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EFFECT OF GERMINATION ON THE QUALITY AND ACCEPTABILITY OF FINGER MILLET PAP

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ABSTRACT

The effect of germination on the proximate, antinutrients and sensory attributes of finger milet pap was investigated. Finger millet pap was produced from germinated and non-germinated finger millet grains. Proximate composition, anti-nutrient content and sensory evaluation were carried out using standard laboratory procedures. Finger millet grains were sorted to remove dirt, washed and sprouted for 24hous and 48hours respectively. The finger millet grains were wet milled sieved and the slurry was allowed to settle after which water was decanted. The result for proximate composition of germinated finger millet pap showed that protein, fat, dry matter, and energy value increased significantly ($p \leq 0.05$) with increase in germination i.175%, 42.89%-51.47% respectively while the carbohydrate and crude fibre decreased . The anti nutrient contents

Introduction:

Finger millet (Eleusine coracana L.) belongs to the family of small millets, meaning small grained cereals. It is the staple food of the millions inhabiting the arid and semi-arid tropics of the world. The grains of finger millet being nutritionally superior to rice and water provide cheap proteins, minerals and vitamins to poorest of the poor where the need for such ingredient is the demanded. Finger millet is also known as 'ragi''nagli' in Indian and birds food millet, coracana millet and African millet in Africa. (Malleshi, 2006).

Finger millet has excellent nutritional value and contains 6% to 15% 0f protein 1% to 17% fat, starch 65% to 75% minerals and dietary fibre

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were similar as phytate, alkaloid, oxalate and cyanide decreased significantly ($p \leq 0.05$) with increase in germination time. The result for Sensory evaluation of germinated finger millet pap showed decrease with increase in germination time in all attributes evaluated such as taste, mouth feel, appearance and overall acceptability. values ranged from 6.280%-5.786%, 6.357%-6.143%, 6.786%-6.429% and 7.389%-7.286 respectively.sample A was most preferred in all the sensory attributes evaluated.

Keywords: *Germination, Quality, Acceptability, Finger Millet Pap*

18% to 20%. Its proximate composition is similar to wheat, maize, sorghum and rice with regard to dietary fibre, calcium and few micronutrients. The seed coat of this millet is a rich source of phenolic compounds minerals and dietary fibre (Shobana *et al.*, 2007).

Pap or "ogi" is a local generic name for a semi solid food made from cereals (commonly millet, maize, and sorghum).It is also refered to as a fermented cereal pudding traditionally prepared from maize sorghum or millet(Akabi and Hoonhourgan, 2003). The amount of water in the preparation determines the final viscosity. (Ash worth and Wraper 2002). It is a staple food in most African countries (Nago *et al.*, 2008). It is often taken by nursing mothers as it stimulates breast milk production, personal observation shows this is due to the fact that it has higher heat capacity than ordinary water while also supplying energy and nutrients. Medical personnels do recommend it for sick people because it is light in the stomach and easy to digest (Sanni *et al.*, 2001).

Germination of seeds is usually done to improve taste and nutritional value. It is also done to reduce the phytic acid and tannin contents by 88.8%and 90.1% respectively, with an increase of 61.5% minerals, reducing sugar, and soluble proteins thereby supporting the production of more nutrients(Ajani,2003).Germination has also been reported to improve protein from 6% to 16% in germinated preparations and increase lysine to more than 50percent(Ego-Untely *et al.*, 2002). It is commonly recommended to add nutrients to weaning gruels (Ajani, 2003).

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Attempts have been made to improve the nutritional value of ogi by fortifying it with either plant protein (melon, okra, cowpea and soyabeans) or animal protein source (egg and milk). (Ogori et al., 2020) In this study,finger millet seeds will be germinated to produce pap which will be evaluated for it's proximate, antinutrients and sensory attributes.

Justification for the Study

The beneficial effects of germination are reflected in terms of increased bioavailability of nutrients, lowing of anti-nutrient concentration and improving the texture of foods(Shobana *et al.,* 2013).

Aim and Objectives

Aim

The aim of the study is to investigate the effect of germination on the quality and acceptability of finger millet pap.

Objectives.

1. To produce finger millet pap from germinated and non-germinated finger millet seeds.
2. To determine the proximate composition and anti-nutrients of finger millet (germinated and non-germinated) pap.
3. To evaluate the sensory properties of the pap produced from germinated and non-germinated finger millet grains.

MATERIALS AND METHOD

Materials Used

The material that was used is finger millet grains. Other equipment's and utensils includes jute bag, bowl, milling machine(attrition mill) and muslin cloth.

Sample Collection.

The finger millet grains were purchased at Katsiina central market in Katsina state,Nigeria.

Sample Production

Preparation of Germinated Finger Millet Pap.

Finger millet grains(samples) were sorted to remove foreign materials and washed with water. Samples were poured inside a jute bag and water was subsequently sprinkled every 4 hours for 24and 48 hours respectively at room temperature. The sample was subsequently decanted and wet milled with attrition milling machine and sieve with a muslin cloth. The slurry was allowed to settle for 24hours after which the water was decanted.

Preparation of Non Germinated Finger Millet Pap.

Finger millet grains were sorted to remove dirts, washed, soaked for 24hours and rinsed .The finger millet grains were wet milled to smooth paste and sieved with a muslin cloth . The slurry was allowed to settle for 24hours after which the water was decanted.
Sorting

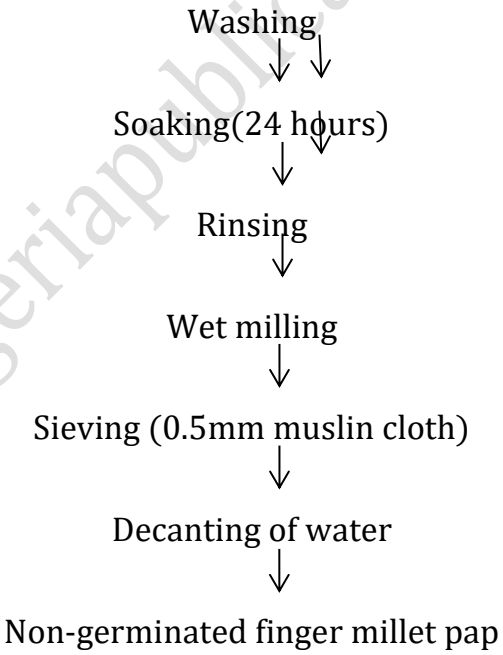

Fig 1: Flow chart for production of pap from non-germinated finger millet (Teniola and Odunfa, 2006)

Proximate Analysis

The proximate composition such as moisture content, crude fibre, crude fat ash content was determined according to the method described by (AOAC, 2005) while carbohydrate was determined by difference (AOAC, 1995).

Anti-nutrient Analysis

Phytate, Oxalates, Flavonoid and Cyanide was determined according to method described by Young and Greaves, (2004). Tannins was determined according to method described by Bradford, (2006) while alkaloid was determined according to the method described by Harbored, (2001).

Sensory Evaluation.

Taste, colour, mouth feel, Aroma, Appearance, and overall acceptability were evaluated by twenty semi-trained panelis as described by Larmond (2004). A nine point hedonic scale was used. The panel members consisted of both staff and students of the polytechnic community.

Statistical Analysis

Data was subjected to analysis of variance (ANOVA) and Duncan Multiple Range Test (DMRT)was used to seperate means.

RESULTS AND DISCUSSION

Table 1: Proximate Analysis of Finger Millet Pap

	SAMPLES		
Parameters	A	B	C
Dry matter %	$5.989^{a} \pm 0.01$	$8.775^{a} \pm 0.011$	$11.175^{b} \pm 0.011$
Moisture %	$94.01^{a} \pm 0.01$	$93.23^{ab} \pm 0.12$	$93.47^{c} \pm 0.14$
Ash %	$0.150^{a} \pm 0.00$	$0.190^{a} \pm 0.00$	$0.255^{a} \pm 0.01$
Crude fat %	$0.615^{c} \pm 0.01$	$1.595^{a} \pm 0.01$	$1.760^{a} \pm 0.04$
Crude protein %	$2.883^{a} \pm 0.01$	$3.417^{a} \pm 0.01$	$36.83^{a} \pm 0.01$
Crude fibre %	$0.533^{ab} \pm 0.01$	$0.060^{b} \pm 0.02$	$0.0445^{a} \pm 0.04$
Carbohydrates %	$2.17^{a} \pm 0.01$	$1.241^{a} \pm 0.1$	1.00^{b} 0.00
Energy value K/Cal.	$27.712^{c} \pm 0.302$	$42.89^{b} \pm 0.24$	$51.47^{a} \pm 0.50$

Values are means of ± SE of duplicate determinations.Means along the rows followed by different super subscripts are significantly different ($p \leq 0.05$).

Keys

A = Non Germinated Finger Millet Pap (Control Sample)

B = Germinated (24hours) finger millet pap

C = Germinated (48hours) Finger Millet Pap.

Table 2: Anti Nutrient Content of Finger Millet Pap

Parameters	SAMPLES A	B	C
Tannin %	$1.026^{a} \pm 0.01$	$0.0145^{a} \pm 0.08$	$0.0127^{a} \pm 0.01$
Phytate %	$0.0700^{a} \pm 0.02$	$0.0545^{b} \pm 0.01$	$0.0525^{b} \pm 0.01$
Flavonoid %	$1.32^{a} \pm 0.03$	$1.23^{a} \pm 0.75$	$1.007^{b} \pm 0.00$
Alkaloid %	$0.051^{a} \pm 0.01$	$0.0465^{b} \pm 0.01$	$0.0435^{b} \pm 0.01$
Oxalate Mg	$2.665^{a} \pm 0.01$	2.300^{b} 0.00	$1.2615^{b} \pm 0.02$
Cyanide Mg/L.	$18.875^{a} \pm 0.05$	$11.63^{b} \pm 0.02$	$11.030^{c} \pm 0.01$

Values are means ± SE of duplicate determinations. Means along the rows followed by different superscript are significantly different ($p \leq 0.05$)

Keys:

A = Non Germinated Finger Millet Pap (Control Sample)

B = Germinated (24 Hours) Finger Millet Pap

C = Germinated (48n Hours) Finger Millet Pap

Table 3: Sensory Evaluation of Finger Millet Pap

Parameters	Samples A	B	C
Taste	$6.78^{a} \pm 0.03$	$6.280^{a} \pm 0.30$	$50786^{a} \pm 0.01$
Mouth feel	$7.357^{a} \pm 0.20$	$6.357^{a} \pm 0.03$	$6.143^{a} \pm 0.01$

Appearance	$7.286^{a} \pm 0.30.$	$6.786^{a} \pm 0.30$	$6.429^{a} \pm 0.22$
Overall Acceptability	$7.5714^{a} \pm 0.35$	$7.386^{a} \pm 0.30$	$7.286^{a} \pm 0.30$

Values are means ± SE of duplicate determinations Means along the rows followed by the same superscript are not significantly different ($p \geq 0.05$).

Keys:

A = Non Germinated Finger Millet Pap

B = Germinated (24 hours) Finger Millet Pap

C = Germinated (48hours) Finger Millet Pap

Discussion

Proximate Composition Of Finger Millet Pap

The moisture content reduced significantly ($P \leq 0.05$) in germinated finger millet pap. This could be attributed due to the high activity of catabolic enzymes during germination(Marwins et al., 2011) The result is however similar to the findings of (Inyang and Idoko,(2006).

Presence of ash is an indication that minerals are present in a food. The ash content increased without significant differences ($p \geq 0.05$) from 0.015%-0.255% with increase in germination time. This finding is similar to the report by Ajani, (2003). The result of this study is slightly different from the findings of Nnam,(2000) which reported that values of ash ranged between 0.75-0.85 in complementary food prepared with germinated finger millet.

Total protein percentage in non-germinated finger millet pap was 2.883 but in germinated finger millet pap it increased to 3.417 and 3.653 for 24hours and 48hours respectively. The increase was significant ($p \leq 0.05$) with increase in germination time. These results were however comparable with findings of other researchers (Mbithi-Mwikya *et al.,* 2000, Swami *et al.,* 2013) Singh and Raghuvanshi (2012) also observed around 30 % increase in the available protein of finger millet after four days of germination at room temperature. Swami *et al.,* (2013) reported a linear increase in the available protein content of finger millet grains that were germinated up to 24hrs. In their study, protein availability enhanced from the initial 14 % up to the final 17.5 %. In the present study, a similar positive relationship between crude protein availability and germination

duration was observed. The physical mechanisms and bio-chemical reactions that explain the observed increase in bio-availability of protein content during germination process are strongly associated with the morphology of the finger millet seed. The finger millet, endosperm represents the largest portion of the grain, which consists of an aleurone layer and three distinct starchy sections: the peripheral, corneous, and floury endosperms. Peripheral endosperm contains small and tightly packed cells of protein bodies that are embeded in fiber-starch-protein matrices. Corneous is the largest portion of the endosperm containing predominantly protein (Mbithi-Mwikya et al., 2001)

Finger millet is a rich source of carbohydrate (Malleshi *et al.,* 2006). In this study the carbohydrate significantly($P<0.05$) reduced from 1.24%-1.00% with increase in germination time from 24hours to 48hours. This could be as a result of loss during germination as reported by Mostaga et al,(2002) where it was also stated that simple sugar, low molecular weight oligosaccharides and starch are quickly consumed in the metabolic processes during germination. The values obtained in this research were however related to the investigation of Ajani,(2002) which reported values ranging from 2.06%-1.04%.

The fat increased significantly ($p\leq0.05$) from 1.595%-1.760% with increase in germination time. This result is consistent with the findings of Hamad and Field (1979) which showed that total fat notably increased by about 4.5 fold during germination of finger millet. The increase may be associated to the activation of some enzymes during germination which consequently enhanced fat hydrolysis. The enzymes break down the fat into smaller pieces and fatty acid groups(Vidsyavathi *et al.,*2003).

Crude fibre in food is an indication of the level of non-digestible carbohydrate and ligins and it's presence has an important function in providing roughages that softens stool in the body(Inyang and Idoko 2006). The crude fibre percentage decreased significantly ($p\leq0.05$) from 0.060-0.0445 with increase in germination time. This could be attributed to the sprouting of the finger millet seeds. Although crude fibre enhances digestibility, it's presence in high levels can decreased nutrient utilization (Oladiji *et al.,*2005).

The energy value for germinated finger millet pap varied from 27.712%_51.47% indicating significant ($p \leq 0.05$) increase with increase in germination time. The values obtained from this research were similar to the findings of Jones *et al.,* (2000).

Anti-content of Finger Millet Pap.

The tannins of non-germinated finger millet pap was 1.026% . It decreased without significant differences ($p \geq 0.05$) in germinated finger millet(24hours and 48hours) pap .This result is consistent with (Mbithimwikya *et al.*, 2009) which stated that sprouting of finger millet grains resulted in lowering of tannin and trypsin inhibitor activity.

The phytate decreased significantly ($p \leq 0.05$) from non-germinated to germinated finger millet. The values obtained however were comparable to the investigation of (Mbithi-Mwikya *et al.,* 2001) who reported that germination of finger millet grain resulted in lowering of phytate content which range from 0.03% and 0.25%.

It was observed that the germination significantly reduced ($p \leq 0.05$) the flavonoid content of finger millet pap. The values compared favorably with the findings of Akinhanme *et al.,* 2008) which that reported sprouting of finger millet for a limited period caused decrease in dry matter, starch and flavonoid contents.

Oxalate content of finger millet pap decreased significantly ($p \leq 0.05$)with increase in germination time. Values ranged from 2.300%-1.2615%. which was similar to the report by Chung *et al.,* (2001).

The cyanide for germinated finger millet varied from 11.630% to 11.030% indicating significanct decrease ($p \leq 0.05$) with increase in germination time. This value obtained from this study were however similar to the investigation of Mittali *et al.,* 2013).

The alkaloid for finger millet pap ranged between 0.051%-0.0435% indicating significant decrease ($p \leq 0.05$) as germination time increased. The values obtained from the research work were similar to the findings of Traore *et al.,* (2004) which reported that germination significantly reduced alkaloid percentage.

Sensory Evaluation of Finger Millet Pap

Finger millet pap samples showed no significance difference ($p \geq 0.05$) with regard to taste, mouth feel, appearance and overall acceptability. However pap from non-germinated finger millet was the most preferred with a score of 7.5714 on the 9 point hedonic scale.The scores obtained were similar to the findings of Akanbi and Hounhourgan (2003).

CONCLUSION AND RECOMMENDATIONS

Conclusion

Finger millet pap was successfully produced from germinated (24hours and 48hours) and non-germinated finger millet grains.

The proximate composition showed similarities as there was significant increase in protein, energy value, and fat of germinated finger millet pap and decrease in carbonhydrate, moisture, ash and crude fibre.

The anti-nutrient composition were also similar as the phytate, tannin, cyanide, oxalate, alkaloid, and flavonoid decreased significantly($P<0.05$) with increase in germination time.

Similarities were observed from finger millet pap samples as significance differences($P<0.05$) were observed in the taste, colour, appearance, mouth feel and overall acceptability.

Recommendations.

The study recommends sample C (finger millet pap germinated for 48hours) because of its high protein and ash (mineral) contents. Subsequent research should be carried out on the functional properties and bulk properties of finger millet pap.

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