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Qualitative Analysis of Physico-Chemical Changes as per Nutritional Aspects of Stored Wheat Grain in Various House Hold Containers

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Abstract - There has been a considerable amount of work designed to investigate the reasons for the variability in the nutritional value of wheat. Some studies have focused on its origin (variety, site of growth, etc.) or physical measurements (storage time, inclusion form, etc.), and their influence on nutrients digestibility, gut structure and function. Others have studied nutritive value of wheat as influenced by its chemical composition (crude protein, ether extract, starch, etc. Few studies considering both physical and chemical measurements of wheat have been conducted.We had takendifferent varieties ofwheat stored in 200 rural households of Mewar for family consumption over a period of twelve months was studied. Regional differences in the level of infestation and associated quality changes were noticed. Chemical levels were found to be within permissible levels. Results of both years showed an increase in moisture content during storage that was least in cotton bags and earthen pots resulting in higher test weights and flour yield. Tin containers performed better in retaining low fat acidity values. Storage duration of 12 months generally increased moisture and fat acidity while decreased test weight and flour yield in both years.This study aims to describe qualitative factors that influence the observed variability in wheat nutritive value by considering origin (variety, growing conditions, post-harvest and home based storage), chemical composition of the wheat grain.

KEYWORD: Qualitative, storage,Physico-Chemical, Nutritional Value, Wheat. Containers

I. INTRODUCTION

Wheat (*Triticumaestivum L.*), having a place with the family Gramineae, is world's most broadly cultivated food crop and the second significant oat crop by rice in India. Wheat is a typical raw material used to give energy in eats less. Its apparent metabolisable energy and its effect on performance fluctuate between wheat tests. Explanations behind that fluctuation can be named characteristic (assortment, compound organization) and outward factors (developing conditions, storage, and so on.), the two of which influence nutrient digestibility and accessibility in various house hold containers.

It has been accounted for that apparent metabolisable energy (AME) of wheat ranges from 8.49 to 15.9 MJ/kg dry issue (DM) (Mollah et al., 1983; Wiseman, 2000). Growth performances weresupported distinctive wheat tests varied as much as 13% (Scott et al., 1998).

Wheat grains after harvest are generally put away till the following harvest season for home consumption. It is very much archived that around 80 percent of the wheat grains delivered in India are put away by provincial families for their very own consumption. Mass storage is utilized for the staying 20 percent of the wheat grain, which goes to urban markets. Appropriate storage of the food grains in provincial families at that point would not just help in crossing over the current peripheral food hole, yet would likewise add to health and sustenance by preserving grain quality. Regardless of its significance, information on grain quality changes during storage, particularly in home storage, is rare.

Broadly detailed storage losses fluctuate generally somewhere in the range of 5 and 50 percent (Swaminathan 1977). A large portion of these evaluations depend on ponders directed in mass storage structures. A study directed by Boxall et al. (1979) on ranch level storage of paddy in beach front Andhra Pradesh is one of only a handful barely any endeavors to survey losses in homestead and home-level storage. Information on storage losses - both quantitative and qualitative - of wheat grains.

A few endeavors were made in the ongoing past to outline the accessible information on post-harvest losses (Shulten 1982) to distinguish area, causes, and extent, and to derive proper methodologies for preservation of food grains. These reports obviously show that qualitative changes in storage of these grains, particularly at home levels, are the primary dim fixes in our insight into post-harvest damages happening in food grains. In surveying harm, accentuation is much of the time on weight loss pursued by wheat kernel harm. Different types of harm, for example, decrease in quality and nutritive worth, practicality of seeds, microbial decay, and pollution with substances unsafe to health or unsatisfactory for consumable purposes, which could be of more prominent significance than weight loss, are regularly disregarded or given low need. In any event, when these factors are given significance, absence of endorsed and institutionalized approach for surveying qualitative changes is the principle requirement.

The present paper describes the qualitative analysis of physico-chemical changes as per nutritional aspects of stored wheat grain in various house hold containers by considering variety, growing conditions, storage, chemical composition (carbohydrates and protein) and its impact.

II. OBJECTIVES

- To qualitative analysis of wheat grains during storage in various containers in rural area people.
- To analysis the physic-chemical changes in different varieties of the stored wheat grain quality

III.MATERIALS AND METHODS

Wheat Grains Sample

Samples of freshly harvested grains of wheat varieties, WH-711, HD-2967 and DBW-17 were collected during the years 2013-14 and 2014-15 from Wheat Programme, CCR(PG) Collage, Muzaffarnagar (UP), India.

Storage Conditions

Wheat grains were fumigated with phosphine and stored in duplicate (50 Kilogram/container) in FoodQuality and Nutrition Labs. at CCR (PG) Collage, Muzaffarnagar (UP), India for one year under normal environmental conditions in five different containers namely earthen pots, tin container, cotton bags, jute bags and poly propylene bags. Dailyrecords of temperature and humidity were maintained which ranged between 15 to 35°C and 52-87% in 2013-14while 12 to 39°C and 45 to 97% in 2014-15 respectively. The storage room was well ventilated, with door opened indaytime (5 days a week).

Physicochemical Analysis

For analysis samples were drawn after every four months and analyzed in triplicate for parameters such asmoisture, test weight, flour yield, falling number and fat acidity according to standard methods of AACC (2010)and AOAC (2015) with some modifications.

Statistical Analysis

ANOVA of three-factor factorial along with complete randomized block design was applied using MSTAT-C.Means were compared by applying Duncan's Multiple Range Test (DMRT) at $P = 0.05$ (Steel and Torrie, 1980).

IV. PHYSICAL AND CHEMICAL CHARACTERISTICS OF WHEATVARIETY

Physical and chemical characteristics of wheat may contrast as indicated by assortment. For instance, wheat hardness, thousand grain weight, consistency, phytase action, absolute NSP, starch content or gross energy content have been appeared to rely upon wheat cultivar. Be that as it may, singular varieties don't react in a uniform way and even in one assortment, energy esteem isn't consistent. The motivation behind why this happens is because of factors, for example, harvest year, harvesting conditions, post-harvest storage or developing area that impact physical and chemical creation inside a similar wheat cultivar. This makes it hard to separate among them. All in all "soft wheat" varieties will in general have higher starch content and higher digestible energy (DE) for pigs and higher starch digestibility than "hard-wheat" varieties. On the other hand, "hard-wheat" varieties have been found to give an improved grill growth performance contrasted with "delicate wheat" varieties.

A few contemplates have attempted to concentrate on the connection between the measure of protein in the wheat kernel, and its physical and chemical characteristics, as an approach to all the more likely characterize wheat quality. Physically, the most convincing relationship was found between explicit weight (SW) and protein content. This relationship has been accounted for to be negative by a few researchers ($r = -0.62$, $P<0.05$, $n = 12$; McCracken et al., 2002) ($r = -0.668$, $P<0.05$, $n = 18$; Kim et al., 2003). Chemically, a backwards connection is thought to exist among protein and starch content (Jenner et al., 1991; Simmonds, 1995; Hucl and Ravindran, 1996).

V. RESULTS AND DISCUSSION

Moisture

Grain moisture is one of the most significant factors influencing the nature of flour. Higher lipolytic and proteolytic activities are known to be identified with higher moisture content, which prompts loss in nutrients (lipid, protein) and creation of all the more free fatty acids bringing about inferior sensory characteristics (Kent and Evers, 1993).

Moisture content of wheat seeds was resolved at various storage periods and it was seen that the MC increased continuously with the extension of storage periods in the three storage containers. As fixed compartment and plastic holder was open for tallying moisture rate, at that point the seeds of these containers could go to the contact with surrounding room air coming about critical difference in their moisture content.

The consequences of moisture saw in put away grains during this investigation are exhibited in Table I. During the year 2013-14 varieties, containers and storage period fundamentally influenced the moisture content of wheat grains. The entirety of the interactions including most elevated request interactions essentially influenced this parameter during 2013-14. During the year 2013-14 altogether most noteworthy moisture content (9.21%) was found in DBW-17, though HD-2967 and WH-711 contained moisture contents that were measurably non-huge. During storage around the same time, most extreme moisture (9.29%) was seen following 4 months of storage. This increased moisture is credited to high relative mugginess of storage godown during these months with beginning of storm downpours. Later on, at next examining moisture content decreased altogether and afterward again increased (9.29%) essentially following a year of storage because of more moisture in the earth. Polypropylene and jute bags appeared not to be a good storing media forwheat grains. Probable reason that can be explained based on the materials with which these storage receptacles aremade up off poly propylene bags, jute bags and tin containers.

Table 1.Moisture content (%) of wheat grain in different containers in different period.

Period Means	0 Month	4 Month	8 Month	12 Month
2013-14	8.44	9.29	9.10	9.29
2014-15	7.71	9.95	9.90	10.39

Changes in different varieties after storage

Variety Mean	DWB-17	HD-2967	WH-711
2013-14	9.21	8.98	8.92
2014-15	9.50	9.46	9.49

Poly propylene bags made by weaving of the synthetic fibers that have no capacity to itself retain or move warmth or moisture yet the pores in polypropylene bags enable the put away grains to take or surrender moisture to the environment. The porosity of jute bags enables the put away grains to trade moisture from existing climate.

While earthen pots just as cotton bags demonstrated best reasonableness for putting away of wheat grains concerning moisture content of grains. It is commonly seen that cotton fibers are increasingly impervious to moisture ingestion when contrasted with jute fibers. Earthen pots are reasonably fixed or less influenced by high temperature and sticky condition. This property obstructs the declining of the put away grains. Contrasting the moisture content of tin pots and jute bags during that year, Jute bags ingest more moisture during storage. This conduct is in understanding to past investigation by GC (2006) who watched nearly higher moisture content of maize in jute bags when contrasted with metal bins.

During year 2014-15 varieties demonstrated a non-critical (P>0.05) impact on moisture content of put away grains while storage periods compartment and their interactions affected the moisture during that year. All otherinteractions during this year were found non-significant. During the 2014-15 moisture content raised from 7.71% to9.95% after 4 months due to onset of rainy season and this raised in moisture content was comparatively higher thanthat observed during the year 2013-14. For the next 4 months (i.e. up to 8 months from start of storage) this moisturecontent remain statistically non-significant (P>0.05), then raised to highest value of 10.41% due to higher relativehumidity as noted during this course of storage duration. Over all during the storage year of 2014-15 more moisturewas observed in stored grains at different storage intervals as compared to the moisture content during the year2013-14 on respective sampling times.

As concerned with the containers, earthen pots and cotton bags again appeared as best storage media forwheat grain. Jute and polypropylene bags again proved insufficient in controlling increase of moisture contentduring the year 2014-15.

Test Weight

Test weight estimates the weight of a fixed volume of grain and gives rough sign of its measure and shape. Wheat grains of higher test weight are typically considered to process all the more promptly and to yield better flour, which can be identified with more noteworthy proportion of endosperm to wheat layer for kernel (Gaines et al., 1997). Table 2 shows the impact of storage on test weight of wheat grains. During the year 2013-14, varieties, containers and storage period fundamentally influenced the test weight of wheat grains. The entirety of the interactions including highest request interactions essentially influenced this parameter during 2013-14. The varieties contrasted fundamentally (P<0.01) in this regard. WH-711 had highest test weight of 73.66% while WH-711 with higher moisture for example 9.21% had most minimal test weight of 72.82%.

Table 2. Wheat storage in different containers on test weight (Kg/hl) and its impact

Period Means	0 Month	4 Month	8 Month	12 Month
2013-14	74.75	72.35	73.15	72.90
2004-15	76.53	71.73	71.01	70.18

Changes in different varieties after storage

Variety Mean	DWB-17	HD-2967	WH-711
2013-14	72.82	73.37	73.66
2014-15	72.35	72.37	72.38

Flour Yield

Flour yield is identified with kernel hardness. Storage temperature additionally supports increment in flour yield. Cavion and Young (1998) saw that wheat with lower test weight for the most part yield poor extraction rate. The aftereffects of flour yield in this examination is shown in Table 3, which shows that varieties, storage periods, their connection and the highest request collaboration were seen as profoundly critical (P<0.01) during 2013-14. WH-711 and WH-711 had highest values during the entire storage practice. Flour yield was essentially influenced by containers for example highest flour yield was seen in grains put away in cotton bags pursued by earthen pots. Storage time essentially (P<0.01) decreased flour yield from 66.84% to 63.89% following 4 months storage and 1% expansion was seen following 8 months, after which it stayed consistent during the remainder of storage time of year. During 2013-14 the cooperation among all the three factors was huge (P<0.01).

Table 3. Wheat storage in different containers on flour yield (%) in different period.

Period Means	0 Month	4 Month	8 Month	12 Month
2013-14	66.84	63.89	64.87	64.90
2014-15	68.26	64.28	62.98	62.16

Changes in different varieties after storage

Variety Mean	DWB-17	HD-2967	WH-711
2013-14	64.39	65.61	65.41
2014-15	64.12	64.69	64.49

Falling number of α- Amylase Activity

Falling number is inversely proportional to α-amylase activity. It has considerable significance, since there is a direct relationship between enzyme activity and finished product attributes (bread crumb quality, loaf volume etc.). Pre harvest sprouting or sprouting during storage, which results due to high temperature and humidity, increases the level of ά- amylase enzyme (Kruger and Tipple, 1980). Table 4 shows the results of falling number. It was found that variety; period, containers types and their interactive effects were significant. The three way interaction was also found significant (P<0.01). The varieties differed significantly throughout the storage period of one year. The interaction among varieties, containers and storage duration was also highly significant (P<0.01). Storage period significantly affect the α-amylase activity. It was noted that change in falling number was not consistent. It decreased from 267 to 256 seconds in 1st four months of storage period, increased during 4-8 months of storage (285 seconds) and then decreased during 8-12 months (276 seconds). During 2014-15, variety, period, containers types and their interactive effects were again significant.

Table 4. Wheat storage in different containers on falling number of wheat

Period Means	0 Month	4 Month	8 Month	12 Month
2013-14	267	256	285	276
2014-15	290	282	280	282

Changes in different varieties after storage

Variety Mean	DWB-17	HD-2967	WH-711
2013-14	272	258c	279
2014-15	292	279b	285

Fat Acidity

Fat acidity is significant for baking quality of flour. During a more drawn out storage time, flour properties change by the impact of unsaturated fatty acids created inferable from lipolytic activity. Fatty acids can decrease gluten growing and water assimilation and increment starch obstruction against gelatinization bringing about high Falling number (Chen and Schofield, 1990). The results of fat acidity exhibited in Table 5 uncover that varieties, period, containers and their intuitive impacts contrasted significantly (P<0.01) during 2013-14. WH-711 accomplished highest fat acidity (40.35 mg/100g) while most reduced fat acidity was watched found in HD-2967. Storage period significantly increased the fat acidity with the progression of time. As respect the containers impact, the most reduced fat acidity was found in wheat grains put away in tin pots. The communication among varieties, periods and containers was likewise significant (P<0.01). Most minimal values of fat acidity were seen in DBW-17 and HD-2967 put away for 4 months in cotton bags and tin pots and in WH-711 in tin pots in particular.

Table 5 wheat storage in different containers on fat acidity (%)

Period Means	0 Month	4 Month	8 Month	12 Month
2013-14	20.77	37.58	46.55	51.09
2014-15	22.08	40.07	45.05	50.85

Changes in different varieties after storage

Variety Mean	DWB-17	HD-2967	WH-711
2013-14	39.02	37.64	40.35
2014-15	40.15	39.19	39.18

VI. CONCLUSION

The information accessible on wheat grain quality changes, however constrained, does demonstrate that decay in the quality of Wheat grains put away for a time of six to a year is of a magnitude that merits the consideration of researchers dealing with the post-harvest issues of wheat grains. So far decrease in losses was endeavored primarily regarding weight loss. Considering the degree of nutrient losses just as the brought down natural quality of the wheat grain during storage, endeavors to limit qualitative losses would improve the per capita accessibility of nutrients to the rural populace.

The present investigation uncovered that wheat grains put away in earthen pots and cotton bags increased less moisture and indicated higher test weight and flour yield when contrasted with different containers. The values of moisture remained lowerthan safe level. Storage period decreased flour yield. It was noted that cotton and jute bags were suitable forretaining falling number with in recommended range. Storage for one year increased the fat acidity being lowest intin pots. Considering the adjustments in the quality parameters examined, it is recommended that cotton bags and earthen pots perform better for storing wheat grains in regions with higher temperature and humidity in Muzaffarnagar, UP, India.

This examination is useful in comprehension about differing wheat varieties and their conduct for wheat production. Results can be utilized in wheat assortment development with explicit end utilize quality of wheat making and chose varieties can be utilized for mechanical production with completely automated procedure for good quality products

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