ANALYZING THE EFFECT OF OPTIMIZATION CONDITIONS OF GERMINATION ON THE PASTING PROPERTIES, RHEOLOGICAL PROPERTIES, MORPHOLOGICAL PROPERTIES AND THEIR IMPACT ON *IN VITRO* ANTIOXIDANT CHARACTERISTICS

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Running Title: **Germination and its effect on kodo millet flour properties**

Abstract
The objectives to study the effects of germination on pasting properties, rheological properties, morphological properties and in vitro antioxidant charateristics of γ-aminobutyric acid of kodo millet. Rheological analysis depicted shear thinning behaviour of flour, the frequency sweep demonstrated decrease in visco-elastic solid like character to visco-elastic fluid after germination. The results of pasting profile revealed that germination significantly reduced the pasting of Kodo millet flour and the scanning electron micrographs indicated ungerminated Kodo millet flour exhibits intact structure of starch granules. The results of pasting profile revealed that germination significantly affected the pasting properties (peak viscosity, breakdown, setback, final viscosity and pasting temperature) of Kodo millet flour. Germinated Kodo millet flour showed substantially lower peak 287 cP, breakdown 29 cP, final viscosity, 365 cP, setback 183 cP and pasting temperature 85.35 ºC than ungerminated Kodo milletflour 437, 35, 728, 326 cP and 87.45 ºC, respectively. The other in vitro antioxidant activity determination parameters such as DPPH, hydrogen peroxide scavenging activities and the metal chelating abilities increased due to overall increase in total phenolics and γ-aminobutyric acid contents. After germination, the total antioxidant power increased from 45.34 to 67.23 mg AAE / g in kodo millet. GABA yield also improved significantly in germinated kodo millet by 11.42 percent compared to ungerminated millet samples, whereas GABA content purity ranged from 9.36 mg to 47.4g/100 g in Kodo millet The result of the study of kodo millet grains extracts enables its use as an ingredient infunctional and convenience food formulations after the germination.

Keywords: Pasting properties, Rheological properties, Morphological properties, *in vitro* Antioxidant characteristics

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1. INTRODUCTION

In the world, millets are traditionally grown throughout India, Africa, and China, and they also expect a large share of the world's various developed countries ' support for security and economy. The earliest preliminary reports on millet production date back to about 5,500 BC in China (Crawford, 2006). These are essential harvests in semi-bone dry areas where there is usually little survival of distinctive vegetation. Millet postitions as the sixth most vital grain and nourishes 33% of the combination world populace. The sorghum and millet are good sourse of phenolic and antioxidant activity (Linda and Lloyd, 2006). Kodo millet is dominatingly developed in the Indian subcontinent, which is viewed as minor millet. During the germination stage, critical changes in the biochemical, dietary and tangible qualities of grains result from the debasement of save substances as they are utilized to inhale and integrate new phone parts of the seed's embryo (Danisova et al., 1995). Rao et al. (2011) expressed that the kodo millet has greatest phenolic content (10.3%) and unrefined fiber content material (14.3%) while foxtail millet has demonstrated negligible phenolics (2.5%). A few researchers have recommended that drenching, germination and additionally expulsion cooking adjust the dietary qualities of entire rice items (amino acids, lysine available, protein edibility, unsaturated fats, fiber, inositol phosphate (IPs), totalphenoliccompounds and cancer prevention agent characteristis) (Micaela Albarracín et al., 2019). γ-aminobutyric acid is a non-protein amino corrosive and is one of the essential inhibitory synapses in the focal restless framework. γ-aminobutyric acid has various physiological, dietary and supper fixing highlights. (Sharma, Saxena and Riar, 2017). Sharma et al. (2016c) repotred that dietary, tactile and in-vitro cancer prevention agent properties of glutenfree treats arranged from flour blends of developed minor millets are more prominent than glutenfree treats arranged from flour blends of crude minor millets. γ-aminobutyric acid substance was found to be more noteworthy in developed and matured dark colored rice examples than the controlled darker rice examples (Amir Hayat et al., 2015). Lee et al., 2019 recorded the effects of different germination conditions on bioactive components, cancer prevention agent action, and in vitro supplement edibility of pigeon pea and oats. In view of the writing, it is discharged that the researchers completed a little explore on the cancer prevention agent property of millets, principally minor millets. (Sharma, Saxena, and Riar, 2017) especially investigating the germination parameters (soaking time, germination time and temperature).

Study of scanning electron microscopy clearly showed that germination caused significant changes in starch's granular structure. Owuamanam et al., (2014) studied the impact of sprouting seed on minerals, anti-nutrients and flour pasting characteristics produced from certain tropical legume seeds. The final viscosity of non-sprouted flours was higher than sprouted flours, with non-sprouted cowpea recording the highest 272 RVU viscosity value, while sprouted red kidney beans displayed the lowest viscosity value of 109.06 RVU. Because of their nutritional significance including vitamins, fibre, trace elements and amino acids as well as flavonoids and phenolic acids, sprout consumption is a fresh way of nutrition in recent years, which has gained attention as functional foods (Hubner and Arendt, 2013).

In this study, the rheological properties, morphological properties, pasting properties and *in vitro* antioxidant characteristics of γ-aminobutyric acid extract were investigated after the germination of kodo millet.

2. MATERIALS AND METHODS

1.1 Ungerminated material procurement

The millet kodo (*Paspalum scrobiculatum*) was purchased from the seed focus in Hyderabad (India). The grains were washed to expel grains and pollutions that were wilted, juvenile, harmed. For further examination, the cleaned grains were put in impenetrable holders under cooled conditions.

1.2 Chemicals and reagents

All synthetic compounds, solvents and reagents utilized for investigation were of logical (AR) grade.

1.3 Selection of independent variables and response for germination of kodo millets

The three autonomous variables, for example, soaking time (St) germination (Gt) and germination temperature (GT) were chosen. The soaking time interval for millets shifted from 8-16 h. Steeped seeds were sprouted in a pilot scale seed germinator (Seed germinator Large scale logical works Pvt. Ltd. India) at various temperature ranges (19.55-46.55ºC) and time interval time (13.20-46.80 h). The time and temperature for soaking and germination conditions depended on past and primer investigations. The optimum germination of kodo millet grains was carried out as per previous work (Sharma et al., 2017).

1.4 In vitro antioxidant characteristics of ungerminated and optimized germinated kodo millets extract

1.5 Total antioxidant capacity

Thetotal antioxidant capacity of the extracts of unger minatedand germinated kodo millet flour was assessed using the phosphomolybdenum technique according to the mentioned procedureby Khan et al. (2012).

1.6 Ferrous ion chelating capabilities (Metal chelating capacity)

The chelating capacity of the extract's

ungerminated and germinated kodo millet flour was determined by the technique of Benzie and Strain, (1999).

1.7 Reducing power assay

The reducing power ungerminated and germinated kodo millet flour the extract of was determined according to the method of Yen and Duh (1993).

1.8 Extraction of γ–amino butyric acid (GABA) from kodo millet

The gamma-amino butyric acid extract was obtained from ungerminated and germinated kodo millet flour was carried out as per previous work (sharma et al., 2017).

2. The in vitro antioxidant characterstics of γ-amino butyric acid (GABA) extracts of ungerminatedand optimized kodo millets

2.1. Total antioxidant capacity of γ–amino butyric acid extract

The phosphomolybdenum method assessed the total antioxidant capacity of γ–aminobutyric acid extract of ungerminated and germinated millets by Khan et al., 2012.

2.2 Scavenging activity of hydrogen peroxide of γ–amino butyric acid extract

Following the Wettasinghe and Shahidi (2010) method, the hydrogen peroxide scavenging assay of GABA millet extract was determined.

3. Scanning electron microscopy (SEM) of ungerminated and germinated kodo millet flour

Both ungerminated and germinated kodo millet morphological properties were analyzed by scanning electron microscope (SEM), JEOL, Tokyo, Japan, Model Noalbum, JSM 6610-LV with 5000 X magnification. Flour samples were placed on aluminum stub using a double backed cellophane tape, coated in JEOL-JFC-1600 auto fine coater with 60:40 g / g gold palladium.

4. Rheological properties of ungerminated and germinated kodo millet flour

A Modular Compact Rheometer (MCR102, M/s. Anton Paar, Austria) fitted with parallel plate geometry (50 mm diameter) and PP50-SN32770 (Dia.0.5 mm) was used to measure the rheological properties of the samples. Approximately 2 ml of flour aqueous suspension (20 percent) was mounted on the Rheometer ram and the sample edge was coated with a thin layer of low-density silicon oil to reduce the loss of evaporation. Frequency sweep tests were performed at 0.1 to 10 Hz, 0.5% strain and 25 °C in the linear regime. The steady shear measurements applied varying constant shear deformation at shear rates 1 to 100 s-1 in the tested materials. The power law model also described flow curves. K and n are the indices of continuity and flow behavior in the power law (ÿn-1). The paste's steady shear viscosity was measured as a function of 1 to 500 s-1 shear values. Dynamic rheological properties were calculated as a function of temperature (storage modulus (G '), loss modulus (G ') and loss factor (tan δ).

5. Pasting properties of ungerminated and germinated kodo millet flour

Pasting properties of both ungerminated as well as germinated minor millet flours were studied using a Rapid Visco Analyzer (RVA Tecmaster, Perten, Australia) using the Standard profile 1.

6. Statistical analyses

The data presented in the represent an avereage of three observations (±SD) and subjected to a two-way variance analysis (ANOVA) followed by a multirange test by Duncan using statistical 7 (statistical soft, TUSA, USA) statistical software packages at $p<0.05$ to determine which means were substantially distinct.

3. RESULTS AND DISCUSSION

1. In-vitro antioxidant characteristics of ungerminatedand optimized germinated kodo millets flour

Antioxidant activities are a fundamental human-important prophylactic asset. Antioxidants have organic capacity through an antioxidation mechanism consisting of antimutagenicity, anticarcinogenicity, and anti-aging. Therefore, by increasing the antioxidant function of foods, it is important to avoid the occurrence of a few diseases. The antioxidant sports were adjusted by means of the germination process as calculated by way of metal chelating interest, decreasing power, total antioxidant capacity, DPPH radical scavenging hobby, and hydrogen peroxide scavenging interest assays within the Table 1.

1.1 Total antioxidant activity

Table 1 shows the total volume of antioxidant activity represented as an mg AAE/100 g extract. The results suggested that the total antioxidant potential of millet extract ($p<0.05$) was significantly influenced by the method of germination. After germination, the total antioxidant power increased from 45.34 to 67.23 mg AAE / g in kodo millet. One of the many metabolic changes that occurred during seed germination is the increase in total antioxidant potential with the germination bioprocess, mainly due to an increase in the content of phenolic compounds due to the activity of endogenous hydrolytic enzymes and the conversion of glutamate in the sample to GABA due to glutamate decarboxylase enzyme stimulation (Lin et al., 2015).

1.2 Ferrous ion chelating capabilities

Chelating prooxidant metals is one of the most significant mechanisms of secondary antioxidant action. Some metals like iron and other transition metals (copper, chromium, cobalt, vanadium, cadmium, arsenic, nickel) function as free radical reaction catalysts that encourage oxidation. During modifications in oxidation states, these redox-active transition metals transfer single electrons. Certain compounds ' chelation of metals reduces their prooxidant impact by decreasing their redox potential and metal's oxidized shape. The formation of metal hydroperoxide complex may also be sterically hindered by chelating compounds (Reische et al. 2008).

The ungerminated and optimized germinated kodo millet seed extract's ferrous ion chelating capacities were provided in Table 1 and expressed as equal to ethylene di-amine tetra acetic acid (EDTA). After germination in millet extract, a substantial distinction was noted in the metal chelating operations. The ungerminated and germinated kodo millet seed extract's Ferrous ion chelating capabilities from 62.34 to 89.32 mgEDTA / g. Due to the existence of elevated phenolic and flavonoid content in kodo millets, the kodo millet had the largest ferrous ion chelating capacities relative to the other millets. Higher ferrous ion chelating capacity of the molecule could occur when the hydroxyl and carbonyl groups were in suitable positions, as ferrous ions are the most efficient food system pro-oxidants (Yamaguchi et al., 1988). Phenols and flavonoids are primarily ascribed to antioxidant activity in crops. These findings confirm that an increase in phenolics and flavonoids can be attributed to improving the metal chelating activity of millet extract during germination.

1.3 Reducing power assay

Reducing energy assay is the antioxidant's electronic donation ability. The presence of reducers results in the transformation of the $Fe3+$/ferricyanide complex into ferrous ($Fe2+$) shape that serves as an important indicator of its antioxidant capacity. Reducing agent compounds are the electron donor and they may be primary or secondary antioxidants which can reduce the oxidized intermediates of the lipid per oxidation reactions. Table 1 describes the decreasing authority of the ungerminated and germinated kodo millet plant extract and the important ($p<0.05$) decreasing energy difference was noted after germination in millet extract. The outcome showed a greater reduction in germinated millet extract strength than ungerminated millet extract. During germination, the reduction force increased depending on the bioactive compounds that increased such as phthalic acid, butyl hex3yl ester, hexadecanoic acid, methyl ester, hexadecanoic acid, ethyl ester, and methyl ester after germination. Fouad and Rehab (2015) reported that the reduction in lentil seed power increased significantly from 0.22 in ungerminated samples to 0.31, 0.32, 0.51 and 0.55 (absorbance value) in the 3, 4, 5 and 6 day sprouting samples.

1.4 Antioxidant activity by DPPH

The DPPH scavenging-determined antioxidant activity is based on the response of the reagent to antioxidant compounds by involving the process of electron transfer and radical hydrogen. When antioxidants reduce DPPH to yellow-colored diphenyl picryl hydrazine, an index of free radical quenching ability is used to measure hydrogen atom-donating activity. Due to the scavenging of radicals by donation of hydrogen, the reduce in absorption of DPPH radical induced by antioxidants results. DPPH scavenging and hydrogen peroxide scavenging activity of the germinated kodo millet extract ($p<0.05$). The ungerminated and germinated kodo millet seed extract from 67.34% to 76.34% of the DPPH scavenging activity. Fouad and Rehab (2015) researched that DPPH radical-scavenging activity increased considerably from 40.76% in ungerminated specimens to 49.26%, 54.73%, 61.31% and 62.19% in those specimens sprouted for 3, 4, 5 and 6 days, respectively in lentils.

1.5 GABA ungerminated and optimized germinated kodo flour antioxidant activity in vitro

The gamma-amino-butyric acid is free amino acids that can assist inhibit the proliferation of cancer cells and also lower blood pressure. GABA yield also improved significantly in germinated kodo millet by 11.42 percent compared to ungerminated millet samples, whereas GABA content purity ranged from 9.36 mg to 47.4g/100 g in Kodo millet (Table 1). Table 1 showed antioxidant capacity of γ-amino butyric acid as determined by three techniques such as scavenging capacity on DPPH radicals, complete antioxidant activity, and scavenging activity of hydrogen peroxide. The antioxidant activity determined by the scavenging activity of DPPH and hydrogen peroxide scavenging is based on the response of the reagent to antioxidant compounds by involving the electron transfer system and radical hydrogen. During the germination phase, as estimated by these three techniques, the antioxidant capability of γ-amino butyric acid ($p<0.05$) was considerably improved.

1.5.1 DPPH activity of radical scavenging assay

After germination in kodo millet, the DPPH activity of radical scavenging improved from 44.70 to 70.210 %. DPPH scavenging capacity on millet extract DPPH radicals considerably ($p<0.05$) through germination (Table 1). The findings indicated that owing to the existence of elevated purity of GABA material, the germinated kodo milletextract has the largest DPPH radical scavenging activity. As a result of stimulation of the enzyme glutamate decarboxylase, the increase in antioxidant activity in germinated millets could be attributed to the conversion of glutamate in the sample to GABA (Lin et al. 2015).

1.5.2 Total antioxidant activity assay

Significantly influenced by germination is the complete antioxidant activity of the millets ($p<0.05$). Ungerminated and optimized germinated kodo millet flour's complete antioxidant activity raised from 18.20 mg Ascorbic acid / g to 50.24 mg AAE / g (Table 1). The increase in GABA content during water soaking, as reported by Komatsuzaki et al. (2007), may be due to the activation of glutamate decarboxylase (GAD), which converts glutamate to GABA at an optimum temperature of 40 ° C. Due to the limited availability of oxygen in water for grain, soaking also leads to hypoxia and GABA content may rise quickly in plant tissues in reaction to hypoxia (Kalderon et al., 1984).

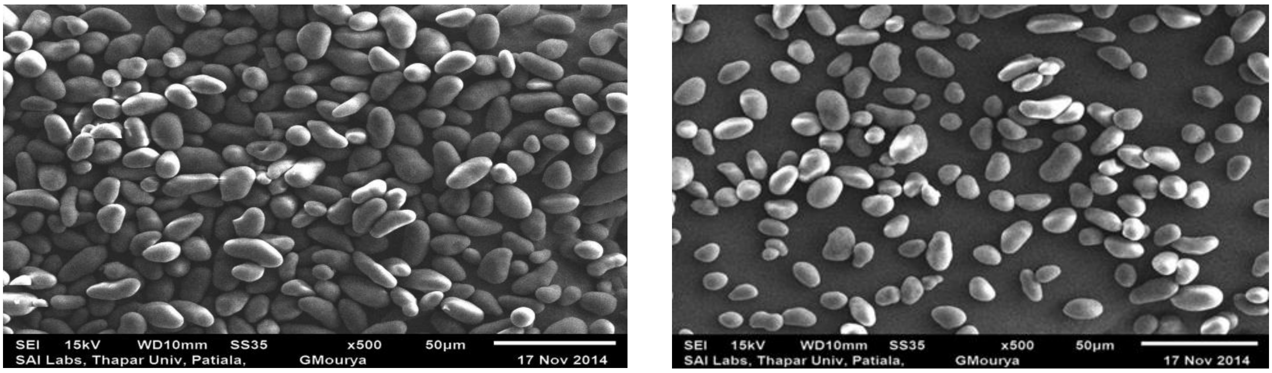
1.5.3 Hydrogen peroxide scavenging activity assay

Compared to ungerminatedkodo millet millet, the hydrogen peroxide scavenging activity was discovered in the optimized germinated kodo millet extract. The ungerminated and germinated kodo millet hydrogen peroxide scavenging activity in γ-aminobutyric acid extract improved from 40.52 to 68.74 mm Trolox/ g (Table 1). Some bound elements may release that play a part in scavenging activity of hydrogen peroxide during germination when the hydrolytic enzymes alter the endosperm. In hydrogen peroxide scavenging activity, the γ-aminobutyric acid tea extracts were more efficient than ascorbic acid, BHA, and a-tocopherol. Tea chelating capacity was ascribed in its flavanol structure to particular functional groups, which enhanced the scavenging activity of hydrogen peroxide (Shahidi, Janitha and Wanasundara, 1992).

Table 1 ***In vitro*** **antioxidant characterstics of phenolic and γ-aminobutyric acid extract of ungerminated and germinated kodo millet**

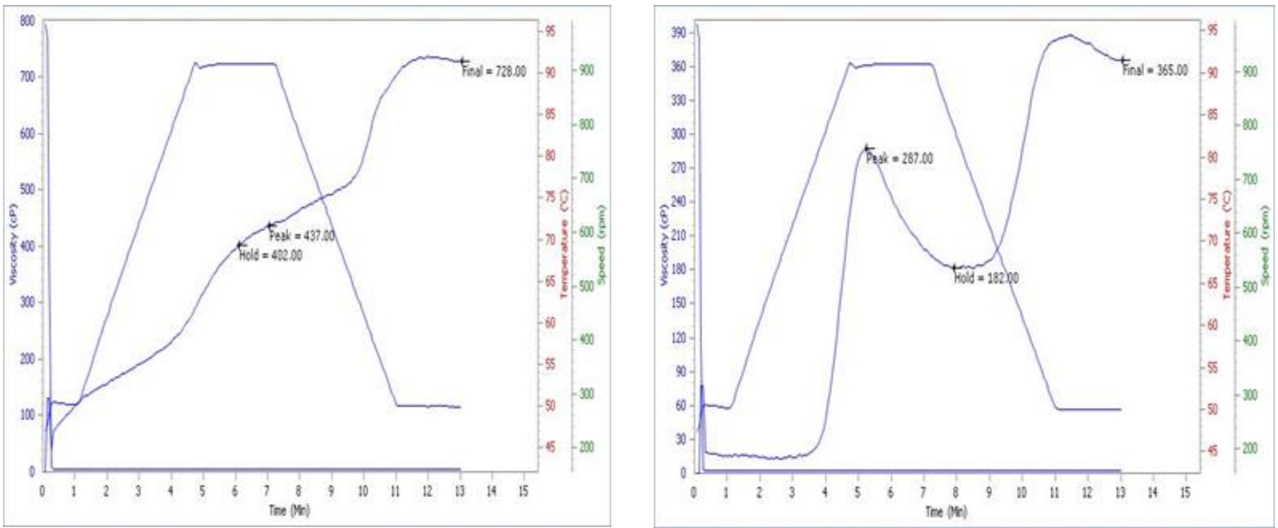
Characteristics	Raw kodo millet flour	Germinated kodo millet flour
Antioxidant characteristics		
TAC (mg AAE/g extract)	45.34±0.13^{b}	67.23±0.23^{a}
Reducing power (µg/ml)	0.78±0.01^{b}	0.93±0.04^{a}
MC (mg EDTA/g extract)	62.34±0.23^{b}	89.32±0.31^{a}
DPPH Activity (%)	67.34±0.09^{b}	76.34±0.02^{a}
Gamma amino butyric acid extract (%)	11.02±0.01^{b}	11.99±0.05^{b}
Gamma amino butyric acid content (mg/100g)	9.36±0.001^{b}	47.73±0.004^{a}
DPPH activity (%)	44.207±0.16^{b}	70.210±0.11^{a}
Total antioxidant activity (millimole equivalents of ascorbic acid /g)	18.20±0.09^{b}	50.24±0.17^{a}
Hydrogen peroxide scavenging activity (milli mole equivalents of Trolox /g)	40.52±0.15^{b}	68.74±0.19^{a}

*****Data are expressed as means±standard deviate. Means with different superscripts (a-b) in the same column are significantly Different (Duncan, p ≤0.05)



(a) (b)

Figure 1. Scanning electron micrographs of ungerminated (a) and germinated (b) kodo millet flour



(a) **(b)**

Figure 2. RVA Curve for (a) ungerminated and (b) germinated kodo millet flour

1.6 Scanning electron microscopy (SEM) of flour

The electron microscopy (SEM) scanning technique has also proved to be an important tool for analyzing the microstructures of various constituents present in cereals, pseudo-cereal grains and related products. Figure 1 displays the morphological characteristics of Kodo millet (underminated and germinated) grain flour. The results revealed the obvious differences in structure between the two. The flour was characterized by a continuous structure embedded in ungerminated Kodo millet flour with the intact starch granules within a very dense protein matrix (Figure 1a). Nevertheless, this continuous structure was broken after germination, due to the activated proteolytic enzyme activity in the germinated samples, the protein matrix was absent and the starch granules degraded during the germination process (Figure 1b).

1.7 Pasting properties flour

Pasting properties reflect changes in flour heating viscosity. Kodo millet (ungerminated and germinated) grain flour pasting profile results are listed in Table 2 and showed in Figure 2a-b. Significant differences in the pasting properties of both floors were found ($p \leq 0.05$). Kodo millet flour's peak viscosity decreased from 437 cP to 287.00 cP during germination, respectively. Similarly, during germination, the trough viscosity also decreased. In germinated Kodo milletflour, a decrease in breakdown value of 29 cP was found as compared to ungerminated 35 cP flour. During the germination cycle, the significant reduction in pasting viscosities in germinated Kodo milletflour may be due to enzymatic degradation of starch. Decrease in germinated Kodo millet flour's final viscosity was found to be more than ungerminated flour (Table 2). In germinated Kodo millet flour, a lower set back value of 183.00 cP was observed than 326.00 cP ungerminated flour. Germinated millet flour from Kodo had lower filling temperature than ungerminated flour. Activation of enzymes during germination, as stated with germinated rice flour, may explain the differences in pasting properties obtained with ungerminated and germinated flour (Cornejo and Rosell, 2015). In wheat and brown rice flour, similar trends have been observed (Juhasz et al., 2005). Starch content, amylase activity, amylose / amylopectin ratio, protein and lipid content can affect the pasting properties of flour (Zhu et al., 2010). The reduction in Kodo millet grain flour viscosity caused by germination may be beneficial for weaning food preparation.

1.8 Rheological properties of the flour

1.8.1 Static viscosity/ steady shear properties

Kodo millet (ungerminated and germinated) grain flour shears flow curves are shown in 3(a) and (b) while their apparent viscosities are shown in Figure 4(a) and (b). The results showed that the value of the flow index' n' was less than unity, according to which these samples behaved at all temperatures and concentrations tested as pseudo plastic materials (Sikora et al., 2007). The determination (r) coefficients obtained were closed to 1, indicating that the power law model was adequate to explain the sample flow behavior (Table 3). Complex flour viscosity decreased from Figure 3 (a) and (b) with an improvement in shear intensity symbolizing the shear thinning action of flour. The shear-thinning behavior may be due to the progressive orientation of soluble starch molecules towards the flow direction and the breakdown of hydrogen bonds between amylose molecules during shearing (McGrane et al., 2004). Shear thinning behavior may have resulted from the hydrodynamic forces that during shear produce a split in the product's structural units (Bahnassey and Breene, 1994). In many food biomaterials such as buckwheat, rice, and wheat flour, shear-thinning activity has been observed (Inglett et al., 2009).

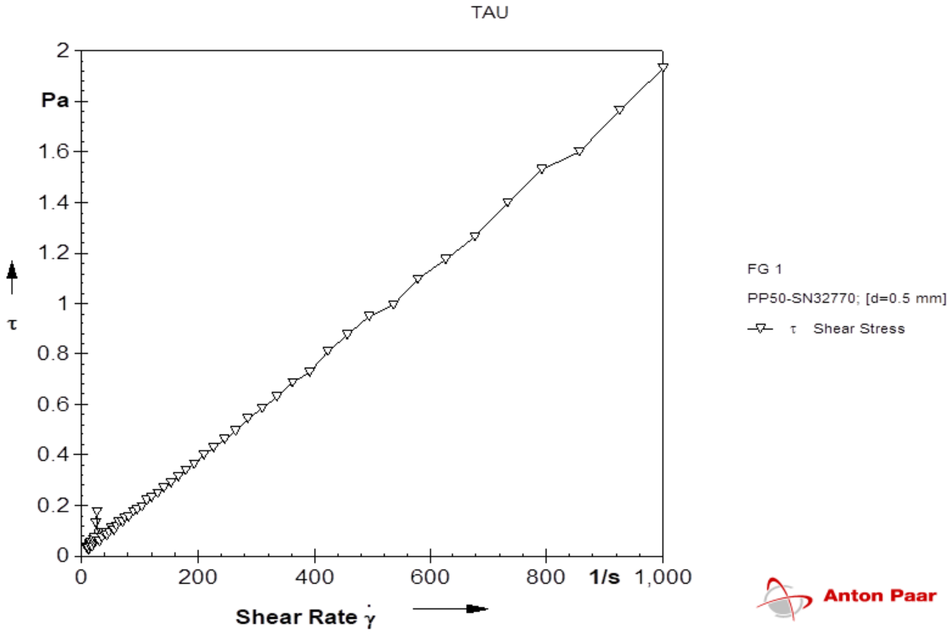
1.8.2 Frequency sweep test of flour

The frequency sweep shows changes in the material's elastic and viscous behavior in application with stress or strain rate, while the signal's constant amplitude. The Kodo millet (ungerminated and germinated) grain flour frequency sweep curves are shown in Figure 4 (a) and (b).

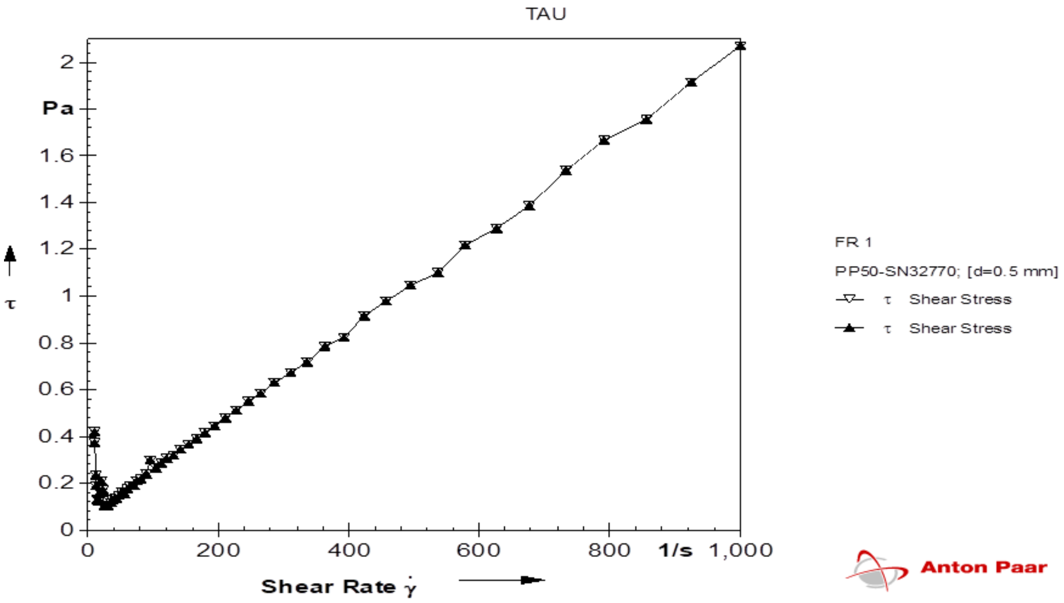
Table 2 Pasting properties of Kodo millet ungerminated and germinated flour

Parameter	Ungerminated kodo flour	Germinated kodo flour
Peak viscosity (RVU)	437.00±14.02	287.00±13.45
Trough viscosity (RVU)	402.00±12.05	182.00±11.03
Breakdown (RVU)	35.00±1.04	29.00±1.08
Final viscosity (RVU)	728.00±14.89	365.00±17.45
Setback (RVU)	326.00±18.00	183±7.34
Pasting temperature (ºC)	87.45±2.49	85.35±1.24

Mean values in the same row which is not followed by the same letter are significantly different (*p≤0.05*). Values represent mean ±standard deviation (n=3).



(a)



(b)

Figure 3. Relationship between shear stress and shear rate of (a) ungerminated and (b)

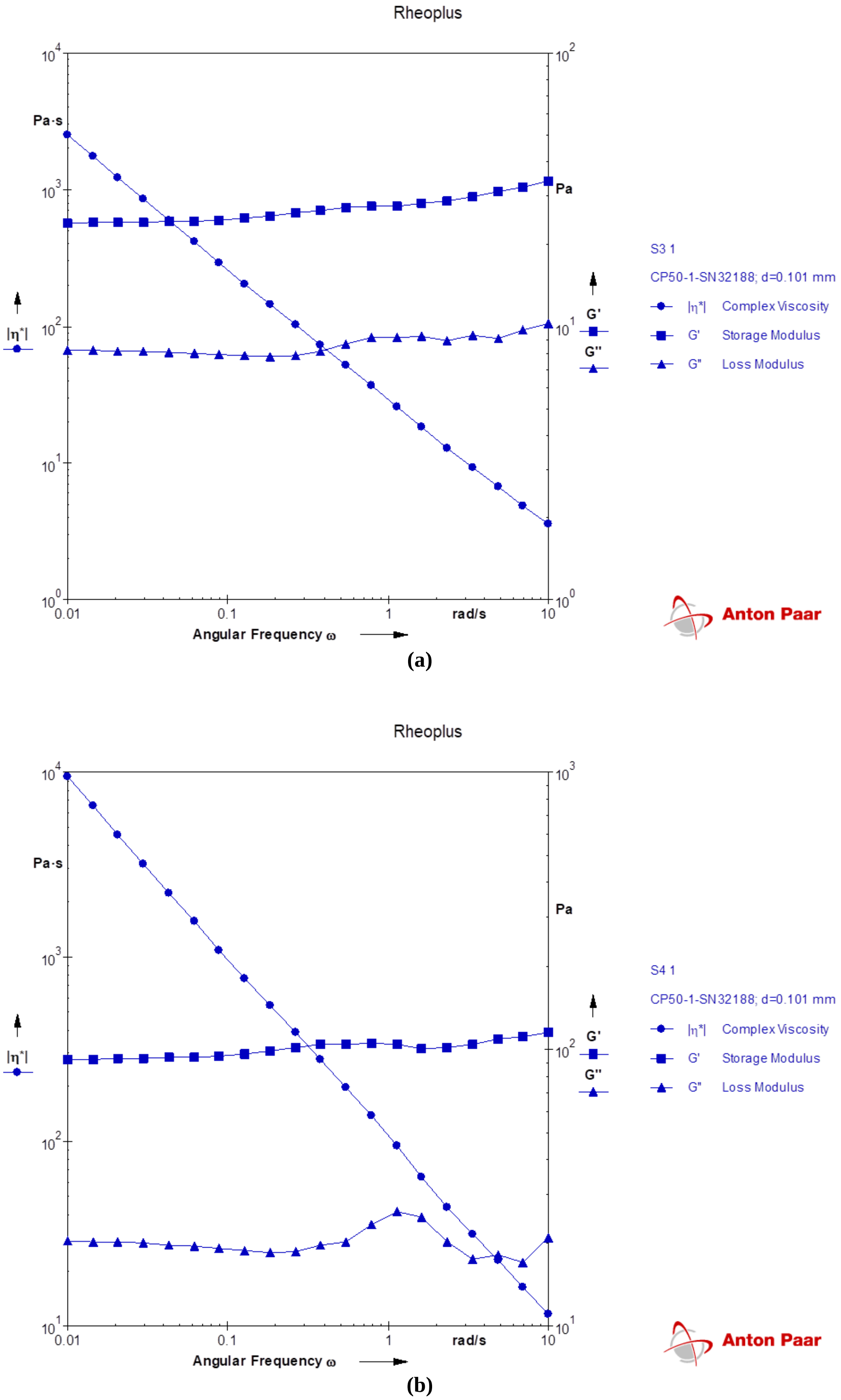


Figure 4. Complex viscosity and Frequency sweep test (a) ungerminated and (b) germinated kodo millet flour

Ungerminated Kodo millet exhibited greater G' than G" in the entire range of frequencies, indicating a strong elastic-like flour behavior (Figure 4a-b). G' was purely frequency-dependent and increased with increasing frequency, but only at higher frequencies was this effect apparent for G'. Because there was a high difference between G' and G" and a low tan δ difference. The germinated Kodo millet flour, on the other hand, gave lower values for both modules (G' and G") and a lower difference between the two; as a result, the higher was the tan δ, thus showing a good balance between the two modules (Figure 4 b). Generally the high G', low G" and small tan δ represent a stiffer and more stable material. A decrease in the frequency suggesting a reduced resistance of the material to flow was observed. Tan δ values ranged from 0.076 to 0.199 for germinated Kodo millet flour paste; indicate that flour changes from visco-elastic solid during germination to visco-elastic fluid (Figure 4.1a and b). Rheological properties of flour have been reported to be related to the quality of baked and other food products (Xu et al., 2007). As a result, germination could damage, alter, and rearrange Kodo millet flour's structure and weaken its visco-elastic properties.

4. CONCLUSION

The Kodo millet (ungerminated and germinated) flour was analyzed for in vitro antioxidant characterstics of gamma amino buytric acid, pasting, morphological and rheological properties. The results of pasting profile revealed that germination significantly affected the pasting properties (peak viscosity, breakdown, setback, final viscosity and pasting temperature) of Kodo millet flour. Germinated Kodo millet flour showed substantially lower peak 287 cP, breakdown 29 cP, final viscosity, 365 cP, setback 183 cP and pasting temperature 85.35 ºC than ungerminated Kodo milletflour 437, 35, 728, 326 cP and 87.45 ºC, respectively. The SEM micrograph showed the structural differences between ungerminated and germinated Kodo millet flour. Ungerminated flour had intact starch granules trapped in a very thick matrix of proteins. In the germinated wheat, on the other hand, starch granules were depleted. The reduction in viscosity of germinated Kodo millet meal with an increase in shear rate indicating its shear thinning behavior. Frequency sweep results revealed that germinated flour showed low storage (G ') and loss modulus (G ") compared to ungerminated flour, indicating an ungerminated strong elastic nature. In the germinated millet flours, the improved functional and pasting properties were observed, making them good base ingredients in formulating infant foods.

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<u>Conflict of Interest</u>
This certifies that in publishing this manuscript there is no conflict of interest of any kind.

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