fayo” and “Fentene” were used. The seeds were collected from Werer Agricultural Research Centre, Afar, Ethiopia during April 2014. The site is located in the Afar National Regional State, Amibara Woreda at Melka Werer town, which is 280 km in the north east of Addis Ababa. The sixteen groundnut varieties were selected for this study are the best performers among the various varieties released and improved in Ethiopia from different groundnut growing regions. Sixteen released and improved groundnut varieties (Table 1) were evaluated. The seeds were crushed and placed in paper bags.

Sample analysis

Physicochemical parameters of groundnut seeds such as purity, percent moisture, hundred seed weight, ash, protein, carbohydrate, crude fat (oil contents), acid value and saponification value, refractive index, specific gravity/density, ester value and free fatty acid were analyzed.

Determination of moisture content

Moisture content was determined by oven dry method according to AOAC, 2000 official method-925.09. Five grams of crushed sample was dried in the oven 105 ± 2 °C for 5 hr. The weight difference shows the moisture content (AOAC, 2000)(Chemists, 2000).

Analysis of ash

The recommended methods of the association of official analytical chemists (AOAC, 2000) method-923.03 were employed in determining the ash content. Ash content was determined by the incineration of 5.0 g samples to a constant weight in a crucible placed in a muffle furnace (LMF4 from Carbolite, Bamford, Sheffield UK) maintained at 550 ^{o}C for 5 hr.

Determination of crude protein

The groundnut seeds of sixteen varieties of crude protein were analyzed. The crude protein was determined according to AOAC, 2000 method-979.09 using micro Kjeldhal apparatus. This was measured following the Kjeldahl method based on the total mineralization of the biological material in an acid environment, followed by distillation of nitrogen in ammonia form (AOAC, 2000). The total mass of vegetable protein wascalculated using a conversion factor of 6.25. Crude protein (% total nitrogen x 6.25) was determined by Kjeldhal method (Kjeldhal 1883), using 1.0 g samples (Chemists, 2000).

Extraction of oil and determination of crude fat (oil contents)

The seeds were crushed using an electric blender. The oil was then extracted from each of the seeds using hexane by adopting the method described by association of official analytical Chemist (AOAC, 2000) method-45.01 (Committee, 2000). A quantity of 5 g of the pulverized seeds were packed in a muslin cloth/ tumble and covered by cotton. The sample was inserted into the soxhlet extractor and hexane was used as the extraction solvent. The soxhlet was then introduced into the container placed on the heating mantle, which was then connected to the cryostat cooling thermostat for a eight hours. The heating mantle was disconnected. At the end of the extraction period, the solvent was recovered/ evaporated by rotary evaporator (RE 121 Rota

Table 1. Description of groundnut varieties used in the study

Varieties	Code	Yield (qt/ha)			Days to Maturity	Adaptation
		Irrigated	High RF	Marginal RF		
SHWAMITH	G-1	58	29	17	150	Marginal areas
NC-4X	G-2	60	31	20	150	Moisture stressed & irrigation areas
NC-343	G-3	53	25	20	150	Moisture stressed & irrigation areas
ROBA	G-4	68	33	-	125	High rain fall areas
SEDI	G-5	32	-	12	100	Moisture stressed areas
MANIPINTER	G-6	47	-	24	155	High rain fall areas
LOTE	G-7	59	20	24	128	High rain fall areas
BULKI	G-8	65	12	22	135	High rain fall areas
WERER-961	G-9	46	-	26	127	Goffa, selamber, babile, miesso, werer
WERER-962	G-10	48		29	130	Kobo, babile, miesso
WERER-963	G-11	46		22	129	Kobo, babile, miesso
WERER-964	G-12	46		21	128	Goffa, selamber, babile, miesso, werer

Source = Werer Agricultural Research Centre (WARC), 2014. qt. = quintal, ha = hectare, RF = rain fade

vapor made in Switzerland). The container with the fat was placed in an oven dried at 75 °C for one hour. The extract was transferred to desiccators for 30 min and weighed. The weight difference gives the fat content of the sample (Committee, 2000). Then stored in air tight container until needed for further analysis.

Analysis of carbohydrate

Total carbohydrate was determined through the method described by Raghuramulu *et al* (2003). The content of the available carbohydrate was determined by the following equation: Carbohydrate = 100- [(Moisture + Fat + Protein + Ash + Oil/Fats) g/100g].

Determination of the physicochemical properties of the oils

The extracted oils were analyzed for saponification value, refractive index, acid value and specific gravity following standard methods of AOAC (AOAC, 2000).

Determination of saponification value (SpV)

This was carried out using the method described by AOAC (2000) (Kaswurm *et al*., 2013, Marín *et al*., 2007). Two grams of the oil sample was added to a flask with 30 cm^3 of ethanolic potassium hydroxide solution and was then attached to a reflux condenser and heated on a water bath for 1 hour with occasional shaking to ensure the sample was fully dissolved. After the sample had cooled, 1cm^3 of phenolphthalein indicator was added and titrated with 0.5M hydrochloric acid until a pink endpoint was reached. A blank determination was also carried out omitting the oil under the same condition and saponification value was calculated using the equation:

$$\text{Saponification Value} = \frac{(b-a)\times M\times 56.1}{\text{Sample wight (g)}}$$

Where: a = sample titrate value
M = molarity of the HCl
b = blank titrate value
56.1 = molecular weight of KOH

Determination of acid value (AV)

The acid value was determined using the method described by Ronald (1991)(Kaswurm, *et al*., 2013, Marín, *et al*., 2007). Equal volumes (25 ml) of diethyl ether and ethanol were mixed together and 1 ml of 1% phenolphthalein indicator solution was added and was then neutralized with 0.1 M potassium hydroxide solution. The oil sample

(between 1 to 10 g) was dissolved in the neutralized solvent mixture and titrated with 0.1 M potassium hydroxide solution with constant shaking until a pink color which persists for 15 seconds is obtained.

The acid value was given as:

$$\text{Acid Value (AV)} = \frac{\text{Titrate value (ml)} \times 5.61}{\text{Wight of sample used (g)}}$$

Determination of Refractive Index (RI)

Melt the sample if it is not already liquid and filter through a filter paper to remove impurities and traces of moisture. Make sure sample is completely dry. Circulate stream of water through the instrument. Adjust the temperature of the refractometer to the desired temperature. Ensure that the prisms are clean and dry. Place a few drops of the sample on the prism. Close the prisms and allow standing for 1-2 min. Adjust the instrument and lighting to obtain the most distinct reading possible and determining the refractive index or butyro-refractometer number as the case may be (Kaswurm *et al*., 2013, Marín *et al*., 2007).

Determination of Specific gravity (SG)

Fill the dry pycnometer with the prepared sample in such a manner to prevent entrapment of air bubbles after removing the cap of the side arm. Insert the stopper, immerse in water bath at 300 C 0.20 C and hold for 30 minutes. Carefully wipe off any oil that has come out of the capillary opening. Remove the bottle from the bath, clean and dry it thoroughly. Remove the cap of the side arm and quickly weigh ensuring that the temperature does not fall below 30 °C.(Hamid and Mohan, 2009)

Specific Gravity at 30 degree C / 30 degree C =

Where,

$$\frac{A - B}{C - D}$$

A = weight in gm of specific gravity bottle with oil at 30°C

B = weight in gm of specific gravity bottle at 30°C
C = weight in gm of specific gravity bottle with water at 30°C

Determination of Ester value (EV)

The ester value was obtained by subtracting acid value from saponification value (Singh *et al*., 2015).

Statistical analysis

Data were statistically analyzed to find out significant differences of parameters among varieties analyzed by using one-way ANOVA (version 2.10). All measurements were done in triplicate and the results were recorded as mean ± standard deviation (SD). The results were analyzed by one-way ANOVA using SPSS version 15.0 (SPSS Inc. Chicago, IL, USA). Multiple comparisons between physicochemical parameters were done. Analysis of variance (ANOVA) was used to check the presence of significant difference at 95% confidence level between mean levels of physicochemical properties of in each cotton varieties. One way ANOVA was also used to compare whether there were differences in the mean levels of in each varieties and parameters among samples.

RESULTS AND DISCUSSION

The physicochemical analyses of oils are mainly made from the stand point of their edible as well as industrial uses. The quality of vegetable oils and production of groundnut varieties can be judged by the knowledge of their physical and chemical characteristics. Analysis of variance for different groundnut varieties and physicochemical properties related traits viz, as purity, percent moisture, thousand seed, ash, protein, carbohydrate, crude fat (oil contents), acid value and saponification value, refractive index, specific gravity/density, ester value and free fatty acid are presented in Table 2. Significant differences ($P \leq 0.05$) among various varieties were observed for all traits.

Seed Weight: Weight of hundred seeds of different released varieties of groundnut was presented in Table 2. It was found that seed weight varied with their size and shape. Seed

Table 2: Analysis of variance for different groundnut varieties and physicochemical properties related traits of released and improved groundnut varieties in Ethiopia.

Variety	Color	MC	CF	Pr	Ash	CHO	SaV
Shwamith	Light red	4.25±0.050^{b}	47.06±2.103^{efg}	21.58±0.146^{e}	9.54±0.023^{bc}	17.57±2.177^{ef}	193.1±0.727^{defg}
Nc-4x	Light red	4.40±0.000^{a}	43.26±0.710^{i}	19.69±0.150^{g}	6.09±3.270^{e}	26.56±3.830^{b}	195.35±0.190^{cd}
Nc-343	Opaque red	4.05±0.050^{c}	56.31±0.260^{a}	22.17±0.150^{d}	10.18±1.190^{b}	7.29±1.540^{k}	195.28±0.660^{cd}
Roba	Light yellow	4.19±0.010^{b}	47.62±1.05^{fg}	18.81±0.150^{h}	10.3±0.030^{ab}	19.08±0.920^{de}	195.21±0.260^{cd}
Sedi	Red	4.20±0.000^{b}	46.49±0.230^{fg}	23.33±0.150^{b}	11.35±1.13^{a}	14.62±0.760^{ghi}	193.85±0.590^{cdef}
Manipinter	Variegated	4.00±0.000^{cd}	46.40±3.440^{fg}	26.91±0.360^{a}	10.02±0.170^{ab}	12.67±3.240^{ij}	191.33±0.120^{g}
Lote	Light red	3.70±0.000^{f}	50.41±0.780^{c}	21.73±0.150^{e}	10.42±0.210^{ab}	13.74±0.740^{hij}	193.6±1.480^{cdefg}
Bulki	Light red	3.25±0.050^{h}	48.48±0.830^{cde}	21.58±0.290^{e}	10.66±0.210^{ab}	16.03±0.860^{fgh}	191.8±0.550^{fg}
Werer-961	Light red	3.45±0.050^{g}	53.25±0.520^{b}	19.10±0.000^{h}	10.12±0.440^{ab}	14.08±0.910^{ghij}	194.21±0.240^{cde}
Werer-962	Light red	3.75±0.050^{ef}	35.85±0.530 ^{j}	15.39±0.510^{j}	2.81±0.080^{f}	42.21±0.010^{a}	191.85±5.03^{efg}
Werer-963	Light brown	3.79±0.010^{e}	48.27±1.100^{def}	18.08±0.000^{i}	9.48±0.420^{bc}	20.37±1.510^{d}	197.89±0.300^{b}
Werer-964	Light yellow	3.80±0.000^{e}	46.32±0.610^{fg}	20.34±0.070^{f}	8.49±0.090^{cd}	21.05±0.620^{d}	199.05±0.860^{a}
Tole-1	Light red	3.74±0.040^{ef}	55.85±0.260^{a}	18.38±0.150^{i}	9.97±0.110^{abc}	12.07±0.250^{j}	198.26±0.080^{a}
Tole-2	Light red	3.40±0.000^{g}	43.83±0.120^{hi}	18.89±0.220^{h}	10.07±0.320^{ab}	23.88±0.660^{c}	198.03±0.110^{ab}
Fayo	Light red	3.95±0.050	45.63±0.050^{gh}	20.49±0.070^{f}	8.47±0.240^{cd}	21.46±0.210^{cd}	195.65±0.670^{bc}

Table 2: Continuation

Light yellow **Fetene**	3.26±0.040^{h}	49.93±1.480^{cd}	22.52±0.220^{c}	7.51±0.430^{de}	16.48±1.310^{fg}	198±0.110^{ab}
Mean	**3.820**	**47.810**	**20.580**	**9.090**	**18.690**	**195.160**
LSD(0.05)	**0.070*** **	**2.004**** **	**0.409*** **	**1.5054*** **	**2.538*** **	**2.379*** **
CV(%)	**1.103**	**2.514**	**0.993**	**9.929**	**8.143**	**0.731**

Where; Mc = Moisture content, CF = crude fate/oil content, Pr = protein content, CHO = carbohydrate content, SaV= Saponification value

weights were determined at 3-4% moisture level. The seeds weight of different released varieties were ranged from 35.27 to 80.22 %. The highest seed weight was found in "Manipinter" (80.22±23.32 g) which was followed by "Shwamith" (73.27±0.09 g) and lowest was found in "Sedi" (35.27±21.85 g). Statistically different results were shown by BARI Chinabadam-8 (99.08 g), BARI Chinabadam-9 (100.2 g). The seed weight more or less different to the reported of Chowdhury *et al.*,(2015). It may be moisture content difference. In Chowdhury *et al.*,(2015) reported seed weights were determined at 13% moisture level.

Ash: Ash content of different released varieties of groundnut was variable and ranged from 2.81% to 11.35% (Table 2). The variety "Sedi" contained significantly highest amount of ash (11.35%). The lowest amount of ash content (2.81%) showed by "Werer-962" variety. The present investigation was higher than the reported value of Atasie *et al.,* (2009). This might be due to the genetic variation among the varieties.

Moisture content: Data regarding moisture contents as presented in Table-2 showed highly significant differences for moisture contents among the different groundnut varieties. The maximum moisture content was recorded in "Nc-4x" (4.40%) variety, while the minimum moisture contents was recorded in "Bulki" (3.25%). Similar results were found by Chowdhury *et al.*,(2015) who found such variation in moisture contents among different groundnut varieties. The difference in moisture contents may be due to genetic nature of different cultivars. The so called critical moisture level for the beginning of rapid spoilage is relatively higher in seeds of low oil contents and relatively low for high oil content seeds. Moisture content in the seeds depends upon the maturity and quality of seeds. The moisture contents of seed determine the ability of all seeds to be stored well.

Proteins content: Protein is the major nutrient components of different varieties of ground nut. Protein content is genetically controlled. It is also influenced by nitrogen fertilizer application and agronomies practices. The protein content was determined on moisture free basis. Protein content of different variety and advanced line are presented in Table 2. Significantly highest amount of protein was obtained from "Manipinter" (26.91%) and lowest protein content was found in "Werer-962" (15.39%), which followed by "Tole-1" (18.38%). The present values were smaller with the reported values of Chowdhury *et al.*(2015). This might be due to the nitrogen fertilizer application, ecology and agronomics practices. The range of protein content of groundnut seeds, recorded in the present work was also in close agreement with that reported by Jambunathan *et al.,*(1985) for different groundnut varieties.

Carbohydrate content: Carbohydrate content of different released varieties was determined moisture free basis. The data were presented in Table 2. Significantly highest amount of carbohydrate contained found in Werer-962 (42.21%) and was significantly highest than other varieties. The lowest amount of carbohydrate was obtained from Nc-343 (7.29%) which was significantly

Table 2: Analysis of variance for different groundnut varieties and physicochemical properties related traits of released and improved groundnut varieties in Ethiopia.

Variety	RI	SW	Pu	AV	SG	EV	FFA
Shwamith	1.47±0.000^{b}	73.27±0.085^{b}	97.50±0.500^{c}	14.52±1.188^{a}	0.92±0.004^{fgh}	178.58±1.914^{g}	7.30±0.598^{a}
Nc-4x	1.47±0.000^{b}	72.36±0.110^{c}	99.00±0.000^{ab}	5.06±0.280^{c}	0.92±0.010^{defg}	190.29±0.100^{b}	2.55±0.140^{c}
Nc-343	1.47±0.000^{b}	60.95±0.130^{g}	98.50±0.500^{b}	4.58±0.130^{d}	0.92±0.010^{efg}	190.72±0.790^{cd}	2.303±0.070^{d}
Roba	1.47±0.000^{b}	49.87±0.280^{j}	97.00±0.000^{c}	5.14±0.220^{c}	0.92±0.020^{efg}	190.07±0.050^{d}	2.59±0.110^{c}
Sedi	1.46±0.000^{c}	35.27±0.080^{o}	92.00±0.000^{e}	4.41±0.290^{d}	0.98±0.010^{a}	189.44±0.890^{de}	2.22 ±0.150^{d}
Manipinter	1.47±0.000^{b}	80.22±0.030^{a}	95.50±0.500^{d}	6.64±0.240^{b}	0.95±0.010^{b}	184.69±0.360^{f}	3.34±0.120^{b}
Lote	1.47±0.000^{b}	62.24±0.090^{f}	99.00±0.000^{ab}	2.55±0.120^{g}	0.94±0.020^{bc}	191.05±1.600^{cd}	1.28±0.060^{fgh}
Bulki	1.46±0.000^{c}	53.99±0.150^{h}	98.50±0.500^{b}	4.84±0.060^{cd}	0.92±0.010^{efg}	186.96±0.490^{ef}	2.44±0.030^{cd}
Werer-961	1.47±0.000^{b}	36.10±0.020^{n}	99.00±0.000^{b}	3.93±0.110^{e}	0.91±0.000^{fgh}	190.29±0.130^{d}	1.97±0.060^{e}
Werer-962	1.46±0.000^{c}	50.72±0.070^{i}	99.00±0.000^{ab}	4.56±0.120^{d}	0.94±0.010^{bcd}	187.29±4.910^{e}	2.29±0.060^{d}
Werer-963	1.46±0.010^{c}	42.51±0.050^{m}	98.50±0.500^{b}	2.77±0.130^{fg}	0.92±0.000^{efg}	195.12±0.430^{ab}	1.39±0.070^{fg}
Werer-964	1.47±0.000^{b}	44.86±0.130^{k}	99.50±0.500^{a}	2.50±0.190^{g}	0.90±0.000^{h}	196.56±1.040^{a}	1.26±0.090^{g}
Tole-1	1.47±0.000^{b}	44.37±0.020^{l}	99.00±0.000^{ab}	2.45±0.240^{g}	0.91±0.010^{gh}	195.81±0.320^{a}	1.23±0.120^{g}
Tole-2	1.46±0.000^{c}	71.81±0.200^{d}	99.00±0.000^{ab}	2.66±0.030^{g}	0.94±0.000^{bcde}	195.38±0.070^{ab}	1.34±0.020^{fg}
Fayo	1.46±0.000^{c}	66.90±0.150^{e}	99.00±0.000^{ab}	2.62±0.240^{fg}	0.93±0.010^{cdef}	193.07±0.910^{bc}	1.32±0.120^{fg}
Fetene	1.49±0.000^{a}	50.65±0.140^{i}	99.50±0.500^{a}	3.00±0.090^{f}	0.86±0.010^{i}	194.1±0.030^{ab}	1.51±0.040^{f}
Mean	**1.470**	**56.00**	**98.09**	**4.51**	**0.92**	**190.64**	**2.27**
LSD(0.05)	**0.004*** **	**0.20*** **	**0.57*** **	**0.46*** **	**0.02*** **	**2.51*** **	**0.23*** **
CV(%)	**0.170**	**0.22**	**0.35**	**6.13**	**1.26**	**0.79**	**6.10**

Where; RI = refractive index, SW= hundred seed weight, Pu = Purity, AV = acid value, SG = specific gravity, EV = ester value, FFA = free fatty acid

lowest among all the varieties. Agronomics practices, environmental factors as well as variation among the varieties might be influenced the carbohydrate content. The present investigation was supported by the value of Asibuo, *et al.,(*2008).

Percentage oil yield: The percentage yield of hexane-extracted oil content from different varieties of groundnut seeds was found to be in the range of 35.85–56.31%. A significant variation was observed for oil content among the groundnut seed samples analyzed. The oil content (56.31%) was considerably higher for Nc-343 variety and lower (35.85%) in the seeds of Were-962 variety. The oil content is a quantitative trait whose variability is conditioned with genetic difference between the varieties (Anwar, *et al*., 2016). The range of oil content of groundnut seeds, recorded in the present work was also in close agreement with that reported by Jjambunathan *et al.,*(1985) for different groundnut varieties.

Specific gravity: The specific gravity of the oil obtained from groundnut range between 0.860 to 0.977 (Table 2) though there were highly significance variation (p ≤0.0001) at all varieties. The specific gravity of groundnut oil lower than water and the differences between oil are quite small, particularly amongst the common vegetable oils.

Refractive index: The recorded refractive index (RI) of groundnut oil at different temperature were significantly (p ≤0.0001) varied. The values of RI obtained from groundnut oils are similar to those of chestnut 1.449 %, sunflower 1.4750 %, soybean 1.4730 %, Cucumeropsis edulis (white seed melon 1.4622 %, melon 1.4680 % and cotton seed 1.4700 %. The higher values of the properties obtained for the crude oils revealed the necessity to purify the oils. The high refractive index of oil also showed that the fatty acids in the oil will contain a high number of carbon atoms (Bello and Olawore, 2012).

Saponification value: Saponification value of groundnut oil (Table 2) was found highest (p ≤0.0001) 199.05 mg/KOH/g at the drying temperature of 60°C and lowest 191.33 mg/KOH/g at 50°C. A saponification value of 200 mg/KOH/g indicates high proportion of fatty acids of low molecular weight and chain length. This shows that the oil may not have a potential for use in soap making and in cosmetics industries and or in the thermal stabilization of poly vinyl chloride (PVC). This property makes them useful as sources of essential fatty acids required in the body (Akanni *et al*., 2005).

Acid value and free fatty acid: Free fatty acids can stimulate oxidative deterioration of oils by enzymatic and or chemical oxidation to form off flavor components. Free fatty acid value is an indication of lipase activity (Ukhun, 1986). Fatty acid (%) has been calculated based on the molecular weight of the dominant acid. Free fatty acid indicates the possible hydrolytic degradation of the oil and the acid value is employed to ascertain the quality (condition) and edibility of the oils. Free fatty acid from peanuts has it's significantly (p≤0.0001) highest value (12.76 %) at drying temperature of 60 °C. A further increase in temperature resulted in a decrease in FFA. Comparing these values with other seeds oil (Table 2), the free fatty acid from groundnut is higher than soybean (0.5 %), Cucumeropsis *E,dulis* (white melon seed) (0.35 %), melon (2.38 %), Avocado (0.37 %), African bean (0.79 %), corn (1.5 %), cotton seed (0.7 %) (Hussain *et al*., 2015).

From the very begging of oil extraction of this oil crop varieties show a color which is different from the normal color of the oil type. Mostly the color is black color and this brings due to the storage condition and long shelf life within inappropriate temperature. Therefore this condition goes to oxidation of the crop with respect to its chemical composition. This damages nutritional availability and oil qualities of these crops. As general to have a good oil production with respect to its nutritional availability we have to develop a culture of good harvesting system, means without attacking the cover part of the crop type and proper storage condition within ambient temperature. We have to be targeted in the future and the research should be conducted to study the detailed physico chemical composition of these Ethiopian oil crops as general, and the nutritional qualities of proteins and lipids (fatty acid compositions).

CONCLUSION

Groundnuts are an excellent and affordable source nutrition, supplementing vital nutrients to the human body such as proteins, carbohydrates, crude fats and fatty acids. The tested sixteen varieties of groundnut were found to be quite different on the basis of variation in most of the important physic-chemical characteristics. The difference may be attributed to their different genetic properties. Gound variety Nc-343 and Tole-1 showed better nutritional status due to the higher quantity of crude fat (Oil contents) and Mnipinter was showed a high quantity of crude protein. While, Werer-962 was showed a high value of carbohydrate as compared to other selected varieties. It is, therefore, concluded that the present groundnut varieties particularly Nc-343, Tole-1, Mnipinter and Werer-962 could be the best choice for the biochemists, food scientists, researchers and manufacturers concerning food and nutrition. Data of this study might be useful for oil chemists and breeders for further investigations. At the same time it might be helpful for local groundnut growers/farmers and oil producers for the selection of the appropriate groundnut variety for cultivation and industrial processing.

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