Evaluation of Food Quality of Released Barley Varieties Grown in Oromia, Ethiopia

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Abstract: This study was conducted to characterize and evaluate food quality of released food barley varieties through physical, chemical and sensory evaluation. Fifteen released food barley varieties were collected from different research centers. Physicochemical qualities of these varieties were analyzed with three replications. Sensory evaluation was also performed by using hedonic scale method. Hectoliter weight, thousand kernel weight, moisture, protein, sodium, potassium, iron, zinc, calcium and magnesium contents were determined in the range of 55.57 – 66.67 grams, 33.50 – 58.50 grams, 7.46 – 11.43%, 9.44 – 16.80%, 79.23 – 316.54 ppm, 3993 – 6040 ppm, 11.49 – 64.32 ppm, 31.07 – 55.73 ppm, 305.42 – 716.91 ppm and 811.50 – 1731.10 ppm respectively. Overall acceptability of porridge prepared from barley varieties were disliked slightly to liked moderately while liked slightly to liked moderately for Injera. There were significant (P<0.05) variation in physical, chemical and organoleptic properties due to test barley varieties variation. Aruso variety was the highest in mean value of thousand kernel weight and hectoliter weight. Walker variety had the highest protein mean score. The study revealed that Robera, Abdane, Bentu, Harbu, Golden Eye and Walker varieties had the highest value of calcium, magnesium, potassium, sodium, iron and zinc respectively. Walker variety porridge was disliked slightly and Bentu variety was mostly liked moderately but not significantly different among Aquila, Gobe, HB 1966 and Robera varieties. Abdane variety injera was liked slightly and Biftu variety was mostly liked moderately but not significantly different among nine barley varieties. Therefore Aruso, Biftu, Bentu and Robera varieties were preferred for physical, chemical and sensory quality attributes.

Keywords: Food Barley, Variety, Physical, Chemical, Sensory, Injera, Porridge

1. Introduction

Barley (Hordeum vulgare L.) is used for animal’s feed and human consumption. It is estimated that about 85% of the world’s barley production is destined for feeding animals, while the rest is used for malt production, seed production and food consumption but also for production of starch either for food use or for the chemical industry [1]. Barley is used as an important food crop in daily diets in Morocco, India, China and Ethiopia [2]. Barley is used as main crop for food and beverage preparation in Ethiopia. It can be used as main dishes like Injera, bread (kita) and porridge in addition to ceremonial and side dishes like local beverage (farso in Afan Oromo), roasted whole grain, Besso, Chuko, Kinche, etc [3]. It’s considered as health food and mostly used for infant food preparation. Because of these various interests, barley is mainly produced in Oromia regional state. Of the top 25 barley producing districts in the country, 18 are found in Oromia [4]. In 2017/2018 cropping season, barley was produced on about 951,993.15 hectares of land from which 20,529,963.72 quintals of yield are obtained [5]. According to Ethiopian Ministry of Agriculture report, there are about 46 released food barley varieties until 2018 [6]. Ten varieties (Walker, Golden Eye, Aquila, Robera, Abdane, Guta, Biftu, Dinsho, Harbu, and Adoshe) were released by Oromia Agricultural Research Institute’s research centers.

The environmental factors, such as rainfall, temperature, soil conditions, fertiliser and genetic factors, can contribute to variations in the chemical composition and physical characteristics of cereal grains [7&8]. Thus characterization of variations in the nutritional value of cereal grains that
result from such factors may help to define appropriate breeding objectives for improving the value of cereal grains for nutrition [8]. The exact physicochemical composition of barley may vary depending on the variety and the environmental conditions during production. Accordingly, different researchers have evaluated internationally and some nationally released varieties barley for their nutritional composition [9 & 10]. Whole barley grain consisted of about 65–68% starch, 10–17% protein, 4–9% s-glucan, 2–3% free lipids and 1.5–2.5% minerals [11].

It is important to investigate the nutritional value of barley in a given to geographic location because their nutritional value may depend on the variety, fertilization and environmental conditions. Considerable number of food barley varieties were verified and released from different Agricultural Research Centers of IQQO. However, some of nutritional compositions of these varieties were not evaluated and profiled as research information as well as consumers preferences were not reported. Therefore the objective of this study was to evaluate the physicochemical compositions and consumers’ preferences of released and mostly produced barley varieties in the Oromia region, Ethiopia.

2. Objectives

1) To evaluate physical and chemical quality of food barley varieties found in Oromia, Ethiopia,
2) To evaluate processed food quality of barley found in Oromia, Ethiopia

3. Materials and Methods

3.1. Sample Collection and Study Site

Fifteen released food barley varieties were collected from Fedis Agricultural Research Center (FARC) and Sinana Agricultural Research Center (SARC) during 2017/18 cropping season as listed on Table 1. Finally, only undamaged food barley grain was chosen and stored under room temperate until analysis. Laboratory analysis and barley food products sensory evaluation activities were undertaken at Food Science Laboratory of Oromia Agricultural Research Institute (IQQO) and Dodola district. Four farmers’ research groups (FRG) having each fifteen members were established at Dodola district (Denaba and Kecama Core kebeles). Food barley Injera and porridge prepared from different barley varieties were evaluated by IQQO’s staff and farmers from Dodola district found in West Arsi zone.

3.2. Sample Preparations for Analysis

Food barley varieties were sorted, cleaned, decorticated by using mortar and pestle and sun dried (as shown on figure 1), milled, sieved and stored at room temperature until chemical and sensory analysis carried out.

| S. No | Variety name | Breeder/Maintainer | Year of Released |
|-------|--------------|--------------------|------------------|
| 1     | Abdane       | SARC/IQQO          | 2011             |
| 2     | Aquila       | FARC(IQQO)/MORRELL | 2012             |
| 3     | Aruso        | SARC/IQQO          | Local            |
| 4     | Biftu        | SARC/IQQO          | 2005             |
| 5     | Benta        | KARC/IQQO          | 2006             |
| 6     | Dafu         | SARC/IQQO          | 2005             |
| 7     | Dinsho       | SARC/IQQO          | 2009             |
| 8     | Gobe         | KARC/IQQO          | 2012             |
| 9     | Golden Eye   | FARC(IQQO)/MORRELL | 2012             |
| 10    | Harbu        | SARC/IQQO          | 2004             |
| 11    | HB 1965      | HARC               | 2017             |
| 12    | HB 1966      | HARC               | 2017             |
| 13    | HB 1307      | HARC/EIAR          | 2006             |
| 14    | Robera       | SARC/IQQO          | 2016             |
| 15    | Walker       | FARC(IQQO)/MORRELL | 2012             |

Where, KARC= Kulumsa Agricultural Research Center, HARC= Holeta Agricultural Research Center, EIAR= Ethiopian Institute of Agricultural Research

3.3. Physicochemical Analysis

3.3.1. Thousand Seed Weight

Thousand barley kernel counted by automatically seed counter and weighed by sensitive balance (0.001g) and thousand seed weight was reported in grams. The weight of each test was repeated with three replicates [12].

3.3.2. Proximate Analysis

Proximate Composition: Moisture, protein and fat content of the grain samples and proximate composition of bread
blends were determined by using the AOAC, 2000 methods [13]. Total carbohydrate is calculated by difference. Energy was calculated using Artwater factor: Fat x 9 + Carbohydrate x 4 + Protein x 4 (kcal).

3.3.3. Minerals
Iron, zinc and calcium content were analyzed by using AOAC Official Method 975.03 [14]. All determinations were done in triplicate.

3.3.4. Injera Preparation from Barley Varieties
Injera was prepared as per the procedure of Bultosa et al., [15] and Fitsum et al., [16]. Equal amount of flour and water were used for the preparation of dough and fermentation of the dough after adding a starter culture (a fermented dough from previous batch) with 1: 1.6 w/v and fermenting at room temperature for 24–72 h. After fermentation, 10% of the sediment was mixed with water (1:3) and cooked for 2–3 minutes with the objective of gelatinization (cooking) primarily to bring about the cohesiveness of dough and secondly to get ride of the easily fermentable carbohydrate from Injera. Then, gelatinized batter (Absit) were cooled to room temperature and added back to the fermenting dough. After fermentation for 0.5–1 h, bubbles were formed, indicating the end point. Additional water was added to fermented dough to bring to correct batter consistency. About 500 g of fermented batter was poured in a circular manner on a hot clay griddle, covered, and baked for 3–4 minutes.

3.4. Consumer Preference Test on Processed Food
Before conducting sensory evaluation; orientation was given for panelists with practical demonstration. Sixty three (36=male and 27=female) and sixty eight (39=male and 29=female) consumers including researchers, farmers, and nutrition and plant science experts were purposely selected to determine the acceptability of barley porridge and Injera displayed on figure 2 and 3 respectively. Acceptability/preference was undertaken using nine point Hedonic scales; where 1=dislike extremely, 2= dislike very much, 3. Dislike moderately, 4. Dislike slightly, 5=neither like nor dislike, 6=like slightly, 7. Like moderately, 8. Like very much and 9=like extremely.

3.5. Data Management and Statistical Analysis
Means and standard deviations were calculated for physic-chemicals and acceptability of the sensory attributes. All quantitative and qualitative data were analyzed using statistical analysis software known as SAS version 9.00 to analysis physic-chemicals and sensory qualities.

4. Results and Discussions
4.1. Some Physical and Chemical Qualities of Barley Varieties Grain
Hectoliter weight, thousand kernel weights, moisture, protein, and some minerals content were determined in selected barley varieties were shown on Table 2. All of determined physico-chemicals of food qualities were significant (p<0.05) among barley varieties. The least hectoliter weight, thousand kernel weight and moisture were obtained from Aruso Variety with value of 74.01 grams, 66.20 grams and 11.43% respectively. The protein composition barley varieties determined with the least from Aruso variety (10.72%) and the highest from Walker variety (18.72%). The level of protein in barley is highly variable, ranging from 7 to 25% according to a large USDA study involving over 10,000 genotypes [18]. The difference is due to the varieties growth conditions, particularly the rate and timing of nitrogen fertilization [19] and also barley protein content is highly dependent on the cultivar [20]. The minerals content of minerals in barley varieties ranged from 87.14 – 366, 4248 – 8778.18, 34.00 – 78.48, 428.77 – 822.54, and 928.05 – 2126.23 ppm for sodium, potassium, iron, zinc, calcium and magnesium respectively. The exact composition of barley will vary depending on the variety chosen and the environmental conditions during growth [9]. The whole barley grain consists of about 65-68% starch, 10-17% protein, 4-9% β-glucans, 2-3% free lipids and 1.5-2.5% minerals [21 & 22].
4.2. Proximate and Energy Composition of Barley Varieties’ Porridge

Proximate (moisture, ash, protein, crude fat, crude fiber, carbohydrate) and energy content of barley varieties’ porridge are presented in Table 3. Both proximate and energy composition were strongly significant (P<0.0001) among barley varieties’ porridge. The mean moisture, ash, protein, crude fat, crude fiber, carbohydrate and energy composition of porridge were 8.21%, 3.17%, 13.90%, 3.03%, 0.93%, 70.76%, and 346.99 Kcal respectively. The maximum moisture and ash content were obtained from Walker and Robera variety with value of 8.96% and 5.81% respectively. But the least moisture and ash content was obtained from Bentu variety with value 7.32% and 1.94% respectively. The protein content of porridge ranged from 8.58% (from Dinsho) to 16.64% (from Golden). The protein composition was not significant among Golden Eye, Robera, HB 1307, Walker and Dafo varieties. The maximum crude fat and crude fiber were obtained from Dafo and HB 1966 respectively. Carbohydrate (CHO), energy, crude fat and fiber value were obtained with range of 68.09 - 75.11%, 335.24 - 356.75 Kcal, 1.99 - 4.31% and 0.50 - 1.21% respectively. Bentu variety was superior by energy with the value of 356.75 Kcal but not significant among Aquila, Gobe and HB 1665 varieties.
4.3. Proximate and Energy Composition of Barley Varieties’ Injera

Proximate and energy content of barley varieties’ porridge are presented in Table 4. Both proximate and energy composition were strongly significant (P<0.0001) among barley varieties’ porridge. The moisture, ash, protein, crude fat, crude fiber, carbohydrate and energy content of Injera determined with range of 8.40 - 10.26%, 1.23 – 3.45%, 8.95 – 18.08%, 2.33 – 5.55%, 0.62 – 1.49%, 66.86 – 74.91% and 337.99 – 352.76 Kcal respectively. The maximum moisture and ash content were obtained from Walker and Robera variety with value of 10.26% and 3.45% respectively. But the least moisture and ash content was obtained from Bentu and BH 1965 variety with value 8.86% and 1.23% respectively. The maximum and minimum protein content was determined in BH07 (18.08%) and Dinsho (8.95%) respectively. The maximum and minimum crude fiber content was determined in HB 1965 (5.55%) and Golden Eye (2.33%) respectively. The least crude fat and CHO content was found from Aquila variety, while the maximum crude and CHO content was determined from Dinsho variety. The least and highest energy content obtained from HB1965 and Abdane variety with the value of 337.68Kcal and 352.76Kcal respectively. The energy composition was not significant among Biftu, BH 1307, Golden Eye and Abdane varieties.

| SN | Variety | Moisture (%) | Ash (%) | Protein (%) | Crude Fiber (%) | Crude fat (%) | CHO (%) | Energy(Kcal) |
|----|---------|--------------|---------|-------------|----------------|--------------|---------|--------------|
| 1  | Abdane  | 8.98±0.04ab  | 1.85±0.01bc | 15.24±0.76bd | 2.72±0.50ef | 1.39±0.03d  | 69.82±0.91bcd | 352.76±1.65c |
| 2  | Aquila  | 9.14±0.02ab  | 1.70±0.07cd | 15.91±0.13d  | 3.40±0.10bd | 0.62±0.13c  | 67.08±0.15b  | 346.16±0.80d |
| 3  | Aruso   | 10.02±0.09bc | 1.66±0.05cd | 13.53±0.63ef | 2.96±0.13bf | 1.11±0.03d  | 70.72±0.55bd | 346.97±0.39bc |
| 4  | Bentu   | 8.86±0.01c   | 1.58±0.00f  | 14.39±0.97ef | 3.44±0.08ef | 0.81±0.03c  | 70.94±0.86c  | 348.50±0.27bc |
| 5  | Biftu   | 8.96±0.19ab  | 1.68±0.04cd | 13.04±0.55gh | 3.92±0.12bc | 1.12±0.07c  | 72.27±0.56bd | 351.35±1.07bc |
| 6  | Dafro   | 9.14±0.28bc  | 1.52±0.04cd | 16.33±1.80bc | 3.15±0.30abc | 0.83±0.04d  | 69.03±1.85bc | 348.90±0.32bc |
| 7  | Dinsho  | 10.11±0.12bc | 1.49±0.01bc | 8.95±0.65a   | 3.06±0.77abc | 1.49±0.02c  | 74.91±0.65a  | 348.82±2.65bc |
| 8  | Gobe    | 9.95±0.15bc  | 2.01±0.54f  | 16.55±0.26f  | 3.84±0.32b   | 0.78±0.09d  | 66.86±0.26c  | 340.72±0.79bc |
| 9  | Golden  | 9.39±0.11c   | 1.65±0.12cd | 16.53±1.72c  | 2.33±0.12f   | 1.05±0.02c  | 69.05±1.90bc | 351.79±1.29bc |
| 10 | Harbu   | 9.52±0.11ef  | 1.62±0.08cd | 15.22±0.64ef | 2.62±0.06ef  | 0.67±0.00ef  | 70.34±0.62bc | 348.30±0.28bc |
| 11 | HB 1307 | 8.40±0.05f   | 1.25±0.00g  | 18.08±0.26f  | 3.15±0.07ef  | 0.76±0.06df  | 68.35±0.40bc | 352.61±0.46bc |
| 12 | HB 1965 | 9.76±0.07ef  | 1.23±0.02g  | 15.01±0.13ad | 5.55±0.88ef  | 0.77±0.06ad  | 67.69±0.95bc | 337.68±3.45bc |
| 13 | HB 1966 | 9.64±0.08ef  | 1.55±0.02ad | 15.95±0.42gb | 2.77±0.20ad  | 0.80±0.06ad  | 69.29±0.68bc | 348.15±0.59bc |
| 14 | Robera  | 10.21±0.14bc | 3.45±0.04f  | 14.75±0.47ab | 2.58±0.10ef  | 1.28±0.11bc  | 67.91±0.66bc | 341.43±0.58bc |
| 15 | Walker  | 10.26±0.17bc | 1.33±0.05ef | 15.02±0.42ab | 3.34±0.61abcd | 1.15±0.02bc  | 68.90±0.31abcd | 346.07±1.45bc |
| Mean |         | 9.49±0.20c   | 1.70±0.17    | 14.97±0.97   | 3.19±0.29    | 0.97±0.04    | 69.53±0.36    | 347.35±0.80    |
| LSD  |         | 0.20±0.25    | 0.25±0.14    | 1.40±0.10    | 0.66±0.02**  | 0.10±0.02**  | 1.70±0.04**   | 2.34±0.04**    |
| CV   |         | 1.27±0.83    | 8.73±5.88    | 5.58±1.57    | 12.41±6.43   | 6.43±1.57    | 1.57±0.40     | 0.40±0.04      |

Where: In each column means followed by different letters (a, b, c, d, e, etc.) are significantly different at α < 0.05. **= strongly significant at P<0.0001

The mean proximate and energy composition determined in both barley varieties’ porridge and Injera conceded with nutrient content of barley products per 100 g as commonly consumed in Ethiopia food 368, 9.1, 8.5, 2.0, 79.0, 2.2, 1.4, 17.0, 294, 6.3 [23, 21]. The proximate composition of barley grain ranges 78 – 83, 7.6 – 14.4, 1.3 – 2.8, 4.0 – 8.0 and 2.0 – 5.0 for carbohydrate, protein, fat, crude fiber and ash respectively [24, 22]. Lipid concentration of barley generally ranges from 2 to 3% [25] with reports of cultivars as high as 5.3% [26]. The ash content, gross mineral matter of barley ranges from 2.0 to 3.0% with low ash occurring in hulless types. Barley hulls contain around 6.0% ash [27]. Mineral contain in barley ranges for Na, K, Ca, Mg, Fe and Zn for raw barley 3, 270, 20, 65, 3.0, and 2.1mg/per 100g [23]. Variables which are difficult to control such as soil composition, moisture, temperature and amount of sunlight, can produce location and seasonal variation in the grain composition [28]. As the proximate and energy compositions of barley varieties porridge and Injera shown on Tables 3 and 4 indicated; Aquila, Bentu, Gobe and BH 1965 varieties among the best for porridge in terms of energy. While, Abdane, Biftu, Golden Eye and HB 1307 varieties had superior for Injera in terms energy.

4.4. Sensory Evaluation Data

Sensory evaluation is defined as a scientific discipline used to evoke, measure, analyze, and interpret those responses to products that are perceived by the senses of sight, smell, touch, taste, and hearing [29]. While acceptable color of a food varies depending on cultural, geographic and sociological aspects of a given population, certain food groups are acceptable only if they fall within a certain color range [30].

4.5. Sensory Evaluation of Porridge

Barley varieties’ sensory acceptability of porridge are shown in Table 5. The tested porridge sensory attributes among barley varieties had significant (P<0.0001) differences in color, texture, mouth feel, taste, odor and overall acceptability. The mean preference of porridge for
color, texture, mouth feel, taste, odor and overall acceptability were 6.59, 5.96, 6.31, 5.90, 5.97 and 6.47 respectively. Barley varietys porridge was accepted with least score given for Walker porridge texture with the value of 3.89 (dislike moderately) and the most preferred score 7.68 (Like moderately) was given for Gobe porridge color. Bentu variety was mostly preferred for overall acceptability but not significant among Robera, HB 1966, Gobe and Aquila varieties for overall acceptability score.

**Table 5. Sensory evaluation of porridge preference for selected food barley varieties.**

| S.N | Sample name | Injera Sensory Attributes | Gas hole distribution (eye) |
|-----|-------------|---------------------------|-----------------------------|
| 1   | Abadan      | 6.38±1.74<sup>c</sup>    | 5.48±1.81<sup>b</sup>      |
| 2   | Aquila      | 7.22±1.13<sup>b</sup>    | 6.79±1.42<sup>b</sup>      |
| 3   | Aruso       | 6.48±1.62<sup>c</sup>    | 6.73±1.52<sup>b</sup>      |
| 4   | Bifito      | 7.05±1.66<sup>b</sup>    | 6.30±1.71<sup>c</sup>      |
| 5   | Bento       | 7.57±1.29<sup>c</sup>    | 7.21±1.19<sup>c</sup>      |
| 6   | Dafo        | 5.43±1.70<sup>b</sup>    | 4.98±1.76<sup>b</sup>      |
| 7   | Dinsko      | 6.32±1.54<sup>c</sup>    | 5.97±1.61<sup>c</sup>      |
| 8   | Gobe        | 7.6±1.23<sup>a</sup>     | 6.51±1.58<sup>b</sup>      |
| 9   | Golden Eye  | 5.84±1.82<sup>b</sup>    | 5.16±1.81<sup>c</sup>      |
| 10  | Harbu       | 6.49±1.30<sup>c</sup>    | 6.06±1.45<sup>c</sup>      |
| 11  | HB 1965     | 6.87±1.35<sup>c</sup>    | 5.95±1.66<sup>c</sup>      |
| 12  | HB 1966     | 7.14±1.70<sup>b</sup>    | 6.67±1.81<sup>c</sup>      |
| 13  | HB 1307     | 6.24±1.82<sup>c</sup>    | 5.11±2.04<sup>d</sup>      |
| 14  | Robera      | 6.94±1.60<sup>c</sup>    | 6.56±1.57<sup>c</sup>      |
| 15  | Walker      | 5.72±2.00<sup>c</sup>    | 3.89±1.36<sup>c</sup>      |
| Mean| 5.69        | 5.96                      | 6.31                      |
| LSD | (p<0.05)    | 0.50                      | 0.49                      |
| CV  | 21.50       | 23.73                     | 20.60                     |

Where: In each column means followed by different letters (a, b, c, d, etc.) are significantly different at α < 0.05.

Barley varietys‘ sensory acceptability of data of Injera are shown in Table 6. Among barley varieties had significant (P<0.0001) differences in gas hole distribution, color, texture, mouth feel and odor preferences, but not significant among Robera, HB 1966, Harbu, Golden Eye, Gobe, Dinsko, Dafo Bento Bifito, Aruso and Aquila varietys for overall acceptability score. All varietys were preferred for tasted sensory qualities varied from the least disliked moderately (3.82) to the highest liked moderately (7.15) as shown in the Table. The highest score for gas whole distribution (eye) and color were 7.15 and 7.13 respectively belonging to Bentu variety and the lowest preferred were HB 1665 and Abdanade variety for eye (4.97) and color (5.99) respectively. Similarly Aruso variety had preferred most for texture, mouth feel, and taste with the scores 6.88, 6.77 and 6.31 respectively. The least score found for mouth feel, taste, odor and overall acceptability were given for Abdanade variety with 3.82, 5.54, 5.49, and 6.25, while the least texture (5.56) score provided for BH 1665. Gobe and Bifito varietys had the highest preferred for odor (6.64) and overall acceptability (7.15)

**Table 6. Sensory evaluation of injera preference for selected food barley varieties.**

| S.N | Sample name | Injera Sensory Attributes | Gas hole distribution (eye) |
|-----|-------------|---------------------------|-----------------------------|
| 1   | Abadan      | 5.94±2.52<sup>b</sup>    | 5.99±2.08<sup>c</sup>      |
| 2   | Aquila      | 7.04±1.77<sup>c</sup>    | 6.94±1.45<sup>c</sup>      |
| 3   | Aruso       | 6.96±1.64<sup>c</sup>    | 6.68±1.46<sup>b</sup>      |
| 4   | Bifito      | 6.79±1.81<sup>c</sup>    | 6.76±1.40<sup>c</sup>      |
| 5   | Bento       | 7.15±1.83<sup>c</sup>    | 7.13±1.07<sup>c</sup>      |
| 6   | Dafo        | 6.44±1.67<sup>c</sup>    | 6.60±1.45<sup>c</sup>      |
| 7   | Dinsko      | 6.38±0.90<sup>c</sup>    | 6.62±1.54<sup>c</sup>      |
| 8   | Gobe        | 6.00±2.60<sup>c</sup>    | 6.47±1.92<sup>c</sup>      |
| 9   | Golden Eye  | 7.12±1.70<sup>c</sup>    | 6.91±1.33<sup>c</sup>      |
| 10  | Harbu       | 6.69±1.21<sup>c</sup>    | 6.10±1.52<sup>c</sup>      |
| 11  | HB 1965     | 4.97±1.82<sup>c</sup>    | 6.19±1.02<sup>c</sup>      |
| 12  | HB 1966     | 6.59±1.65<sup>c</sup>    | 6.59±1.74<sup>c</sup>      |
| 13  | HB 1307     | 5.68±1.55<sup>c</sup>    | 6.74±1.30<sup>c</sup>      |
| 14  | Robera      | 6.51±1.50<sup>c</sup>    | 6.60±1.30<sup>c</sup>      |
| 15  | Walker      | 6.75±2.90<sup>c</sup>    | 6.75±1.38<sup>c</sup>      |
| Mean| 5.53        | 0.45**                    | 0.49**                     |
| LSD | (p<0.05)    | 0.47**                    | 0.48**                     |

Where: In each column means followed by different letters (a, b, c, d, e, etc.) are significantly different at α < 0.05.
respective. The overall acceptability was not significant different among most barley variety except the inferior liked varieties such as Abdane, HB 19665, HB 1307 and Walker varieties. among A good Injera is soft, with uniformly distributed gas holes on its top surface and nonstick top and bottom surfaces, is supple (rolls easily), and has a slightly sour taste [31 & 32]. The appearance, size, and distribution of gas holes on the Injera surface and its taste and texture all impact the preference and acceptability of Injera.

5. Conclusion and Recommendations

Fifteen released food barley varieties were determined for physicochemical and sensory qualities. This study revalied that barley variety had different merits for tested physicals, chemicals and sensory qualities parameters. Accordingly, barley varieties such as Aquila, Bentu and Gobe were preferred for porridge preparation and utilization. While Biftu, HB 1307 and Golden barley varieties were better for Injera preparation and consumption. Generally, depending on the overall yield, physicals, nutrients, energy and sensory qualities Bentu, Gobe, Aquila and HB 1307 varieties recommended for the intended users. In the future, incorporation of nutritional evaluation may be necessary during regional variety verification trails.

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