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Assessment of Potato quality and sensory Acceptability in the central High lands of Ethiopia

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Abstract: **Potato is an important source of energy and micronutrients to most micronutrient malnourished affected population in Ethiopia. The study was conducted to identify the popular potato variety in the centeral high lands of Ethiopia and to determine the nutritional composition and processing quality. Four popular varieties Gudena, Jalena, Belete and Chala were selected .the popular varieties Macro and Micro nutrients composition of raw peeled potato were evaluated .Significant ($p<0.05$) variation between the varieties were observed especially in dry matter, protein, fat and potassium content. All the four variety had high level of potassium and sodium. The nutrient composition and sensory evaluation among the four variety Gudena had high level of protein,Iron and potassium. Jalena had high level of zinc where as Belete had preferred appreance and taste for French fries. Therefore the four popular potato varieties can be utilized in the processed form to fulfill the daily requirement of nutrients.**

Keywords: **Potato Variety, Nutrients contents, processing, Mineral content.**

1. INTRODUCTION

Potato is a versatile, carbohydrate rich food highly popular worldwide and prepared and served in a variety of ways. It contains about 80 percent water and 20 percent dry matter. About 60 to 80 percent of the dry matter is starch. On a dry weight basis, the protein content of potato is similar to that of cereals and is very high in comparison with other roots and tubers. In addition, the potato is low in fat potato is not fattening (and the feeling of satiety that comes from eating potato can actually help people to control their weight). However, preparing and serving potatoes with high-fat ingredients raises the caloric value of the dish.Since the starch in raw potato cannot be digested by humans, they are prepared for consumption by boiling (with or without the skin), baking or frying. Each preparation method affects potato composition in a different way, but all reduce fibre and protein content, due to leaching into cooking water and oil, destruction by heat treatment or chemical changes such as oxidation (FAO, 2008).

Irish Potato (Solanum tuberosum L.) is the most widely grown food crop after rice, wheat and maize (Burton, 1989). The crop has its origins in the Andes Mountains of Peru and Bolivia from where it spread throughout the world. Potatoes are increasingly becoming important in the diets of many Ethiopian. Besides being incorporated into traditional dishes, they are also eaten boiled or fried (Chips and French fries) forms. In major urban centers, they are becoming popular in the form of boiled, French fries and crisps.

Therefore, potatoes are a principal source of carbohydrates and protein, and also contribute some vitamins and minerals in the diet. The present study was designed to determine the macro nutrients and mineral compositions of popular variety grown in central high lands of Ethiopia (Wolemera and Jeldu Districts) as influenced by variety.

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2. MATERIALS AND METHODS

Potato growing areas in the central highlands of Ethiopia were selected and the popular varieties were identified according to the sampled farmer's response.

3. NUTRITIONAL COMPOSITION ANALYSIS OF POTATO

Sample preparation

The samples were collected based on the survey data. The popular potato variety was collected from potato improvement research program Holeta Research center. The tubers were washed with tap water, rinsed with deionizer and distilled water. The washed tubers were dried with towel paper. The tubers were peeled and longitudinally cute in four sections by stainless steel slicer.2-3 slices of each section were obtained and 50 g was weighed. The samples were dried at 80 degree centigrade for 72 hrs. The dried samples were milled by stainless mill.

Solid content of tuber (CIP)

Five tubers were chopped and mixed thoroughly and weigh 200g and place the sample in paper bag and put in an oven at 80 degree centigrade for 72 hours. Offer constant weight for the sample calculates the dry matter.

Dry matter=dry weight/fresh weight X 100

Protein content

The nitrogen content of the potato sample was determined by Kjeldahl method as stated in the AACC (2000) Method 46-11. One gram ground sample were measured and transferred into completely dry kjeldhal flask. Ten gram of kjeldhal tablet was added to the sample inside the flask. Twenty milliliter of 98% concentrated sulphuric acid was mixed with the sample. The sample digestion was started by connecting the kjeldhal flasks with the digestion rock. The digestion was completed when the brown color of the sample was completely disappeared. After the digested sample was cooled, 50 ml of distilled water and 40 ml of sodium hydroxide (32%) were added and distilled into 25 ml of boric acid containing 0.5 ml of screened indicator. The distillate was titrated with 0.1N hydrochloric acid to the pink end point.

Total nitrogen = $\frac{(T-B)x0.1401}{W}$

W is weight of the sample taken for analysis

T is volume of HCl used for titration

B is blank used as control

Crude protein (CP%) = N*6.25

Fat content by Nuclear magnetic resonance spectrophotometer (NMR)

Twenty two gram of the grind sample measured and dry in to oven at 105 Degree centigrade for two hours and cool in adissicator for 30 minute. After cooling the tube were inserted in to NMR and directly measure the fat content.

Mineral content

Potato mineral contents of Ca, Fe, Na, K and Zn were determined using Atomic Absorption Spectrometer by (A.O.A.C, 1984) method.

Sample preparation for Atomic Absorption spectroscopy (AAS) – (AOAC,1984)

Zero point five(0.5) gram of grinded potato samples was weighed. The samples were ashed at 550 degree centigrade for 3hrs in muffulefurnace. After cooling the ashed sample was mixed with 2.5ml distilled water and 2.5 ml conc.HCL.the digested sample were filtered and marked with 100ml volumetric flask. The aliquot were measured using AAS

Concentration (minerals in mg/100g) = concentration reading by AAS X dilution factor X 10/ weight of sample

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4. POTATO FOOD PRODUCT PREPARATION

Potato food products were prepared according to (CIP, 2007)

Chips Making

The tubes were cuted perpendicular to the long axis and take three 0.5 mm slices from the central part of each half. Rinse the slices in water and shake the water of slices and allow to dry. Fry the slices in oil 180 degree centigrade until the oil stops bubbling (3minute) and evaluate the color of the potato chips from the standard color chart.

French Fries

The tubers were hand peeled and cuted long wise using hand operated chip cutter producing 12mm X 12mm strips in cross section. The cut strips washed to remove surface starch.the strips were pre fried at 193 degree centigrade for 1 minute fried after wards at the same temperature for two additional minute.

Cooked potato

The tubers were placed tuber in boiling water until a pin or probe penetrate the tissue and keep it with aluminum foil to present the panelist.

Data analysis:

Data were subjected to analysis of variance (ANOVA) and means separated by the Least Significant Difference test using (SPSS version 23).

5. RESULT

From west Shewa potato growing area Jeldu district and Wolmera district total of 30 sampled farmers were interviewed based on the process ability(cooking time, frying and oil absorption) and food preference (taste, color) for the potato variety according to these the dominant variety's were Gudena,Jalena ,Belete and Chala .

Table 1: Farmers preference on the process ability (cooking time, frying and oil absorption) and food preference (taste, color) for the potato variety

variety	Process ability and Food preferences (%)
1.Gudena	92
2.Jalena	72
3.Belete	60
4.Chala	25

Table 2: Macronutrients (Moisture content, Dry matter content, protein and Fat Content in %) of popular potato popular variety west Shewa, Ethiopia.

Variety	Macro nutrients			
	Water content	DM	protein	Fat
1.Gudena	77.00 ±1.15^{a}	23 ± 1.15^{b}	12.84 ± 1.86^{a}	0.75 ± 0.45^{b}
2.Belete	76 ± 1.00^{b}	24 ± 2.0^{ab}	5.35 ± 2.98^{b}	0.25 ± 0.00^{b}
3.Jalena	77 ± 1.02^{b}	23 ± 1.02^{ab}	7.09 ± 1.45^{b}	0.91 ± 0.38^{ab}
4.Chala	76.00 ± 2.82a^{b}	24 ± 2.82^{a}	6.83 ± 1.05^{b}	1.00 ± 0.00^{a}

Table 3: Micronutrients (Zinc content, Iron content, Calcium Content ,Potassium and Sodium content in mg/100g) of popular potato variety west Shewa, Ethiopia.

Variety	**Micro nutrients**				
	Zn(**mg/100g)**	Fe(**mg/100g)**	Ca(**mg/100g)**	K(**mg/100g)**	Na(**mg/100g)**
1.Gudena	5.00 ± 1.41	49 ± 1.84	13 ± 1.22	2334.5 ± 3.27^{a}	5.5 ± 2.64
2.Belete	5.33 ± 1.52	36.33 ± 2.4	18.33 ± 1.05	1013.3 ± 1.23^{b}	33.3 ± 4.19
3.Jalena	6.0 ± 0.00	34.33 ± 1.5	23.33 ± 1.05	857.3 ± 1.12^{b}	33.66 ± 3.73
4.Chala	4.5 ± 0.70	40.0 ± 1.21	24.0 ± 2.8	360 ±14.1^{b}	25.00 ± 3.1
Recommended daily Intake	5.5	18	2.2	18	0.8

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The dry matter content between the variety were significant different. The dry Matter content of Belete were the highest compared to the popular variety Gudena,Jalena and Chala .The range of dry matter content were from 23-24 % which falls in the recommended level (>20%) for chips and French fries processing (Kabira and lemaga.,2006).

The protein content

The variety had significantly (P<0.05) effect on crude protein content of raw tubers ranging from Belete (5.35%) to Gudena(12.84 %). Gudena variety had highest protein content (12.84%) compared to the other variety.It is also comparable protein content of that of cereals barley (12.3) and wheat (11.3%).This is in Agreement with the finding of (George et al.,2009) and The potato protein was closely comparable with that of the cereals such as corn,rice and sourgum reported by (Augustin *et al*.,1979).The fat content of Jalena were higher than Belete ,chala and have comparable result with Gudena variety.

Micro nutrients

Zinc-the levels of zinc not differed significantly at(P<0.05) among the variety in the raw tubers .the level ranged from chala (4.5mg/100g) to Jalena(6mg/100g) the level of zinc in the study compares well with those (George et al.,2009).

Iron –iron level not differed significantly (p<0.05) among the variety in raw tubers ranged from (Chala)34.33 mg/100g to 49mg/100g(Gudena). The iron content of Gudena were higher compared to the other variety.

Potasium – the level of potassium differed significantly (P<0.05) among the variety.the raw tubers had high amount of potassium content ranging from Chala (360mg/100g) to Gudena (2334.5mg/100g).the variety Gudena having highest level(2334.5mg/100g) while clone Chala (360mg/100g) had the lowest potassium content. This level compares to those documented by (Burton.,1989).

Sodium- the sodium level in raw tubers ranged from 5.5mg/100g-33.6mg/100g .the highest were for Jalena while the lowest were for Gudena.over all Gudena variety were better in iron content (49mg/100g), Jalena were higher zinc (6mg/100g) and Chala were higher in calcium (24mg/100g).Gudena and Jalena rich in micro nutrients especially in iron,zinc,calcium and Sodium compared to the other variety.

Sensory Evaluation of Boiled and fried potato variety

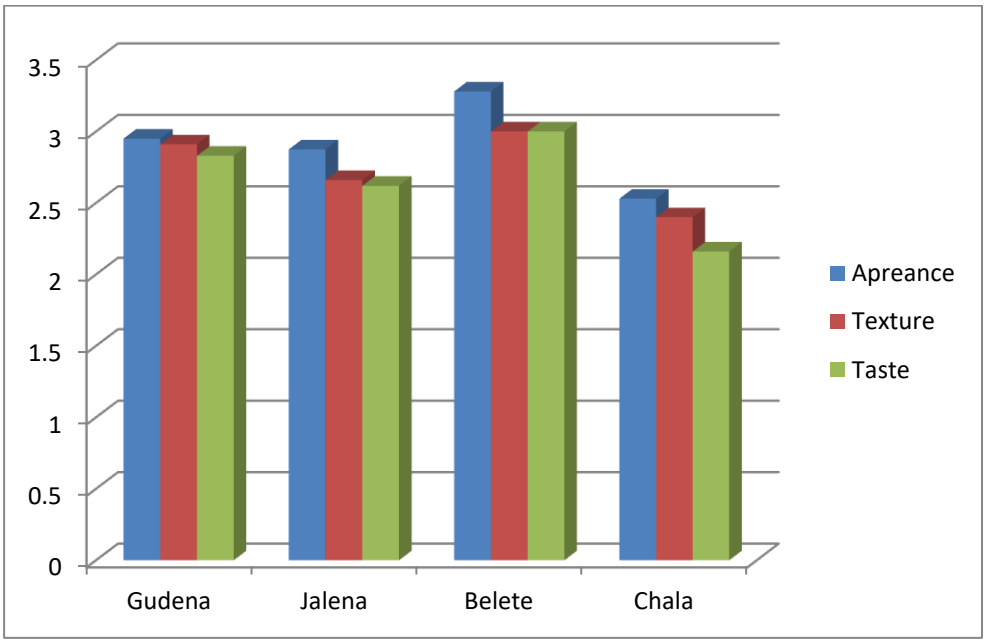

Fig 1. Potato Food Product Evaluation, Cooked potato Result using Five point Hedonic Scale and 12 panalists.

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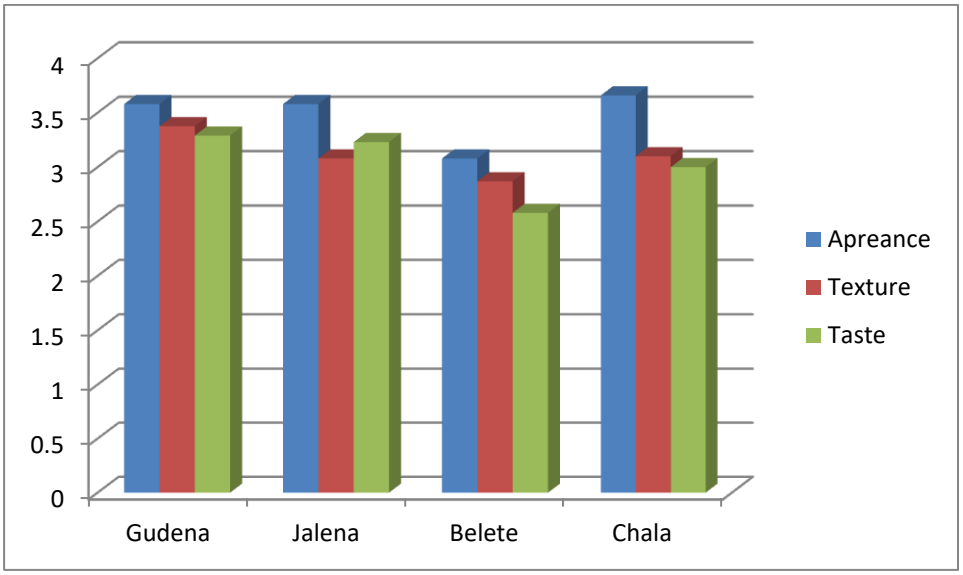

Fig 2. Potato Food Product Evaluation, Chips Result using Five point Hedonic Scale and 12 panelists.

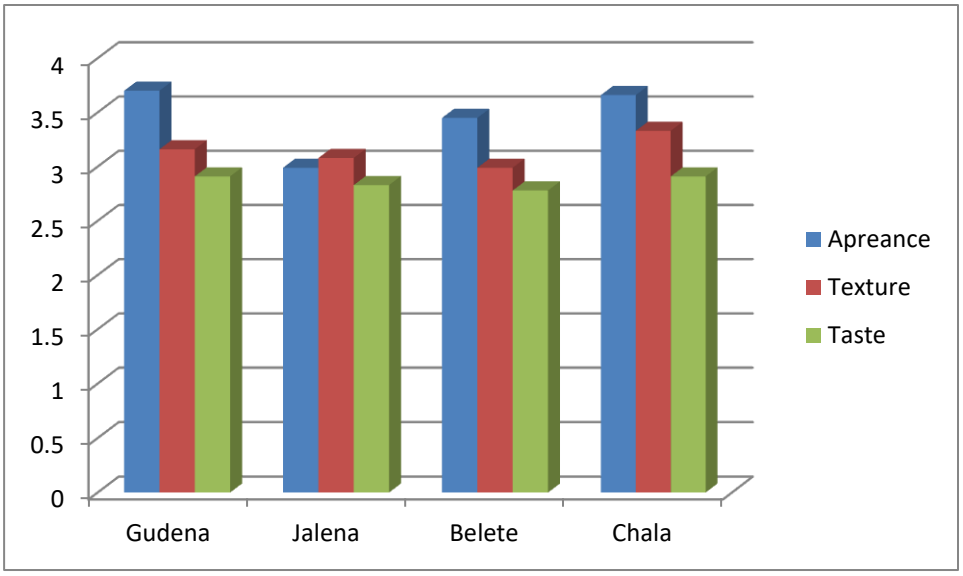

Fig 3. Potato Food Product Evaluation, French Fries Result using Five point Hedonic Scale and 12 panelists.

6. SENSORY EVALUATION

Boiled potato, chips and French fries

A panel of evaluators comprising untrained twelve panelist participated in evaluation of organoleptic quality of the boiled and fryed potato.Belete were the most preferred clones by the panelist for the boiled potato apreance among the other variety Fig(1,2,3).According to the panelist pereception clone Gudena were preferred for taste in all boiled and fryed forms chips and French fries Fig(1,2,3).this result compares with the study done by (Asefaw et al.,2018)

7. CONCLUSION

The nutrient profiling and organoleptic results showed that significant variation among the popular varieties. Gudena were superior in protein, iron and potassium as well as in organoleptic traits taste were preferred. Whereas Jalena were highest in zinc content. Belete were the preferred apreance which is suitable for processing in to French fries and chips. By including the varieties Gudena and Jalena in the daily meal malnutrition problem especially Micro nutrients iron, zinc ,potassium and calcium can be solved.

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