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FLOUR RANCIDITY IN PEARL MILLET: A BOTTLENECK FOR STORAGE

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ABSTRACT:

Pearl millet is the sixth most important crop after rice, wheat and maize in terms of total cropped area. It is often regarded as a climate resilient crop. These are considered as rich source of energy, carbohydrate, and protein compared to other cereals. These are found to be rich sources of phytochemicals such as phenolic acids, flavonoids, phytic acid, and phytosterols. Researchers have reported that the presence of dietary fiber and phenolic compounds help in the prevention of many diseases such as diabetes, cardiovascular diseases, and cataractogenesis. Due to the high fat content and lipase activity, the pearl millet flour had limited shelf life at ambient conditions. Shelf life of pearl millet flour is very short because of rapid development of rancidity. Development of mousy odour in the meal shortly after grain milling is an important constraint to the wider acceptability and utilization of pearl millet.

Keywords: climate resilient, phytosterols, cataractogenesis, rancidity

INTRODUCTION:

Pennisetum glaucum belongs to family Gramineae and originated in Western Africa and it is cultivated mostly in Africa and Asia. Due to the adaptation of this millet crop in dry and arid conditions, it can be grown in India, where low fertility soil, dry climates, hot seasons and high salinity and low pH predominate. It is a dual purpose crop of arid and semiarid areas as it provides cheap food for humans, feed for poultry birds and also dry as well as green fodder for cattle. Use of pearl millet in food industry and consequently its consumption by urban population is very low because of rapid development of off flavour in pearl millet flour. It's an old and unresolved problem which is the major hindrance for wider consumer acceptability.

Rancidity (rancid derived from "rancidus" the Latin word for stinking). Oxidation of fats, generally known as rancidity, is caused by a biochemical reaction between fats and oxygen. Fast deterioration of pearl millet flour is because of high fat content and high activity of few enzymes. Storability of pearl millet flour is in fact depends on interplay between fat content, built up of fat acidity through hydrolytic cleavage of triglyceride the action of lipase, presence of high activity of peroxidase in grains, enzymatic oxidation of phenolics, presence of C-glycosyl flavones, and formation of water soluble acidic compounds and volatiles. Flour is susceptible to rancidity contain 74% unsaturated fatty acids.

Two parameters indicating rancidity namely: Acid value (Indicate Enzymatic rancidity) and Peroxide value (Indicate oxidative rancidity). Oxidative rancidity results in hydroperoxides (chain reaction through autoxidation) and subsequently generation of off-odour causing volatile secondary metabolites (aldehydes, ketones, acids, polymers etc.). Enzymatic rancidity results in free fatty acids by the action of Lipase and further generation of bitter and mousy odour causing phenolic glycones, by the action of Peroxidase on C-glycosyl flavones. Bitter compounds are also formed due to enzymatic browning by the action of Polyphenol oxidase (PPO).

enhance the keeping quality of flour of four different pearl millet varieties with respect to effect of storage containers and temperature on biochemical quality parameters including monitoring of the marker Malondialdehyde used for determination of the extent of lipid peroxidation in pearl millet flours (Bhatt et. al., 2017).

Recently, Datta Mazumdar et. al., 2016 as part of ICRISAT's involvement in the CGIAR Research Program on Dry land Cereals carried out a study to evaluate suitability of popular Indian commercial varieties/hybrids for obtaining shelf-stable pearl millet flour. 56 commercial pearl millet

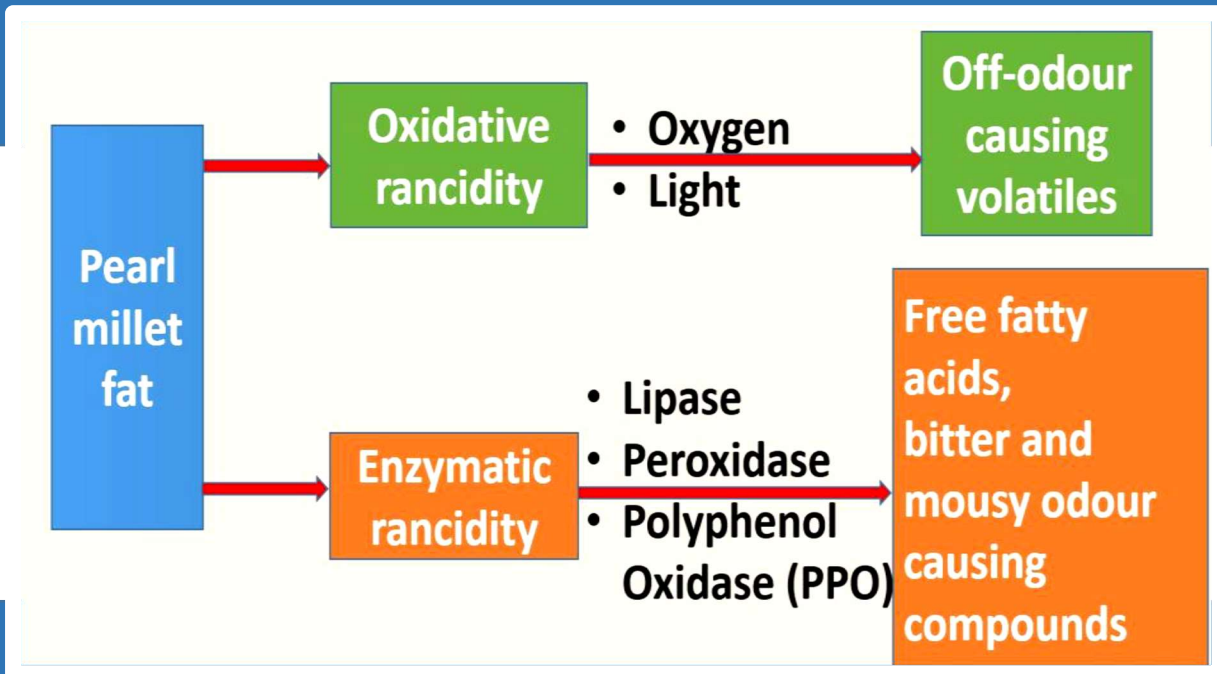

Fig 1: The schematic representation of the mechanism of onset of rancidity (Datta Mazumdar et.al., 2016)

Varsha and Narayanan (2017) studied the effect of different pre-processing options on the rancidity and overall quality of pearl millet flours such as HDPE packaging and refrigeration, combination of fermentation and malting (Akinola et. al., 2017) and evaluating the best storage conditions to

lines (40 hybrids grown in India, 4 OPVs, and 12 hybrid parents) were profiled for peroxide and acid values (AV) of fat extracted from their flours.

Two parameters indicating rancidity namely acid value (AV indicates enzymatic

rancidity) and peroxide value (PV indicates oxidative rancidity) were monitored during the study. Flour from each variety/hybrid were stored under three storage conditions – Refrigerated (4°C), room temperature (25°C) and accelerated (35°C, 70%RH) and the acid and peroxide values of their extracted fat measured at regular intervals. The study clearly established the existence of diversity in the rancidity profile among the select varieties/hybrids of pearl millet studied. There was wide variability observed in the overall rancidity profiles. 13 pearl millet varieties/hybrids least susceptible to rancidity were identified. The study shows that pearl millet varieties/hybrids that are least susceptible to rancidity can be promoted for use in production of self-stable pearl millet flour in conjunction with appropriate pre-treatment, processing and packaging technologies.

The review of literature on status on research for addressing rancidity in pearl millet clearly show that the problem of rancidity in pearl millet needs to be addressed immediately through a holistic approach. Screening genotypes with biochemical and molecular markers for low lipase activity helps in developing hybrids and post harvest processing of pearl millet using different methods to down regulate or denature lipases is another approach.

Few studies have been conducted to screen pearl millet germplasm for rancidity components and limited genetic information developed on these parameters. It has been observed that morphological traits exhibited no significant association with rancidity but some biochemical traits exhibited significant association with rancidity (Kumar and Chhabra, 2008). Genetic variability for peroxidase (POD) activity varies markedly (54-332 unit's g-1 min-1) in different genotypes.

CONCLUSION

It is concluded that once qualitative and quantitative relationship between particular constituents of grain and rancidity determinants is established it would become possible to develop rancidity free pearl millet genotype through conventional breeding or through biotechnological tools.

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