Determination of Nutritional Profile and Physicochemical Properties of Improved Onion (*Allium cepa L.*) Varieties in Ethiopia

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Abstract: Since its significant ingredient in various dishes, medicinal property, nutritional worth and energy value, red onions (*Allium cepa L.*) impart numerous health benefits to users. The purpose of this research was to determine proximate composition and selected physicochemical properties of different red onion (*Allium cepa L.*) varieties grown at same field management condition in Ethiopia as well as comparative study among varieties and between study varieties and standard reference. All field and laboratory data was analyzed one way ANOVA SAS statically soft ware and the results of bulb quality and agronomy data were indicated that there were not significant difference in marketable and unmarketable yield in terms of number and weight of bulbs among the onion varieties while significant different for total yield (P<0.05). The result of physical parameters showed that significant difference among the varieties in JV, JW and TSS content but no significant difference in Juice color, MC and pungency at (P<0.05). Statically comparative study was conducted to investigate the proximate composition between studied varieties and standard reference and the result showed that Ethiopian onion cultivars were high in ash (4.14±0.12 - 8.3±0.14%), protein (8.6±0.03 - 10.84±1.23%) and fiber (3.82± - 5.15±0.12%)content than standard (0.35, 3.1, 1.7% respectively) but low in vitamin C (2.21±0.11 - 4.41±0.12 mg/100g), carbohydrate (16.77±1.1 - 21.87±0.4 g/100g) and energy value(109.45±3.3 - 137.43±7.1 KJ/100g) than standard (7.4, 35.87, 166 KJ/100g respectively). The levels of pH value (5.41±0 - 2-5.59±0.1), fat (0.68±0.7 - 0.85±0.12%) content were almost identical among varieties and standard (5.29, 0.84%) respectively.

Keywords: Onion, Varieties, Proximate Analysis, Physical Parameters, ANOVA

1. Introduction

Onion (*Allium cepa L.*) is a natural part of the daily diet for most of the population and is a crop of great economic importance in all over the world [11]. It has been used as an ingredient in various dishes for thousands of years by different countries under many cultures around the world. In Ethiopia, onion is the most important crop among the spices and is an integral part of diet and hence used in almost all food preparation [1]. It is cultivated almost throughout Ethiopia and ranks first in production among the species [13].

Not only does the vegetable lend an excellent taste to dishes, but also is associated with imparting a number of health benefits to users. As numerous health benefits have been attributed to onion, it has been used traditionally in Ethiopia as well as in different parts of the world as medicine [23]. It can protect against cancer, fight fungi and bacteria, promote cardiovascular health, reduce high blood pressure
physicochemical properties of onion cultivars of released varieties value in term of flavor, provision health-promoting phytochemicals known as disulfides, trisulfides, cepane, and vinyl dithins. These compounds have a variety of health-functional properties, including anticancer and antimicrobial activities. Onion is also a source of vitamin C, potassium, dietary fiber and folic acid. They also contain calcium, iron and have a high protein quality, ratio of mg amino acid/gram protein. Onion is low in sodium and contains no fat. They are low in calories with only 30 calories per serving, yet add abundant flavor to a wide variety of foods. Onion is also cholesterol free, and provides dietary fiber, vitamin C, vitamin B₉, potassium, and other key nutrients [24].

Most onions contain vitamin C, vitamin B₉, folic acid and numerous other nutrients in small amounts. They are low in fats and in sodium, and with an energy value of 166 kJ (40 kcal) per 100 g (3.5 oz) serving, they can contribute their flavor to savory dishes without raising caloric content appreciably [24].

Onion contains chemical compounds such as phenolics and flavonoids that basic research shows to have potential anti-inflammatory, anti-cholesterol, anticancer and antioxidant properties [14]. Antinutrients are chemicals which have been evolved by plants for their own defense, among other biological functions and reduce the maximum utilization of nutrients especially proteins, vitamins, and minerals, thus preventing optimal exploitation of the nutrients present in a food and decreasing the nutritive value.

So far five improved onion varieties namely, Adama Red, Bonbay Red, Melkam, Nasik Red and Nasif were released through researched from Ethiopian Institution of Agriculture Research, Melkassa agriculture research center and these varieties were demonstrate to consumers and they are used for house consumption, local and foreign markets. However, the information on their nutritional profile and quality parameters value in term of flavor, provision health-promoting phytochemicals, anti oxidant as well as nutrients is scanty [5]. Hence the present study was conducted with the objective to determine the nutritional profile and physicochemical properties of onion cultivars of released onion varieties.

2. Materials and Methodology

2.1. Field Experiment and Sample Collection

The field experiment was conducted at melkassa agriculture research center (MARC) in the 2016 off season (September- January) using farrow irrigation. The center is found in the Ethiopian rift valley, 117 km away from Addis Ababa in the south east direction located at 8°24′N and 39°12′E and an altitude of 1550 meter above sea level. The mean maximum and minimum temperature is 28.6°C and 13.8°C respectively. The center receives mean total annual rain fall of 825.9mm with erratic distribution, having high coefficient of variation in amount. The soil is volcanic ash in origin and the soil texture class is mainly sandy loam with pH of 6-8 [3].

In this experiment five onion varieties were used. Seedling were raised on seedbed and transplanted to the field at 3-4 true leaves stage. All recommended routine management practice including irrigation, cultivation, weeding and fertilization were applied equally for all treatments. Randomization complete block design (RCBD) with three replications were employed, with plot size of 2.4m x 3m (7.2m²) at 40cm between water farrows, 20cm between plant rows on the bed and 5cm between plant spacing.

For collection of quality data, the onion bulbs were collected from each experimental plot and cured in the store. Finally the cured onion bulbs were sampled and then unnecessary plant part such as stalk, leaves, roots and others impurities as gravels and others were removed. Depend up on parameters analysis two types of sample preparations were followed.

The samples were ground into fine powder by using automatic gridding machine and dried ready for physicochemical (Ash, Crude protein, Crude fat, and Crude fiber) analysis. The powdered samples were stored in an air tight bottle in refrigerator (about 4°C) until further analysis. The cleaned sample ground by gridding machine and filtered and the aliquot liquid or juice was ready for physicochemical analysis (TSS, TA, pH, Color, Juice volume, juice weight and Pungency) and immediately analyzed within less than 8 hours.

Maturity time was recorded based on the time from transplanting to the time when 50-70% of the leaf falls down. The meter ruler was used for measurement of onion plant height from base to the tip of the main leaf and number of leaves per plant was recorded at vegetative growth stage from central rows by leave border plants. Bulb yield from center rows was also weighed and recorded at harvesting, and the converted in to t ha⁻¹ as follows:

\[
\text{Yield per hectare in ton} = \frac{\text{Total yield per plot (kg)} \times 10,000\text{m}^2}{\text{Net area of the plot (m}^2\text{)} \times 100kg}
\]

2.2. Data Collected in the Field

Data on date of transplanting, depth of planting; plant height and number of leaves per plant, leaf diameters and length, dry biomass, weight of dry bulbs, diameters of dry bulbs were collected. Beside data on yield and yield attributes were collected from ten randomly harvested plants from central rows by leaving boarder plant from each plot. Accordingly data on bolter plants, days to physiology maturity, split bulbs, total and marketable bulbs weight were recorded. Maturity time was recorded based on time from transplanting to the time when 50-75% of the leaf falls down to determine the days to physiological maturity. One
composite soil sample before planting and five composite soil samples from fifteen plots by treatment were collected.

2.3. Determination of Physical Parameters of Onion Varieties

Total soluble solid was determined by using refractometer Index drop of onion juice while titrable acidity was determined by titrating certain juice volume using NaOH as a titrant and phenolphthalein indicator until the pH was come to 8.1, and pH determined by using potentiometric [3]. Onion color was determined by using monsoon color chart after preparation of onion juice. Juice volume and Juice weight were determine by weighing certain mass of onion bulbs and preparing the juice and finally weight of 100g per juice volume was measured. Pungency was determined using sensory evaluation by selecting sixteen women literate and expert panelists [3].

2.4. Determination of Proximate Composition of Onion Varieties

2.4.1. Determination of Total Moisture Content

The moisture content of powdered onion sample was determined in an oven through drying method (at 105 °C) according to the procedure described in AACC (2000). Method No. 44-15A. The moisture content of the sample was determined by weighing 2 g of sample into a pre-weighed china dish and drying it in an air forced draft oven at a temperature of 105 ± 5 °C till the constant weight of dry matter was obtained [2]. The moisture content in the sample was determined as follows:

\[
\text{Moisture Content (\%)} = \left(\frac{\text{Wt. of sample taken} - \text{Wt. of dried sample}}{\text{Wt. of original sample}}\right) \times 100
\]

2.4.2. Determination of Ash Content

Ash is an inorganic residue remaining after the material has been completely burnt at a temperature of 550 °C in a muffle furnace. It is the aggregate of all non-volatile inorganic elements. About 8 g of finely ground dried sample was weighed into a porcelain crucible and incinerated at 55 °C for 6 hours in an ashing muffle furnace until ash was obtained. The ash was cooled in desiccators and reweighed [3].

The % ash content in the onion sample was calculated as follows:

\[
\text{Ash (\%)} = \left(\frac{\text{Wt. of ash}}{\text{Wt. of sample taken}}\right) \times 100
\]

2.4.3. Determination of Crude Proteins

The powdered onion sample was tested for crude protein content according to the Kjeldahl’s method as described in AOAC, which involved protein digestion and distillation.

\text{Protein Digestion: About 2.0 g of the sample was weighed into an ash less filter paper and put into a 250 ml Kjeldahl flask. Then, 1 g of digestion mixture (as catalyst) and 15-20 ml of 98 }\% \text{ conc. Sulfuric acid were added. The whole mixture was subjected to heating in the digestion chamber until transparent residue contents were obtained. Then, it was allowed to cool. After cooling, the digest was transferred into a 100 ml volumetric flask and made up to the mark with distilled water and then distilled using Markham distillation apparatus.}

\text{Protein Distillation: Before use, the Markham distillation apparatus was steamed through for 15 min after which a 100 ml conical flask containing 5 ml of 2 }\% \text{ boric acid and 1 or 2 drops of mixed indicator was placed under the condenser such that the condenser tip was under the liquid. About 5.0 ml of the digest was pipetted into the body of the apparatus via a small funnel aperture. The digest was washed down with distilled water followed by addition of 3-4 drops of phenolphthalein and 5 ml of 40 }\% \text{ (W/V) NaOH solution. The digest in the condenser was steamed through until enough ammonium sulfate was collected. The Boric acid plus indicator solution changed color from red to green showing that all the ammonia liberated had been trapped. The solution in the receiving flask was titrated with 0.063 N hydrochloric acid up to a purple end point. Also, a blank was run through along with the sample. After titration, the % nitrogen was calculated using the formula:}

\[
\% \text{ Nitrogen} = \left(\frac{\text{Vs} - \text{VB}}{\text{W}}\right) \times \frac{1}{\text{M acid}} \times 100 \text{ W}
\]

Where, \text{Vs} = \text{Volume (ml) of acid required to titrate sample; VB} = \text{Volume (ml) of acid required to titrate the blank; M acid= Molarity of acid; W=Weight of sample Then, percentage crude protein in the sample was calculated from the % Nitrogen as % crude protein = % N x F, where, F (conversion factor), is equivalent to 6.25 [3].}

2.4.4. Determination of Crude Fat

The crude fat in the powdered sample was determined using Soxhlet extraction for 24 hour. Approximately, 3.0 g of samples were weighed accurately into labeled thimbles. The dried boiling flasks (250 ml) were weighed correspondingly and filled with about 150 ml of petroleum ether (boiling point 40-60°C). The extraction thimbles were plugged tightly with cotton wool. After that, the Soxhlet apparatus was assembled and allowed to reflux for 24 hrs. The thimble was removed with care and petroleum ether collected from the top container and drained into another container for re-use. After that, the boiling flask was heated in a hot air oven until it was almost free of petroleum ether. After drying, it was cooled in a desiccator and weighed [2].

The % fat in the sample was calculated using the formula:

\[
\text{Fat (\%)} = \left(\frac{\text{Wt. of fat}}{\text{Wt. of original sample}}\right) \times 100
\]

2.4.5. Determination of Crude Fiber

About 2 g fat free sample of powdered onion was taken into a fiber flask and 100 ml of 0.255 N HSO₄ was added. Then the mixture was heated under reflux with heating mantle for one hour. The hot mixture was filtered through a fiber sieve cloth. The difference obtained was thrown off and the residue was returned to the flask to which 100ml of 0.313 M NaOH was added and heated under reflux for another one hour. The mixture was filtered through a fiber sieve cloth and
10ml of acetone was added to dissolve any organic constituent. The residue was washed with 50 ml of hot water twice on the sieve cloth before it was finally transferred in the pre-weighted crucible. The crucible with residue was oven dried at 105°C overnight to drive off moisture. The oven dried crucible containing the residue was cooled in a desiccators and latter weighted (W1) for ashing at 550°C for 4 hours [3].

The crucible containing white and grey ash (free of carbonaceous material) was cooled in a desiccator and weighted to obtain W2. The % of crude fiber was calculated as follows:

\[
\text{Fiber} (\%) = \frac{((W1 - W2) / \text{Wt. of sample}) \times 100}{100 - (\% \text{ moisture} + \% \text{ crude fiber} + \% \text{ protein} + \% \text{ lipid} + \% \text{ ash})}
\]

2.4.6. Determination of Total Carbohydrate

The total percentage carbohydrate content in the onion sample was determined by the difference method. This method involved adding the total values of crude protein, lipid, crude fiber, moisture and ash constituents of the sample and subtracting it from 100. The value obtained is the percentage carbohydrate constituent of the sample [13].

Thus: % carbohydrate = 100 – (% moisture + % crude fiber + % protein + % lipid + % ash)

2.4.7. Determination of Energy Value of Onion Samples

The energy value of the samples was determined by multiplying the protein content by 4, carbohydrate content by 4 and fat content by 9 [3].

Energy Value = (Crude protein \times 4) + (Total carbohydrate \times 4) + (Crude fat \times 9)

2.4.8. Determination of Vitamin C of Onion Samples

Sample preparation and evaluation of ascorbic acid by method spectrophotometer: All samples has been blended then filtered using Buchner, 10 gm of each sample was transferred into a 100ml volumetric flask homogenized by using 50ml acetic acid solution with shaken, 4-5 drops of bromine water has been added until the solution became colored, Then a few drops of thiourea solution were added to it to remove the excess bromine and thus the clear solution was obtained. Then 2, 4-Dinitrophenyl hydrazine solution was added thoroughly with all standards and also with the oxidized ascorbic acid. Then complete the solution up to the mark with acetic acid. The absorbance for all samples has been measured using UV-visible spectrophotometer to determine the concentration of ascorbic acid in the onion under testing [14].

2.5. Statistical Analysis

Statistix 10.0 software (SAS Institute, Inc., Cary, NC, USA) was used for data analysis. Data were subjected to one-way ANOVA, and the comparative analyses between means were conducted by using the Duncan multiple range test.

3. Result and Discussion

3.1. Quality and Yield Performances of Released Onion Varieties

The vegetative and quality performances of released onion varieties were not significant at \( p < 0.05 \) except for leaf length (Table 1). Nafis gave significantly the highest leaf length (59.3cm) than Melkam but there was no significant difference with the rest varieties for these parameters (Table 1). Though there was no significant difference among the onion varieties, Nasik gave the highest plant height (72 cm) than all the test varieties. Regarding number of leaves per plant Bombay Red gave the highest number (12.3) than the rest; but there was no significant difference among the varieties. Nasik Red and Nafis gave better average bulb weights than the rest varieties (Table 1). Adama Red, Nasik Red and Nasif showed better bulb quality in terms of total soluble solids (about 13%) than Bombay and Melkam (11%); however there was no significant difference among the varieties.

<table>
<thead>
<tr>
<th>Varieties</th>
<th>PH</th>
<th>NL</th>
<th>LL</th>
<th>ABW</th>
<th>%TSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adama Red</td>
<td>68</td>
<td>9.0</td>
<td>53.7ab</td>
<td>48.0</td>
<td>13.0</td>
</tr>
<tr>
<td>Melkam</td>
<td>64</td>
<td>9.3</td>
<td>49.7b</td>
<td>53.3</td>
<td>11.3</td>
</tr>
<tr>
<td>Bombay Red</td>
<td>69</td>
<td>12.3</td>
<td>58.0ab</td>
<td>60.0</td>
<td>11.3</td>
</tr>
<tr>
<td>Nasik Red</td>
<td>68</td>
<td>10.0</td>
<td>54.7ab</td>
<td>78.3</td>
<td>12.7</td>
</tr>
<tr>
<td>Nafis</td>
<td>72</td>
<td>10.0</td>
<td>59.3a</td>
<td>73.3</td>
<td>12.7</td>
</tr>
<tr>
<td>Mean</td>
<td>68.1</td>
<td>10.2</td>
<td>55.07</td>
<td>62.6</td>
<td>12.0</td>
</tr>
<tr>
<td>F-test</td>
<td>NS</td>
<td>NS</td>
<td>*</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>CV(%)</td>
<td>5.15</td>
<td>13.15</td>
<td>5.65</td>
<td>21.56</td>
<td>10.15</td>
</tr>
</tbody>
</table>

PH-Plant height [cm], NL-Number of Leaves per plant, ABW- Average bulb weight [g], %TSS-total soluble solid in percent, NS- non significant, *- significant at 5% of probability level. Means followed by the same letter are not significantly different at 5% level

The analysis of variance showed no significant marketable bulb yield differences among the test varieties. However, Nafis (325q/ha), and Melkam (301.7q/ha) gave highest marketable yield than the rest varieties and both gave above average performance of the test varieties (Table 2). There was significant total bulb yield difference among the test varieties. Nafis variety gave the highest total bulb yield (420.3q/ha) than the rest varieties; but there was no significant difference with most of the varieties except Adama Red (Table 2). In terms of percent unmarketable, Nasik Red and Bombay Red onion varieties scored highest percentage than the rest varieties. However, there was no statistical difference among the test varieties (Table 2).

Based on the average performance, Nafis found to be
better performing especially in average bulb yield and vegetative parameters. It had higher marketable and total bulb yield with than the rest varieties. It also gave comparable bulb quality characteristics with Adama Red and Nasik Red varieties.

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Marketable Yield (q/ha)</th>
<th>Total Yield (q/ha)</th>
<th>Percent Unmarketable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adama Red</td>
<td>191</td>
<td>296</td>
<td>35</td>
</tr>
<tr>
<td>Melkam</td>
<td>302</td>
<td>389</td>
<td>22</td>
</tr>
<tr>
<td>Bombay Red</td>
<td>249</td>
<td>407</td>
<td>39</td>
</tr>
<tr>
<td>Nasik Red</td>
<td>221</td>
<td>414</td>
<td>46</td>
</tr>
<tr>
<td>Nafis</td>
<td>325</td>
<td>420</td>
<td>24</td>
</tr>
<tr>
<td>Mean</td>
<td>257.6</td>
<td>385.3</td>
<td>33.1</td>
</tr>
<tr>
<td>F-test</td>
<td>NS</td>
<td>**</td>
<td>NS</td>
</tr>
<tr>
<td>CV(%)</td>
<td>20.97</td>
<td>8.1</td>
<td>30.95</td>
</tr>
<tr>
<td>LSD(5%)</td>
<td></td>
<td>87.902</td>
<td></td>
</tr>
</tbody>
</table>

### 3.2. Onion Bulb Quality Data

Some important bulb quality data of five onion varieties were given in Table 3. The result reveals that all onion varieties were same bulb skin thickness, shape of full grown bulb and bulb flesh color while they are different in bulb skin color and weight of bulbs. Melkum and Bonbay Red were light red in bulb skin color while the remaining was red. Bonbay Red and Nasik Red are high in weight while Adama Red and Nafis are low. This was due to size of bulb and moisture content difference.

<table>
<thead>
<tr>
<th>Onion Variety</th>
<th>Bulb Skin thickness</th>
<th>Shape of full grown bulbs</th>
<th>Bulb skin color</th>
<th>Bulb flesh color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adama Red</td>
<td>Thin</td>
<td>flat</td>
<td>red</td>
<td>Light brown</td>
</tr>
<tr>
<td>Melkam</td>
<td>Thick</td>
<td>flat</td>
<td>Light red</td>
<td>Light brown</td>
</tr>
<tr>
<td>Bonbay red</td>
<td>Medium</td>
<td>flat</td>
<td>Light red</td>
<td>Light brown</td>
</tr>
<tr>
<td>Nasik</td>
<td>Thin</td>
<td>flat</td>
<td>Red</td>
<td>Light brown</td>
</tr>
<tr>
<td>Nafis</td>
<td>Thin</td>
<td>flat</td>
<td>Red</td>
<td>Light brown</td>
</tr>
</tbody>
</table>

Major soil data parameter of onion field before planting and after harvested was shown in Table 4. The pH and EC result was shows that no significant difference Adama Red, Bombay Red, Nafis and before planting of field plot at P<0.05 while there is a significant difference for Melkum and Nafis plot. Organic matter also no show significant difference among the plot except Nasik at p<0.05. The result of this study area were indicated that there were no significant different in total nitrogen among the plot except before planting while a significant difference were observed in available phosphorous Adama Red, Melkum and BP field plot. This was due to application of DAP fertilizer and uptake by plant in the form of P<0.05 according to Weldemariam [25] recommendation, but no difference among Melkum, Nasik and Nafis grown field plot. There was no significant different in sulfur content among the field plot except before planting at p<0.05. Exchangeable potassium was no show significant difference among the plot of different onion varieties grown and before planting.

<table>
<thead>
<tr>
<th>Plot</th>
<th>PH(1:2.5H2O)</th>
<th>EC(µS/mol)</th>
<th>%OM</th>
<th>%TN</th>
<th>AP(ppm)</th>
<th>S(ppm)</th>
<th>Exch. K (cmol/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Red</td>
<td>7.4±0.07a</td>
<td>123±2.87a</td>
<td>2.61±0.08a</td>
<td>0.21±0.03ab</td>
<td>13.74±0.15a</td>
<td>17.42±0.27a</td>
<td>1.74±0.27a</td>
</tr>
<tr>
<td>Melkum</td>
<td>7.1±0.18b</td>
<td>131±1.98ab</td>
<td>2.74±0.07a</td>
<td>0.18±0.06b</td>
<td>17.13±0.14a</td>
<td>17.5±0.25b</td>
<td>1.54±0.25b</td>
</tr>
<tr>
<td>Bombay Red</td>
<td>7.2±0.03ab</td>
<td>127±2.26a</td>
<td>2.49±0.08ab</td>
<td>0.22±0.08ab</td>
<td>14.92±0.13a</td>
<td>17.3±0.14a</td>
<td>1.73±0.14a</td>
</tr>
<tr>
<td>Nasik</td>
<td>7.1±0.06b</td>
<td>133±2.79a</td>
<td>2.28±0.09b</td>
<td>0.27±0.06a</td>
<td>18.27±0.21a</td>
<td>16.64±0.19a</td>
<td>1.64±0.19a</td>
</tr>
<tr>
<td>Nafis</td>
<td>7.3±0.04c</td>
<td>130±3.14a</td>
<td>2.68±0.11a</td>
<td>0.23±0.07ab</td>
<td>15.67±0.26a</td>
<td>15.62±0.11b</td>
<td>1.56±0.11b</td>
</tr>
<tr>
<td>BP</td>
<td>7.4±0.07a</td>
<td>137±3.27a</td>
<td>2.47±0.15ab</td>
<td>0.24±0.04c</td>
<td>14.89±0.17a</td>
<td>23.31±0.13a</td>
<td>1.33±0.13a</td>
</tr>
</tbody>
</table>

EC-electric conductivity OM-organic matter TN- total nitrogen AP-available phosphorous S- Sulfur ppm-parts per million BP- before planting A. Red- Adama red

### 3.3. Comparison of Physical Parameters Among Onion Varieties

Physical parameters of different onion varieties were shown in Table 5 below. The Juice volume and weight of onion were done by preparing juice from ten gram of onion bulb and the result reveal that there were no significant different in juice volume and juice weight among five onion cultivars at p<0.05. The moisture content of fresh onion bulbs were show significant different between Melkum and other varieties but, no significant different among Bombay red, Nasik and Nafis. According to USDA standard (2015) onion moisture content was 89% which was higher than this study. However, high moisture content in a sample implies its poor storage quality because samples with moisture content more than 15% encourages microbial attacks during storage [21].

Total soluble sugar were shown a significant for Adama Red, Bombay and Nasif but, on significant different among
Melkum, Nasik and Nafis at p < 0.05. Except Adama Red all varieties were same in juice color (white). Pungency of onion was shows a puyvic acid content and anti biotic sulfur compound and this study result revealed that Adama Red and Bombay Red were high pungent while the other varieties were medium in pungency.

Table 5. Comparison of Physical Parameters among Onion Varieties.

<table>
<thead>
<tr>
<th>Varieties</th>
<th>JV(ml)</th>
<th>JW(g)</th>
<th>%MC</th>
<th>%TSS</th>
<th>J. Color</th>
<th>Pungency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adama Red</td>
<td>512.17±7.1abc</td>
<td>668.93±15de</td>
<td>75.18±0.27</td>
<td>10.52±0.26</td>
<td>red</td>
<td>high</td>
</tr>
<tr>
<td>Melkum</td>
<td>652.6±1±0.2a</td>
<td>745.84±1.46</td>
<td>73.74±0.8b</td>
<td>10.76±0.06</td>
<td>white</td>
<td>medium</td>
</tr>
<tr>
<td>Bonbay</td>
<td>531.56±2.5c</td>
<td>633.87±2.51</td>
<td>76.16±0.6b</td>
<td>9.93±0.28</td>
<td>white</td>
<td>high</td>
</tr>
<tr>
<td>Nasik</td>
<td>649.68±0.45c</td>
<td>712.24±1.74a</td>
<td>77.31±0.63</td>
<td>10.98±0.23</td>
<td>pink</td>
<td>medium</td>
</tr>
<tr>
<td>Nafis</td>
<td>601.76±2.22a</td>
<td>681.63±1.2a</td>
<td>77.2±0.06</td>
<td>11.12±0.24</td>
<td>white</td>
<td>medium</td>
</tr>
</tbody>
</table>

3.4. Comparison of Proximate Nutritive Value Among Onion Varieties.

Results of the proximate composition in studied sample materials are given in Table 6. The pH result of this studied was no significant different among the varieties at p < 0.05 but, different from standard. In this studied the ash contents of onion varieties were revealed that no significant different among the varieties except Nafis and standard. From the result all varieties were high in ash content than standard this mean Ethiopian onion were high inorganic compound.

There were no significant different in crude protein and crude fat content among Adama Red, Bonbay Red, Melkum, Nasik while significant different for Nafis and standard. Anova revealed that all varieties were higher than standard in protein which shows advantage for human since onion was daily consumption with other food but lower than 10.45% [15]. However, food samples with high amount of crude protein contribute as a source of energy and helps in building tissues in animals' body [19].

In this study no significant different was observed in fiber content between Adama Red and Bombay Red and among Melkum, Nasik and Nafis except for standard. All varieties were higher in fiber (3.8–5.15%) (p < 0.05) than standard (1.7%) and 0.73% of red (Allium cepa L.) documented by Odebunmi et al. (2007). Hence, samples with higher amount of crude fiber improve protection against constipation and it also prevents cardiovascular disease because studies have shown that soluble fiber lowers levels of artery-clogging cholesterol in the blood stream [10].

In this studied anova revealed that standard was highly significant in carbohydrate content than all onion cultivars while on significant different between Adama Red and Bombay Red and also among Melkum, Nasik Red and Nafis varieties. This studied shows standard (35.87g/100g) was higher in carbohydrate content than Ethiopian onion (16.7–21.8g/100g).

In this studied there were a significant different in energy value among onion varieties as well as standard at p < 0.05 and standard(116KJ/mol) was higher in energy than all varieties (109.45–137.43KJ/mol). This result was agreement with both of them appeared to be lower than 357.19 and 367.64 kcal/100g of red Allium cepa L and Allium sativum, respectively [15]. Hence, the report of Sharma et al. (2002) demonstrated that samples with higher energy value contribute in providing more energy in animals’ body, i.e. the energy value of food is a measure of the heat energy available by the complete combustion of a weighed food sample.

In this studied there was a significant different in vitamin C between onion varieties and standard and also among the three varieties Adama Red, Bonbay Red, Nafis but, no significant different between Melkum and Nasik varieties. The standard (7.4g/100g) was twice higher than Ethiopian onion cultivars (2.21-4.41g/100g).

Table 6. Comparison of Proximate Analyzed Among Onion Varieties.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Adama Red</th>
<th>Bonbay Red</th>
<th>Melkum</th>
<th>Nasik</th>
<th>Nafis</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH</td>
<td>5.42±0.01</td>
<td>5.52±0.014</td>
<td>5.57±0.014</td>
<td>5.59±0.1</td>
<td>5.41±0.2b</td>
<td>5.29a</td>
</tr>
<tr>
<td>Ash</td>
<td>4.44±0.1</td>
<td>8.3±0.14</td>
<td>4.3±0.2</td>
<td>4.27±0.14</td>
<td>4.14±0.12b</td>
<td>0.35a</td>
</tr>
<tr>
<td>Protein%</td>
<td>10.84±1.23</td>
<td>9.06±0.1</td>
<td>9.04±0.15</td>
<td>8.7±0.02</td>
<td>8.6±0.03b</td>
<td>3.1a</td>
</tr>
<tr>
<td>Fat%</td>
<td>0.85±0.12</td>
<td>0.68±0.07b</td>
<td>0.67±0.07ab</td>
<td>0.83±0.05ab</td>
<td>0.84±0.016b</td>
<td>0.84b</td>
</tr>
<tr>
<td>Fiber</td>
<td>4.78±0.089</td>
<td>5.15±0.21</td>
<td>4.99±0.03b</td>
<td>4.04±0.085b</td>
<td>3.82±0.07</td>
<td>1.7a</td>
</tr>
<tr>
<td>Carb(g/100g)</td>
<td>21.59±0.85</td>
<td>17.97±0.89</td>
<td>16.77±1.15</td>
<td>19.99±0.28</td>
<td>21.87±0.4</td>
<td>35.87</td>
</tr>
<tr>
<td>EV(KJ/100g)</td>
<td>137.43±7.1b</td>
<td>114.12±3.5a</td>
<td>109.45±3.3d</td>
<td>122.28±1.18b</td>
<td>129.41±1.8a</td>
<td>166a</td>
</tr>
<tr>
<td>Vitamin-C (mg/100g)</td>
<td>3.01±0.13d</td>
<td>4.41±0.12d</td>
<td>3.67±0.13d</td>
<td>3.67±0.12d</td>
<td>2.21±0.11e</td>
<td>7.46a</td>
</tr>
</tbody>
</table>

Carb (g/100g) - carbohydrate in gram per 100 g EV (KJ/100g) - energy value in kilo joule per 100gram

The ash, crude protein and crude fiber contents were higher in the study Allium cepa L. Varieties (4.14–8.3 %, 8.6-10.84% and 3.83-5.15% respectively) compared to the standard (0.35, 3.1, and 1.7%). Whereas, the crude fat, carbohydrate and energy value contents were lower in the studied onion variety (0.67-0.85 %, 16.77-21.87 g/100g and 109.45-137.43 KJ/mol respectively) compared to the standard reference (0.84%, 35.87 g/100g, 166KJ/100g respectively). Moreover, the crude fat contents were comparable and did not indicate any remarkable distinction.
between the Ethiopian varieties and standard. The vitamin content of onion varieties analysis was expressed in the level of vitamin C were higher in the standard of *Allium cepa* L. compared to the Ethiopian varieties (2.1-4.41mg/100g respectively) (Table 6).

Onion bulbs which are used in our study have high levels of ash, fiber and protein, but comparatively low moisture content, carbohydrate and energy value. The high content of crude protein is important for quality assessment which will be obtained from the seed pulp and high content of ash is important in that it involves higher value of inorganic material.

4. Conclusion

Agronomy management practice for onion on the field was high significant effect on onion nutritional quality parameters. Comparative study of different onion varieties’ were fit the standard in bioactive and medicinal properties as well as physical parameter. Significant differences of the chemical composition, nutritional value, and antioxidant activities among the onion cultivars were observed, Adama Red varieties was showed considerable high nutritional value and antioxidant activity which could be developed for functional food that benefits human health. The study was showed Ethiopian onion cultivars were fit WHO standard in the quality of proximate nutritive value for moisture content, ash, protein, fat, fiber but provide less energy value, carbohydrate, and vitamin C. Further studies should be required on *Allium cepa* for bioactive, antibiotic and inorganic mineral composition since its ash and pungency was remarkable.

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