Diversification and advancing whole sorghum-based foods in Ethiopia

Takele Tadesse1, Welday Hailu1, Haile Misganaw1 and Tadesse F. Teferra1, 2
1School of nutrition, Food Science and Technology, Hawassa University, Ethiopia; 2Dept. of Food Science and Technology, Texas A&M University, College Station, TX 77843

Abstract
Sorghum is an important food security crop for about 1 billion people in developing countries in the tropical and semi-arid regions of the world. Ethiopia is one of the significant producers of sorghum as a food security crop. However, the crop is limited to household level food use and is not popular ingredient for the food industries, which presents limitations in the sustainability of its value chains. A research project was designed to develop varieties of whole grain sorghum-based commercial foods in Ethiopia. The research project had two wings where, on one hand, different local and novel varieties were evaluated for their suitability for whole grain-based snack and breakfast type products and on the other hand, an annealing technique was used to modify sorghum endosperm to check its suitability for batter-based products – injera as a model. The results from the first wing of the trials showed that some of the local varieties of sorghum are suitable for production of popped sorghum snack (55-70% yield), grits (93% yield) and couscous (83% yield). The second wing of the research with the annealing treatment resulted in better functionality of sorghum in injera, making samples comparable to that of tef. It is therefore apparent that existing varieties of sorghum in Ethiopia could be recommended for different industrial applications to enhance its value chain in the country for enhanced food security and livelihoods of the farmers.

Introduction
Sorghum is one of the top five cereals cultivated for food, feed and industrial uses. The industrial application of sorghum is limited in food processing dimensions, which greatly impeded the developed world are expected to increase the desirability of grain sorghum, making it a healthy (gluten free) natural food security crop of the future coupled with its tolerance to climate change and for their suitability for diverse categories of food products.

Materials & Methods
- Three varieties of sorghum lines (2 local and a novel (Wx/HD)) were tried in whole sorghum-based snack and breakfast meals (popped sorghum, kinche (coarse grits) as well as couscous (fine grits)).
- Melkam and waxy/HD lines performed good in terms of the yield of kinche and couscous with average total yield of about 80-80%, the remaining being dust – animal feed
- Mera was performing poorly for all the three products, with the least performance corresponding to popping process.
- Given its production sustainability, economic advantages, and nutritional/health promoting properties, sorghum can be a competitive ingredient in:
  ✓ Traditional/ethnic foods, and
  ✓ Commercial products
- Breeding programs might assess future lines and cultivars for suitability in making these products

Results and Discussion
- Melkam and waxy/HD lines performed good in terms of the yield of kinche and couscous with average total yield of about 80-80%, the remaining being dust – animal feed
- Mera was performing poorly for all the three products, with the least performance corresponding to popping process.
- Annling generally resulted in higher microbial load of grain type and fermentation time (Fig. 2[A]), with sorghum revealing faster changes in the pH and titratable acidity (Fig. 2[C], likely due to improved endosperm by the annealing process.
- There is no difference in the trends of biochemical changes between sorghum and tef over the fermentation times (Fig. 2[B &C]), implying that sorghum has a potential of being used as a raw material for injera making.
- Annealing improves sorghum endosperm by making it readily interact with water, which further make them easily acted upon by the microbes and their enzymes in batter-based products – injera.
- The implication of the results is that sorghum grain can be significantly modified by different processing methods; resulting in improved: flour functionality and final product quality
- Different novel and traditional processing methods might be explored for enhancing sorghum functionality in foods.

Conclusions
- Sorghum cultivars demonstrated potential suitability for diverse groups of whole grain sorghum-based breakfast, snack or side dishes that are of either ethnic (traditional) or commercially established categories.
- Sorghum flour were compared to tef controls under normal and annealing conditions coupled with different sources of traditional starter cultures.
- Fermentation dynamics of batter under different treatments were investigated
- Traditional practices of injera fermentation were followed over 3 days.
- Sorghum is an important food security crop for about 1 billion people in developing countries in the tropical and semi-arid regions of the world. Ethiopia is one of the significant producers of sorghum as a food security crop. However, the crop is limited to household level food use and is not popular ingredient for the food industries, which presents limitations in the sustainability of its value chains. A research project was designed to develop varieties of whole grain sorghum-based commercial foods in Ethiopia. The research project had two wings where, on one hand, different local and novel varieties were evaluated for their suitability for whole grain-based snack and breakfast type products and on the other hand, an annealing technique was used to modify sorghum endosperm to check its suitability for batter-based products – injera as a model. The results from the first wing of the trials showed that some of the local varieties of sorghum are suitable for production of popped sorghum snack (55-70% yield), grits (93% yield) and couscous (83% yield). The second wing of the research with the annealing treatment resulted in better functionality of sorghum in injera, making samples comparable to that of tef. It is therefore apparent that existing varieties of sorghum in Ethiopia could be recommended for different industrial applications to enhance its value chain in the country for enhanced food security and livelihoods of the farmers.

Materials & Methods

Results and Discussion

Conclusions

References

Acknowledgement: This study is made possible through funding by the Feed the Future Innovation Lab for Collaborative Research on Sorghum and Millet through grants from American People provided to the United States Agency for International Development (USAID) under cooperative agreement number AID-OAA-A-13-00047. The contents are the sole responsibility of the authors and do not necessarily reflect the views of USAID or the US Government.