Effect of flour treatment and starter culture source on the physicochemical and Sensorial properties of injera from Sorghum flour

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Abstract

Sorghum is known for its poor endosperm functionality due to the starch and protein interaction leading to the formation of hydrophobic mass that poorly interacts with water in batter and dough based foods. Annealing process of sorghum flour has valuable impact on its starch modification to improve sorghum starch functionality for food application. Annealing process improved the property of sorghum as compared to tef flour regarding physicochemical and microbial properties. Annealing was able to show physicochemical properties and microbiological load differences between sorghum flour through starter culture source. Additionally, microbial growth was faster with in the first 24 hours. This study showed that annealing process and the sources of starter culture (*shameta*, a traditional beverage) had, significant difference among the treatment. The sorghum had shown high microbial load than tef. For this matter, the annealing process and *shameta* starter culture source had the great opportunity to reduce the fermentation time.

Introduction

Sorghum grain is one of the most important ingredient for injera making. Sorghum is the world's fifth most significant grain in terms of yield. sorghum injera is attractive, but has poor texture and fast staling are significant drawbacks. The annealing is well-known hydrothermal (physical modification) treatments which physically modify cereal and pseudo-cereal flours and starches (Iuga and Mironeasa, 2019). It provides a lot of benefits in terms of quality and cooking time. Injera processing requires long fermentation time. In particular, sorghum injera has poor quality due to staling, resulting in brittleness and dryness over storage. There has been little research on the effects of processing methods on injera quality. However, for enhancing injera quality, substrate treatments such as flour heat treatment and alternative traditional starter cultures have yet to be applied. Annealing and the use of traditional starter culture might reduce the fermentation time and improve injera quality. In the present study, annealing of sorghum flour and applying traditional starter cultures was investigated on the fermentation time and injera quality. The objective of the current research was to check the effect of flour treatments, as well as the uses of traditional starter culture source on the physicochemical and sensory quality of injera. Annealing and starter culture were believed to work better because, annealing condition provide functionalized flours that bring some benefits (Youssouf et al., 2019) and employed to manage the structural and mechanical characteristics of injera products.

Materials & Methods

- Annealing treatment (ANN) of tef and sorghum flour was done based on the procedures reported by Youssouf et al., (2019).
  - The grain samples were cleaned, milled, sieved under 710 µm and about 200 g flour was mixed with distilled water (above 20% w/w) tightly sealed,
  - Samples were annealed at 50°C for 15 minutes.
- The functional properties of flour was done following standard methods as detailed by Kindeya et al., (2022).
- The batter samples prepared were following the procedure described by Fox and Jordan, (2020).
  - About 50 g of flour samples were mixed with 45 mL of water, 10 mL of ersho mixed, and kneaded for 2 mins
  - Fermented at room temperature (25 0C) for 72 hrs..
- The microbiological dynamics of batter was assessed at a 24 hr. intervals of the fermentation period.
- The sensory acceptability of injera samples from different treatments were carried out by 50 panelists composed of male and female consumers.
  - The panelists were requested to evaluate the injera samples in terms of color, taste, texture, flavor and overall acceptability using a seven-point hedonic scale.
  - Data were analyzed using factorial analysis of variance (ANOVA) using JMP Pro version 13 statistical software of the SAS Company.

Results and Discussion

- The physicochemical properties of the sorghum and tef (control) were significantly influenced by annealing.
- ✓ On Annealing, the sorghum flour behaved similar to the control tef, which makes them competent ingredients for *injera* making.
- The physicochemical properties of sorghum and control tef were significantly varied (Figure 1).
- The microbial load (TAMC, yeast - mold and LAB) of the batter from sorghum and control tef were significantly different (Figure 1).

Results and Discussion …

- Annealing of sorghum flour also resulted in significantly higher microbial load for yeast and mold, LAB and TAMC with significantly lower pH and higher TA (%) for the samples fermented by the shameta culture (Figure 1, c & d).
- The microbial load of the batter samples was significantly ($p<0.05$) increasing for the LAB and (Figure 1 e & f).

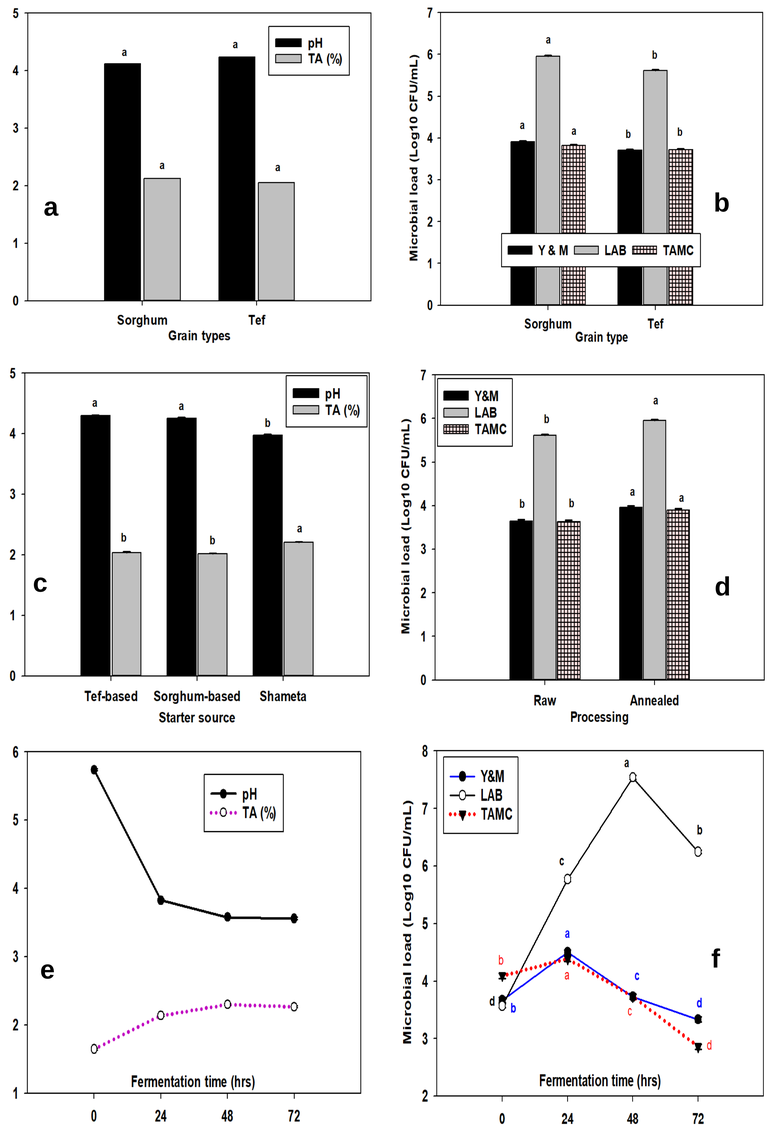

Figure 1: Physicochemical properties [a, c, e] and microbial load [b,d,f]

The sensory acceptability of injera from sorghum and tef control was significantly different. (Table 1). Injera samples from sorghum flour with the *shameta* culture preferred by the consumers.
Annealing of sorghum flour followed by fermentation using *shamita* cultures is a good combination for better injera quality (Figure 2).

Table 1: Sensory Acceptability of sorghum

Ingredient	Color	Appearance	Flavor	Taste	Overall acceptance
Tef	$5.66^{a} \pm 17$	$5.55^{a} \pm 17$	$5.63^{a} \pm 17$	$5.55^{a} \pm 18$	$5.7^{a} \pm 16$
Sorghum	$5.24^{a} \pm 17$	$4.15^{b} \pm 17$	$4.53^{b} \pm 17$	$4.41^{b} \pm 18$	$4.44^{b} \pm 16$
Starter culture					
Shameta	$5.91^{a} \pm 17$	$5.27^{a} \pm 17$	$5.29^{a} \pm 17$	$5.24^{a} \pm 18$	$5.31^{a} \pm 16$
Tef-based	$4.99^{b} \pm 17$	$4.43^{b} \pm 17$	$4.87^{a} \pm 17$	$4.72^{b} \pm 18$	$4.83^{b} \pm 16$
Grains by starter sources					
Tef, Shameta	$5.96^{a} \pm 24$	$5.68^{a} \pm 23$	$5.64^{a} \pm 24$	$5.58^{a} \pm 25$	$5.74^{a} \pm 23$
Tef, Tef-based	$5.36^{b} \pm 24$	$5.42^{a} \pm 23$	$5.62^{b} \pm 24$	$5.52^{a} \pm 25$	$5.66^{ab} \pm 23$
Sorghum, Shameta	$5.86^{a} \pm 24$	$4.86^{a} \pm 23$	$4.94^{ab} \pm 24$	$4.9^{a} \pm 25$	$4.88^{b} \pm 23$
Sorghum, Tef-based	$4.62^{b} \pm 24$	$3.44^{b} \pm 23$	$4.12^{b} \pm 24$	$3.92^{b} \pm 25$	$4^{c} \pm 23$

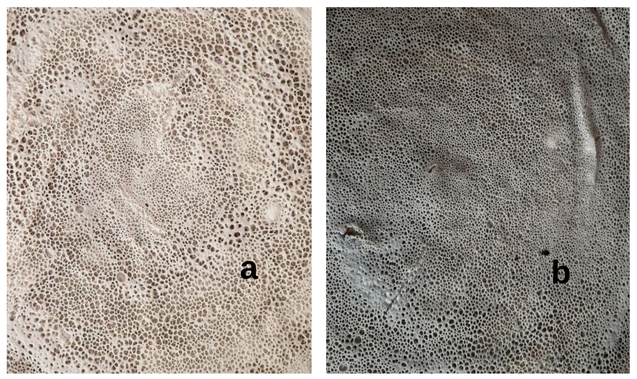

Figure 2: Injera samples from sorghum (a) and tef (b)

Conclusions

- The present study revealed that annealing process and starter culture of *shameta* had significantly better performance among the treatments. Sorghum had shown high microbial load as compared to control tef and significantly increase microbial load regarding to increase in fermentation time, implying that the annealing process coupled with the *shameta* starter culture had a great potential to reduce the time required for injera fermentation.

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