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Nutritional Situation of Potato (Alpha) Subjected to Sudanese Cooking Methods

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Abstract: The present study was conducted to evaluate the nutritive value of potato(alpha variety) which was subjected to three different cooking methods (boiling, frying and Sudanese home cooking style , stew). Proximate analysis, minerals, amino acids content and sensory evaluation were determined. Protein was found to decrease insignificantly by boiling. While frying caused a significant increase in protein. However stew has higher significant increase in protein content. On other hand stew caused a significant increase in ash, fat and fiber, while high significant increase in fat was caused by frying. CHO showed a significant decrease in stew and by boiling, however, frying showed a significant increase in CHO. With regard to starch significant decrease was obtained by boiling and stew while significantly increased by frying. Generally speaking boiling was found to decrease insignificantly the amount of Na and Ca, while significantly decreased K, P and Mg and increased insignificantly the Fe. Amino acid, argnine and methionine were destructed by the three methods of cooking. Some amino acids were variably destructed by the different methods.All other amino acids were decreased by the three methods of cooking. Sensory evaluation showed that the texture was not significantly affected by the three methods of cooking. No significant difference was observed in flavor, color, taste and over all quality in stew and fried potato.

Key words: Potato (alpha), cooking (Sudanese style), nutritive value, sensory.

INTRODUCTION

The potato (*Solanum tuberosum*) is widely grown in the world and ranks fourth in food production, after wheat, maize and rice. It is the top of the root crops followed by cassava, sweet potato and yams. Potato does better than rice and wheat as edible energy source [11].

Potato was apparently introduced by the British to the Sudan in early twentieth century [6]. Fresh potatoes for human consumption is important in developed and developing countries, which account for 60 – over 80% of total national out put [7].

Potatoes are an economical food since they provide a cheap source of available energy to the human diet [1].

Again potatoes are good source of vitamins and minerals. Cooking is an essential process to improve the digestibility of starchy vegetables including potato [9]. The composition and nutrient contents of potato products vary depending on the method of cooking used. The most widely used methods of cooking are boiling, steaming, pressure cooking, baking and frying. Few years ago, microwave kicked off to be used for the purpose of cooking. In Sudan potato is usually cooked by boiling, frying and in form of stew.

The aim of this study was to evaluate the effect of three Sudanese methods of cooking on the nutritive value of potato (alpha) and its acceptability to consumer.

MATERIALS AND METHODS

Materials: The potato was purchased from the local market one day before preparation and cooking. Sun flower oil, meat, salt, pepper, garlic, onion and tomato paste were purchased from the local market as well.

Experimental:

Stew Process: The stew was made according to the traditional method usually employed by the Sudanese households. In a sauce pan 190 g of oil were heated for about 2 minutes, then 680g chopped onion were agitated in the hot oil for 7minutes and then 292g of meat were added and agitated with the onion, then 26g of salt were added to the mixture and water of 512ml

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was added as well .After about 15 minutes 30g of tomato paste were added to the pan. After the tomato paste become consistent with the other ingredients, 1246g of peeled potato cubes were added and agitated with the mixture. More water of about 768ml was added, then the mixture was left until completely cooked for about 33 minutes.

Two grams of hot pepper and 14g of smashed garlic were added to the mixture and left on the fire for further 5 minutes and then the stew is ready for consumption.

Frying Process: Frying process was done in a frying pot as follows: Amount of 1.28ml oil was heated to about 180^0c, then 3 00 g of peeled potato slices were added and left for about 9minutes before they were removed from the hot oil.

Boiling Process: Boiling was done in a sauce pan as follows: About 1.5 kg potato tubers were washed and put in the pan and then 1.024ml water was added. The process was done at 90^0c for about 35 minutes.

Chemical analyses: The moisture content, crude protein content, fat content, ash content and fiber content were determined according to AOAC[4]. The total carbohydrates, were calculated by substracting the sum of fat, protein, moisture and ash contents from 100 as described by West *et al* [17]. The starch was determined according to AOAC [2].

The minerals (Na, K, Mg, Ca and Fe) were determined by Perkin- Elmer 3110 atomic absorption spectrophotometer. Phosphorous was determined by vandatemoly bdate yellow method according to AOAC [3].

Amino acids values were determined according to Sykam procedure in Saba Central Laboratory, South Khartoum, Sudan.

The profile of samples was performed with wave length fluorescence detector at excitation and emission wave length of 440 to 570 nm.

Organoleptic Evaluation: The three potato products were assed organoleptically by fifteen panelists who scored on five point hedonic scale [16].

Statistical analysis: The analysis of variance was performed to examine the significant effect in all measured parameters. Means were tested by analysis of variance (ANOVA). Ducan Multiple Range (DMR) test was used to separate the mean write the two ref. in the following form [5,13].

RESULTS AND DISSCUSSION

Proximate Analysis: Table 1. shows the proximate analysis results. The fried potato showed a significant decrease in moisture content (16.67%) and this almost agrees with the results obtained by Talburt and Smith [14] who showed a decrease of 20%. Boiling showed a significant increase in moisture content (4.33%) and this fairly agrees with the findings obtained by Talburt and Smith [14] (3.00%) while Kala and Prakash[12] reported a decrease of only 0.5%. However, stew showed an insignificant decrease in moisture content (1.17%).

The protein content decreased insignificantly by boiling (1.60 to 1.40%). Kala and Prakash[12] reported a decrease from 1.95 to 1.84%. FAO[8] mentioned that boiling reduced protein content of potato. In contrast, frying caused a significant increase in protein (1.60 to 2.60%). Talburt and Smith [14] found a range of 1-2% of fried potato and FAO[8] stated a reduction in potato protein by frying. Stew has the highest significant increase in protein content (1.60 to 3.16%) compared to other methods of cooking and this is acceptable since meat is added in stew making.

The fat content showed insignificant decrease by boiling and significant increase by the other two methods of cooking especially by frying method. These findings are consistent with those reported by Talburt and Smith,[14] surprisingly Kala an Prakash [12] found that fat content showed a slight increase after boiling.

Boiling increased slightly the fiber content and this agrees with Varo *et al*. [15] and Kala and Prakash [12]who showed that boiling caused an insignificant increase in fiber content. Frying caused no change, while stew caused a significant increase in fiber content. FAO [8] reported that both boiling and frying of potato reduced the fiber.

CHO content significantly decreased by boiling and stew while frying increased it. Starch decreased significantly by boiling and stew making while frying caused significant increase in starch content. The reduction of starch is attributed to the swelling and starch molecules by water.

As shown in Table 1 ash content decreased insignificantly by boiling (0.83 to 0.50%). Kala and Prakash [12] reported that boiling did not cause any significant decrease in ash content (0.78 to 0.73%). On other hand frying and stew caused a significant increase in ash content (0.83 to 1.25%and 0.83 to 3.83%, respectively). These results do not agree with those obtained by Kala and Prakash [12] who reported that cooking did not cause any significant difference in minerals content.

Minerals Content: Table 2 shows the effect of cooking of potato on minerals content (mg/100g).The six major elements determined (Ca, Na, K, P, Mg and Fe) increased significantly in stew and decreased significantly except Fe which increased significantly by boiling.

On other hand frying decreased significantly four elements (Na, K, P and Mg) and increased the other two (Ca and Fe). These results are in agreement with those obtained by Kala and Prakash [12] and FAO [8] who reported that frying significantly reduced mineral content.

Amino Acids Content: As shown in Table 3 some of the amino acids were destructed variably by the different methods of cooking. For instant boiling destructed lysine, phenylalanine,arginine, methionine and tyrosine, while frying destructed lycine,arginine,methionine and tyrosine. Stew only destructed arginine and added alanine which was not detected in the raw potato. Tryptophan was not detected in all samples (raw, stew, fried and boiled).

Findings of Talburt and Smith [14]of valine and isoleucine of fried potato compare favourably with the present study. Golazewska and zalewski[10] found that the best quality of potato was achieved by dry cooking.

Sensory Evaluation: The scores of sensory evaluation of potato samples cooked by different methods are shown in Table 4. No significant difference was recorded in colour, flavour, taste, texture and overall quality between fried potato and potato stew.

On other hand boiled potato was found to be significantly different in all parameters of sensory evaluation except texture compared to the other two methods. However, boiled potato scored the highest values in all parameters.

Conclusion: From this study one can conclude that:
1/ The potato stew (typical Sudanese style of cooking) gave the higher nutritive value compared to the other two types of cooking (frying and boiling).
2/ The boiled potato was the most preferred by the panelists.

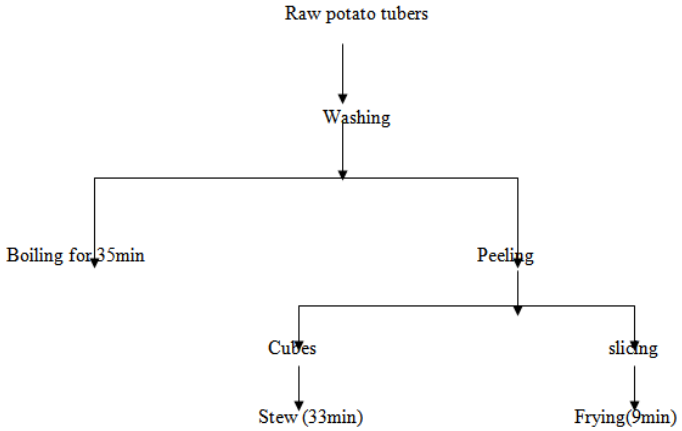

Fig. 1: potato preparation for cooking.

Table 1: Chemical composition (%) of whole raw and cooked potato (alpha variety).

Sample	Moisture	D.M.	Ash	Protein	Fat	Fiber	COH	Starch
Raw	75.17^{b}	24.83^{b}	0.83^{c}	1.60^{c}	0.50^{b}	0.43^{b}	21.47^{b}	12.39^{b}
Fried	58.50^{c}	41.50^{a}	1.25^{b}	2.60^{b}	6.20^{d}	0.43^{b}	31.02^{a}	17.07^{a}
Boiled	79.50^{a}	20.50^{c}	0.50^{c}	1.40^{c}	0.37^{b}	0.53^{c}	17.70^{c}	10.33^{b}
Stew	74.00^{b}	26.00^{b}	3.83^{c}	3.16^{b}	2.43^{a}	0.80^{a}	15.78^{d}	7.55^{c}

DM: Dry matter.
COH :Total carbohydrates.
Values with same letter in the same column are not significantly different at level ($p \leq 0.05$).

Table 2:. Minerals content (mg/100g) of whole raw and cooked potato (alpha variety).

Minerals	Raw	Fried	Boiled	Stew
Calcium	16.67[b]	26.67[ab]	13.33[b]	36.67[a]
Sodium	24.67[b]	3.33[c]	10.33[b]	35.00[a]
Potassium	433.00[a]	317[b]	200[c]	437[a]
Phosphour	48.97[b]	44.00[c]	45.67[c]	60.00[a]
Magnesium	34.67[b]	23.00[d]	26.67[c]	36.00[a]
Iron	1.76[b]	1.85[ab]	1.86[ab]	2.00[a]

Values with same letter in the same row are significantly different at level (($p \leq 0.05$).

Table 3: Amino acids content (mg/100g)of raw and cooked potato (alpha variety).

Amino Acids	Raw	Stew sample	Fired sample	Boiled
Lysine	56.39	1.496	nd	nd
Leucine	124.23	38.26	2.79	1.6
Isoleucine	79	31.86	2.17	1.8
Thereonine	62.9	6.62	0.798	0.226
Phenylalanine	114	21.8	0.53	nd
Tryptophan	nd	nd	nd	nd
Valine	180	5.15	3.03	2.7
Arginine	82.08	nd	nd	nd
Histindine	32.25	4.68	1.71	1.2
Metnionine	22.68	nd	nd	nd
Aspartic Acid	495	8.21	7.9	5.15
Serine	32.3	1.59	0.43	0.097
Glutamine	280	26.7	1.159	0.780
Glycine	82.63	10.33	3.42	2.77
Tyrosine	46.18	5.26	nd	nd
Alanine	nd	3.395	nd	nd

nd = not detected

Table 4: Organopepptic quality of alpha variety products:

Sample	Colour	Flavour	Taste	Texture	Over all quality
Potato stew	1.60[b]	1.87[b]	1.53[b]	127[a]	1.60[b]
Fried potato	1.53[b]	1.93[b]	1.23[b]	1.33[a]	1.73[b]
Boiled potato	2.60[a]	2.93[a]	3.13[a]	1.53[a]	2.73[a]

Values with same letter in the same column are not significantly different at level (($p \leq 0.05$).

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