

SOMALI REGION PASTORAL & AGRO-PASTORAL RESEARCH INSTITUTE (SoRPARI)

FOOD SCEINCE AND NUTRITION RESEARCH DIRECTORATE

RESEARCH PROPOSAL SUBMITTED TO SOMALI REGION PASTORAL AND AGRO-PASTORAL RESEARCH INSTITUTE

PROXIMATE, ANTI-NUTRITIONAL, PHYSICOCHEMICALPROPERTIES, AND FUNCTIONAL PROPERTIES OF DIFFERENT WHEAT VARIETIES PRODUCED/ADAPTED UNDER SoRPARI AND IN SOMALI REGIONAL STATE

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ABSTRACT

Wheat is one of staple crop that widely consumed in Somali community. The study was conducted in Somali Regional state with objective to analyze the proximate, functional and physical characteristics of different wheat varieties adapted in Somali regional state. Nine different types of samples such as *fantail, jay, nasired, Qunfo, shid, xiryane, Local* and control as control sample were collected from Kelafo research sub-center and other areas like Tuuli, and Lafcise. The collected wheat samples were individually grounded to a fine powder (30 mesh size), packed in air tight polyethylene plastic bags and were stored at 4°C until further analysis. Proximate composition such as crude Protein, crude Fat, crude fiber, moisture content, carbohydrate, total energy, different minerals like Calcium, Iron, Zinc, Magnesium, and Potassium were determined by AOAC. The anti nuitrional content such as phytate & tannins and functional & physical properties were also determined by different standard procedure. Based on the result obtained the moisture, ash, crude fiber, protein and fat are in the range of 11.21 (bardheer) -7.71% (fantail), 2.64% (fantail) - 0.67% (jay), 2.51%(xiryane) 1.46% (jay), 13.23% (Qunfo) 6.36% (fantail) and 1.10% (local) 1.75% (control) respectively and most of them are statistically different at $P<0.05$. The minerals content is also in the range of 55.77 (fantail) – 35 mg/100g (bardheer), 7.47% (fantail) 3.24 mg/100g (local), 406.8 (fantail) – 204.3mg/100g (Qunfo) and 6.950 (fantail)-2.53mg/100g (local) for calcium, potassium, zinc and iron respectively and more or less they were statistically different at $P<0.05$. Regarding the anti-nutritional content, the tannins and phytate content is in the range of 6.381% fantail and xiryane) 3.481% (control) 0.077% and (xiryane) 0.035% (control) - (xiryane) for tannins and phytate respectively and statistically different for tannins content at $P<0.05$. The functional and physical properties of different wheat varieties under study were more or less statistically different at $p<0.05$. Overall, from the finding we conclude that, adapted wheat varieties have better in nutritional content especially, ash and fiber and protein content especially varieties with Qunfo. Varietal difference, agro-ecology, nature of soil, farming management and some other reason might be the factor for their different in their nutritional content. Wheat is reached in protein, minerals and other important nutrient and therefore, we recommend that, it can be used either alone or mix with those staple legumes as part of fighting against malnutrition and in the preparation of different recipe.

Key words: *Wheat, Varieties, Proximate analysis, Anti-nutritional factors, functional propertie*

CHAPTER ONE

2. INTRODUCTION

2.1. BACKGROUD

Wheat (Triticumaestivum) is one of the world's most important cereal crops produced and consumed around the world (1) Wheat is the grass widely cultivated for its seed a cereal grain which is worldwide staple food the many species of wheat together make up the genus wheat is grown on more land area than any other food crops largest producer of wheat contributing 3.17 percent of the total world wheat production (2)

It contributes 13.8 percent to the value addition in agriculture grain hardness being the most important. Wheat quality is dependent upon soil composition and environmental factors including temperature, rainfall, Humidity etc. (3). Variation in quality parameters like physic-chemical, rheological and functional characteristics of wheat varieties suitable for chapatti making is due to the differences in soil, environmental conditions and agronomic practices (4). Fluence quality of wheat (5) and 30 percent to the total GDP of Pakistan (6).

Africa produces more than 25 million tons of wheat on10mha while sub-Sahara Africa (SSA) produce at total of 7.5MT on a total area of 2.9mha accounting for 40 and 1.4 percent of the wheat production in Africa and global level respectively (7). The wheat which on the account for 95 percent of the wheat production at the global level is also dominant types produce in SSA from 1970 to 2014. The most important wheat producing countries in SSA are; Ethiopia, South Africa, South Sudan, Kenya, Tanzania, Nigeria, Zimbabwe, and Zambia.Ethiopia account for the largest production area (1.7mh) followed by South Africa. Wheat consumption in Africa has been rising faster than in any other region around the world. The population of the Sab-Sahara Africa was 50 percent greater than it had been 14 years prior and the last year Sub-Sahara Africans were consumed one-third more wheat.

2.2. Statement of the problem

Wheat (Triticum aestivum L.) is a major crop grown in many countries. It is predominantly used for the production of products, such as bread, pasta, cereals and cakes, which are consumed on a regular basis Thus; wheat has the potential to contribute to the reduction of malnutrition and defi-

ciency-related ailments by contributing to food security and the daily required intake of essential macro- and micro-nutrients in individual.

Nutritional quality is a collective term that refers to the bioavailability or concentration of desirable nutritional components for human health such as iron (Fe), zinc (Zn), vitamins and selected phenolic acids found in the wheat grain. These key nutritional components are found in different wheat grain compartments at varying concentrations [40]. The wheat germ and bran region contain the highest levels of these nutritional components [41]

Micronutrient deficiencies, especially those arising from Fe, Zn and vitamins pose a serious threat to human health as they affect more than 2 billion people worldwide especially women and children under the age of 5 years [42]. Cardiovascular diseases, diabetes, cancer and malnutrition are among the most dreadful diseases. These diseases could be prevented through regular consumption of selected nutritionally important components, such as wholegrain products and antioxidants, which are acquired as phenolic acids from various foods including the wheat grain [43].

Human health through ensuring that the required dietary intake of essential nutrients can reach poor individuals in a more sustainable and cost-effective manner. Bio fortification is a process of enhancing the dietary bioavailability or concentration of desirable nutritional components in plants genetically [44]. This process has been used to successfully improve the bioavailability or levels of β-carotene in rice, Zn and Fe in wheat grain as well as levels of other nutrients in other crops [42].

As a result, a number of strategies have been deployed to improve nutritional quality in wheat, such as conventional, technological and transgenic approaches that were undertaken in efforts to improve the levels and bioavailability of micronutrients and phenolic acids, mainly through the bio fortification route [40]. This includes several efforts that managed to successfully increase the total grain nutrient content and bioavailability of some micronutrients through genetic bio fortification, agronomic bio fortification, the use of bioavailable.

Wheat is a strategic food security commodity in Ethiopia, and its production has effected significant change in the livelihoods of farmers and has well for a large number of people across different areas of the country. In the Somali region, the production of wheat plays an important role in abating the problem of food insecurity in the farming community. Enriching Livelihoods and increasing the quality and nutritional analysis of wheat production in the Somali region is mandato-

ry. Therefore, this is research is aimed at helping by evidence or data on all efforts made on mass production of this strategic crop through analysis nutritional content of different wheat varieties.

2.3. Objective

2.3.1. General Objectives

The general objective of the study was to evaluate the proximate, functions and Physico chemical property of different wheat varieties adapted under SoRPARI and in Somali Region state.

2.3.2. Specific Objective

The specific objectives of the study were to;

- To analysis the proximate composition of different wheat varieties
- To analysis the anti-nutritional factors of different wheat varieties
- To analysis the physic-chemical properties of wheat varieties

2.4. Significance of the study

This study was important as it is the 1st in its nature to conduct such a study on different wheat varieties proximate composition, Physico-chemical properties. The outcome of the study was important to get up-to-date data on the nutritional composition, physical, functional. The result obtained from this study was further be important for the future researchers as baseline information to conduct their research. Based on the recommendation come out from this study, policymakers, government, non-Government organizations and other interested institutions working on the area was expected to get up-to-date information from.

CHAPTER TWO

2. LITERATURE REVIEW

Cultivated Wheat emerged about 10,000 years ago in an area belonging now to north-western Iran or northeastern Turkey (McFadden and Sears 1946; Zohar and Hop 2000). The first introductions of wheat in Europe occurred around 7000 BC in the southern portion of the continent and from there the species migrated to North Africa (Feldman 2001), while a second major wave of migration occurred from North Africa during the middle Ages (Moragues et al. 2006a). The first introductions of wheat to the Archipelago of Madeira commenced in the 15th century from mainland Portugal along with the island colonisation when a great variety of crop species were brought here from different geographical regions of the world. Several later introductions have occurred in the 17th and 18th centuries from North

Wheat diversity were associated with new settlers arriving to the island who brought a wide variety of germplasm from other locations. The introduced diversity was preserved for several centuries as a result of specific cultivation practices adopted by the Madeiran farmers. For centuries, wheat was cultivated on all the inhabited islands of the archipelago at altitudes ranging from 30 m (Canic¸o or Santana) to 600–800 m asl (Maloeira, Santa Cruz or Campana). Local farmers who operated on small plots, often located in remote and isolated mountain valleys, have been using their own stocks of wheat seeds that were apparently introduced to the island centuries Wheat production and productivity in Ethiopia

2.2. Proximate Composition

2.1.2. Moisture Content

The moisture content of Asomdwee cowpea was the highest and was significantly ($P < 0.01$) different from soft wheat flour. The moisture content of wheat flour was lower than 11.60% and 13.29% recorded for buckwheat flour and refined wheat flours [8] as well as 13.3% for wheat flour as reported by [9]. The moisture content in this study for cowpea was higher than the (9.20%) for cowpea flours in Nigeria by [10]. The moisture content of wheat flour was within the acceptable limit of not more than 10% for long term storage of flour [11]. Moisture content of foods is influenced by type, variety and storage condition [12]. The low moisture content of wheat flour would enhance its storage stability by avoiding mould growth and other biochemical reactions [11]. [13] Reported moisture content of (7.75%) for wheat flour which was quite higher than the moisture content in the soft wheat flour in this research. This assertion explains why they have

longer shelf life and also confirms their used in both noodles and bakery products. According to high quality noodles should have an adequate shelf life without any microbiological deterioration and therefore.

2.2.3. Crude Protein Content

The crude protein content of the flour samples ranged between 10.23% and 24.53% The protein content of wheat flour reported in this study was found to be lower than the 14.70% [1] and 12.86% [14] for wheat flours. The crude protein content differences can be attributed to the geographical location. Since soils with high nitrogen levels can influence protein levels [15]. The protein content of the flours in this study suggests that they may be useful in food formulation systems especially with the Asomdwee cowpea variety. The protein content of Asomdwee cowpea (24.53%) was found to be between the range of 20 - 27 % reported by [16] for some cowpea varieties and also close to 21.63- 25.28% for four advanced lines of cowpea reported by [17]. The crude protein content and quality of wheat flours can be improved by blending wheat flours with cowpea flours and used as composite flours.

2.2.3. Crude Fat Content

Soft wheat flour had higher (1.33%) fat content than cowpea (1.00%). [18] had 2.80% and 1.80% fat content for brown rice and refined wheat flours respectively. The fat content of wheat flour from this study was found to be lower than1.5% reported for wheat flour [19]. The differences in fat content may be due to location and varietal differences [20]. Diets with high fat content contribute significantly to the energy requirement for humans. High fat content of soft wheat flour in this study would make it a better source of fat than the cowpea flour. High fat flours are also good for flavor enhancers and useful in improving palatability of foods in which it is incorporated [21].

2.2.4. Ash Content

The ash content of the flours ranged between 1.00 and 3.00% The ash content for wheat flours in this study was lower than the 2.53% for mung bean flour and 2.53% for chickpea flour as well as 6.51%, 4.58%, 4.73% and 3.25% for Jack bean, Pigeon pea, cowpea and mucuna bean flour respectively [10]. The ash content (1.40%) of refined wheat flour [18] was close to 1.00% wheat flour reported for these studies. Ash content is an indication of mineral content of a food. This therefore suggests that Asomdwee cowpea flour could be important sources of minerals than wheat flours. Ash content in wheat flours can be improved if cowpea is incorporated.

2.2.5. Crude Fiber Content

[18] Reported 1.23% for brown rice flour and 0.85% refined wheat flour. The crude fibre content of 0.51% recorded for wheat in this research was quite close to the 0.85 % reported by [18]. Asomdwee cowpea flour had the highest crude fiber content (3.21%). [16] Reported crude fiber content of 8.19% for pigeon pea, 9.58% cowpea, 4.61% mung bean and 6.83% for peas flour. These were all higher than the crude fiber obtained for the two flours in this research. Crude fiber helps in the prevention of heart diseases, colon cancer, diabetes etc. Wheat flour would not be a better source of fiber content since it had significantly lower crude fiber content. Therefore, it will be useful if cowpea is added to it and used in food formulation to help relieve constipation.

2.2.6. Carbohydrate Content

The carbohydrate content of the flours varied from 57.35% to 83.60%. Wheat flour had the highest carbohydrate content (83.60%). The carbohydrate content of the flours for cowpea and wheat flours was comparable to 57.17% for cowpea, 74.22% for wheat; reported by [25]. Carbohydrate content of 50.95% to 53.98% reported for Nhyira, Tona and Adom cowpea varieties were within the ranges recorded in this research [25]. [24] recorded lower range (34.97 to 39.86%) carbohydrate content for three soya bean varieties. It can be observed that the flours used for these studies had higher carbohydrate content. The high carbohydrate content of wheat flour suggests that it could be used in managing protein-energy malnutrition since there is enough quantity of carbohydrate to derive energy from in order to spare protein so that protein can be used for its primary function of building the body and repairing worn out tissues rather than as a source of energy [28]. Carbohydrates are good sources of energy and that a high concentration of it is desirable in breakfast meals and weaning formulas. In this regard therefore, the high carbohydrates content of the wheat flour would make it a good source of energy in breakfast formulations [28].

2.3. Functional Properties

2.3.3. Bulk Density

The bulk densities obtained in this research were lower than those reported by [24] for three soya beans varieties in Ghana (1.56 to 2.09g/cm3) however; the bulk densities obtained were also found to be higher than six improved commercial chicken pea cultivars in India with bulk densities ranging from 0.55 to 0.57g/cm3. Bulk densities of 0.85±0.01 and 0.68±0.00 g/cm3 reported by [18] for brown rice flour and refined wheat flour were similar to the results obtained from this research. According to [9] bulk density is a function of particle size, particle size being inversely propor-

tional to bulk density. Particle size differences may be the cause of variations in bulk density of the flours. The particle size also influences the package design and could be used in determining the type of package material required. Higher bulk density is desirable since it offers greater packaging advantage as greater quantity of flour can be packed within a constant volume.

The bulk density of the flours could be used to determine their handling requirement, because it is the function of mass and volume [26]. Bulk density is also important in infant feeding where less bulk is desirable. Since soft wheat flour was the least dense it would occupy greater space and therefore would require more packaging material per unit weight and so could have high packaging cost [27] however, soft wheat flour would be easier to transport as it was lighter. The low bulk density of wheat flour would be an advantage in the use of the flour for preparation of complementary foods. The low bulk density of soft wheat flour could be attributed to the relatively lower protein content and moisture content [26].

2.3.2. Oil Absorption Capacities

Oil absorption capacity is attributed mainly to the physical entrapment of oils. It is an indication of the rate at which the protein binds to fat in food formulations [11]. The lower oil absorption capacity of soft wheat could be due to low hydrophobic proteins which show superior binding of lipids [28]. The Oil absorption capacity of cowpea flour in this study was lower than that (1.95 to 2.14ml/g) reported for Nhyira, Tona and Adom cowpea varieties [25]. [29], reported oil absorption capacity of 1.05 to 1.17 ml/g for six improved commercial chicken pea cultivars. Oil absorption capacity values of 1.13, jack bean, 1.48 pigeon pea and 1.13ml/g cowpea were in accordance with the results obtained in this research [10]. Higher oil absorption capacity of 1. 96 and 1.61 ml/g were reported for brown rice flour and refined wheat flour [18]. These values were found to be higher than those obtained in these studies. The relatively high oil absorption capacity of cowpea flour suggests that it could be useful in food formulation where oil holding capacity is needed such as sausage and bakery products [25]. This shows that cowpea flour would be useful in this respect than wheat since it had significantly higher oil absorption capacity.

2.3.3. Water Absorption Capacity

The cowpea flour had higher (2.27%) water absorption capacity than wheat flour (1.50%). The water absorption capacities of the flours were comparable to that of full fat flours in six mucuna species (1.2 to 2.00 g/g) reported by [23]. The water absorption capacities of the flours under

study were found to be higher than 0.32 g/g for wheat, 1.68 g/g maize and 0.89 g/g cowpea reported by [26]. [28] Reported water absorption capacity value of 2.45g/g for wheat flour, which was higher than the one under study. [29] Reported water absorption ranges of 1.34 to 1.47g/g in some chicken pea cultivars. Water absorption capacity represents the ability of the products to associate with water under conditions when water is limiting such as dough's and pastes. The result of this study suggests that cowpea would be useful in foods such as bakery products which require hydration to improve handling features [22].

2.4. Anti-nutritional factors

Several types of anti-nutritional factors with a toxic potential have been measured in foods and shown to be heat stable or heat-labile. These factors include tannins and phytic acid.

2.4.2. Phytate

Phytate or phytic acids occur naturally in the plant kingdom. Phytate is generally known as myo-inositol-1, 2, 3, 4, 5, 6, hexakis dihydrogen phosphate, which is present in foods at various levels ranging from 0.1 to 6.0% (30). Phytic acid is a secondary compound, which concentrates naturally in plant seeds, mainly in legumes, peanuts, cereals, and oilseeds and generally found in all plant-based foods (31). In several cases, Phytate contain about 50 to 80% of the total phosphorous in seeds

(32). Because plant-based foods contain more amount of phytic acids than animal-based foods, the vegetarian diets culture in developing countries contribute to high ingestion levels (33). According to a previous report, phytic acid hinders the activity of enzymes, which are necessary for protein degradation in the small intestine and stomach (34). Generally, phytic acids affect the bioavailability of minerals and have a strong effect on infants, pregnant and lactating women when large portions of cereal-based foods are consumed (35) during germination of seeds, some native enzymes.

2.4.3. Tannin

Tannins are phenol compounds, which consist of molecular weights greater than 500Da. One of the properties of these compounds is that they can precipitate proteins. Tannins are secondary compounds, which are formed in plant leaves, fruits and bark (37). Tannins usually affect protein digestibility and lead to reduction of essential amino acids by forming reversible and irreversible tannin-protein complexes between the hydroxyl group of tannins and the carbonyl group of proteins (36). Proteins, which generally form complexes with tannins, are relatively large and hydro-

phobic in nature, in addition to an open and flexible structure that is enriched with proline (38). Tannins are largely concentrated in beverages, pomegranate, berry fruits and cocoa bean, although they are also found in cereals such as sorghum and barley (39). In nature, there are two types of tannin groups: hydrolyzable (e.g. gallotannins and ellagitannins) and condensed.

CHAPTER THREE

3. METHOD AND MATERIAL

3.2. Structure of the Experiment work

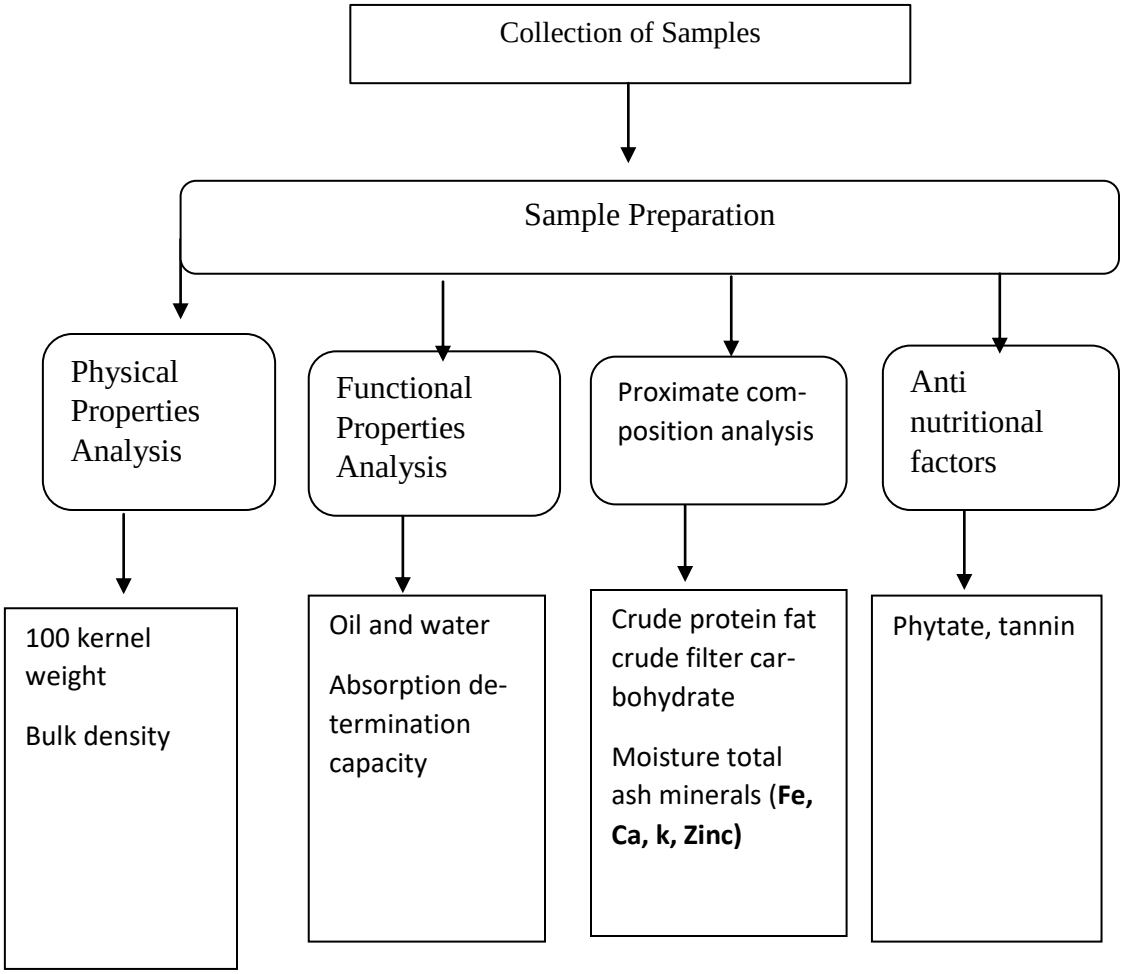


Figure 1. Experiment work

3.3. Materials and Equipment Used

Nine sample adapted under s Somali Region were collected. Two wheat varieties produced or adapted under Somali Region it was collected from **Qalaf**o center and **Tulli** a & **Lafcise** and another three wheat samples were purchased from each respective centers/area market as a control for comparison purpose. Only wheat without any physical damage or insect infestation was selected for analysis. All equipment used in sample preparation was expected to be obtained from laboratories and missed equipment was used from local institutes further, after bringing to the laboratory, wheat samples was individually ground to a find powder (30 mesh size), packed in air tight polyethylene plastic bags and was stored at 4°C until further analysis

3.4. Physical properties

A. hundred (100) kernel weight and bulk density

One thousand wheat kernels were randomly selected and weighed separately. For bulk density, 50 g of rice grains was weighed and was dropped into a graduated glass measuring cylinder from a constant height (approximately 30 cm). The volume occupied by rice samples were recorded and bulk density were calculated as g/ml ratio (24).

3.5. Proximate Composition

3.5.1. Moisture content

The moisture content of the samples was determined by drying 10g of sample in an air oven at 105oC to constant weight (16 -18 h)

3.5.2. Protein content of the flour

Protein content was determined according to AOAC (2000) using the official method 979.09, which comprised three major steps: digestions, distillation and titration, and quantification.

Digestion

Fresh samples (in duplicate) of each 0.5g was added into Tecator tubes and 6ml of acid mixture (5parts of concentrated ortho-phosphoric acid and 95 parts of concentrated sulfuric acid) was added into each tubes and mixed, and 3.5ml of 30% hydrogen peroxide was added step by step, resulting in violent reaction. Following the cessation of violet reaction, the tubes should be shaken and placed back to the rack. Catalyst mixture (ground 0.5g of selenium metal with 100g of potassium sulfate) of 3g was added into each tube and was allowed to stand for about 10 minutes before di-

gestion. Following the attainment of digester temperature at 370^{o}C, the tubes was low ill bed into the digester. The digestion was continued until a clear solution was obtained (~ after 4 hours). The tubes in the rack should be cooled in a fumehood. 25 ml of de-ionized water was added and the mixture should be shaken to avoid precipitation of sulfate in the solution.

Distillation and titration

The digested and diluted sample solution was distilled using boric acid and the distillate was subjected to titration using 0.1N hydrochloric acid until reddish color appeared.

Quantification of crude protein concentration

$$\text{Nitrogen } \% = \frac{\text{VHCl} * [\text{HCl}]}{\text{Wo}} * 14 * 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$\text{Protein } \% = 6.25 * \% \text{ Nitrogen} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where; V is the volume of HCl consumed in liter, N is the normality of HCl (0.1N), W_O is the sample weight on dry mass basis and 14 is the molecular weight of nitrogen.

3.5.3. Experimental analysis of fat

The fat content of the complementary food samples (flours) was determined using a semi-continuous solvent extraction method (Sox let method) following the procedures of AOAC 960.39 (2000). In this method, the solvent builds up in the extraction chamber for 5-10 minutes and completely surrounds the sample and then siphons back to the boiling flask.

The crude fat content (percent weight by weight) was calculated as follows:

$$F = \left(\frac{W2 - W1}{W}\right) * 100\% \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where;

F= Crude fat content in percent weight by weight

W_1 = Weight of the extraction flask in gram (g)

W_2 = Weight of the extraction flask and the dried crude fat in gram (g)

W = Weight of sample in gram (g)

3.5.4. Experimental analysis of ash content

The ash content was determined based on AOAC (2000) using the official method 923.03. Briefly, porcelain crucible that is was behed using distilled water was ed in a muffle furnace at 550^{o}C for 30 minutes. Then, the crucibles will be cooled by placing it in desiccators for 30 minutes at room

temperature. Following this step, they was weighed to the nearest milligram (M_1) using the dried, cooled and weighed crucible, 2.5g of fresh sample together (M_2). Then the sample was thoroughly char in fume-hood by placing it on a hot plate, and increasing the temperature slowly until smoking ceases. After the completion of charring, the sample was placed into the muffle furnace at 550^{o}C for 5 hours. The ignition was continuing by cooling for 1hour and weighing until a clean and white ash was obtained, which was then measured to the nearest milligram (M_3).

$$\text{Total ash(in \% weight by weight)} = \left(\frac{M3 - M1}{M2 - M1}\right) * 100 \ldots\ldots\ldots\ldots\ldots (5)$$

(M_2-M_1) is the weight of sample in gram (g) on dry basis
(M_3-) $M_1$is the weight of ash in gram (g)

3.5.5. Experimental analysis of carbohydrates

The total available carbohydrate concentration was determined by difference according to AOAC official method, (922.02, 925. 05).

% Carbohydrate = 100% - (%moisture + %protein + %fat + %ash + % crude fiber)….

3.5.6. Experimental analysis of the crude fiber content

The crude fiber content of the complementary foods (flour) was determined by using the official method of AOAC (2000). The method involved the digestion of a fresh sample, filtration, will being, drying and combustion. Following these steps, the crude fiber was calculated using the following formula:

$$\text{Crude fiber in } \left(\frac{g}{100g}\right) = \frac{[(W2-W3)*100]}{W1} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where;

W_1 = weight of the fresh sample

W_2 = weight of crucible with the sample after

W3 = weight of the crucible with the sample after ashing

3.5.7. Gross energy (total calorie)

Gross energy was determined by calculation from fat, carbohydrate and protein contents using the Atwater's conversion factors: 16.7 KJ/g (4 kcal/g) for protein, 37.4 KJ/g (9 kcal/g) for fat and 16.7 KJ/g (4 kcal/g) for carbohydrates and expressed in calories.

3.5.8. Gross energy (total calorie)

Gross energy was determined by calculation from fat, carbohydrate and protein contents using the Atwater's conversion factors: 16.7 KJ/g (4 kcal/g) for protein, 37.4 KJ/g (9 kcal/g) for fat and 16.7 KJ/g (4 kcal/g) for carbohydrates and expressed in calories.

3.5.9. Mineral analysis

Mineral composition of the samples was determined according to methods recommended by Sociation of Official Analytical Chemists (AOAC, 2000). Fe and Zn content of complementary food samples was determined by atomic absorption spectrophotometer (AAS) following standard procedures.

3.5.10. Sample preparation for Fe and Zn

The complementary food samples were ashed following the procedure described above in the total ash analysis section. 7 mL of 6N HCl solution was added to the ash of each sample and heated on a low temperature hot plate until it dried. Then, 15 mL of 3N HCl solution was added and the mixture will be heated on the hot plate till it just boils. After the solution cooled down, it was filtered through a filter paper into a volumetric flask (50 mL). Ten mL of 3N HCl was added and the crucible will be heated until the solution boiled.

The solution was allowed to cool and filtered through a filter paper into the volumetric flask. The crucible and filter paper was behed thoroughly and the will beings was collected into the flask. Finally, 2.5 mL of lanthanum chloride was added into the solution and the volume was made up to the 50 mL mark with demonized water. Blank sample will also run by taking the same amount of reagents. The solutions were transferred to polyethylene bottles and stored in cool place until analysis.

3.5.11. Calibration curve and AAS reading

In order to fit calibration curves, a series of standard solutions of the minerals was prepared From stock solutions of 20 pm for Fe (0, 0.5, 1, 2, 3, and 4) and Zn (0, 0.5, 1, 2,3 and 4 pm). The flame AAS was calibrated with the prepared standards for the respective minerals and the sample solutions and also the blank was run to correct the obtained values. Finally, the mineral content of the samples was calculated by using the following formula.

$$\text{Mineral content } (mg/100g) = \frac{[(cs-cb)x\ v\ x\ D]}{10\ x\ W}$$

Where,

Cs = concentration sample, Cb = Concentration of the blank, V = volume (mL) of the extract and W = weight of samples, D= dilution factors.

$$\text{Fe content } (mg/100g) = \frac{(c-D)x\ 200}{w\ x\ 10}$$

$$\text{Zn content } (mg/100g) = \frac{(E-F)x\ 2000}{wx\ 10}$$

W = weight (g) of sample

C and E = Concentration of the sample

D and F = Concentration of blank

The mineral contents were determined by the procedure of AOAC (1984). Calcium, iron, and zinc will be determined according to AOAC 2000 official methods of 985.35 using an Atomic Absorption Spectrophotometer while phosphorous was determined by official method of 986.24 using calorimetric method using ammonium molybdate. After removal of organic material by dry ashing, the residue was dissolved in dilute acid. The solution was sprayed into the flame of Atomic Absorption Spectrophotometer (Varian SpectraAA-20Plus, Varian Australia Pty., Ltd., and Australia) and the absorption of the metal to be analyzed was measured at a specific wavelength.

The stock standard solutions of minerals (iron, zinc and calcium) was diluted with 0.3 N HCl to concentrations that fall within the working range (0, 0.6, 1.0, 1.4, 1.8, µg/ml for zinc analysis; 1.0, 1.5, 2.5, and 3.0 µg/ml for calcium analysis and 0, 2.0, 6.0, 10.0 12.0 µg/ml for iron analysis). The Atomic Absorption Spectrophotometer (AAS) used for mineral determination will be calibrated using standard solutions and the reagent blank solution will be run with the sample.

Ashes was obtained from dry ashing. The ash was wetted completely with 5ml of 6N HCl, and dried on a low temperature hot plate. A 7ml of 3N HCl was added to the dried ash and heated on the hot plate until the solution just boils. The ash solution was cooled to room temperature at open air in a hood and filtered through a filter paper (What man 42, 125mm) into a 50ml graduated flask. A 5ml of 3N HCl was added into each crucible dishes and heated until the solution just boil, cooled, and filtered into the flask. The crucible dishes were again was bath three times with deionized water; the was beings was filtered into the flask. A 2.5mL of 10% Lanthanum chloride solution was added into each graduated flask. Then the solution was cooled and diluted to the mark (50ml) with deionizer

Water. A blank was prepared by taking the same procedure as the sample.

Calculation:

Mineral content (mg/100g) = [(a-b) x V]/10W

Mineral content (mg/Kg) = [(a-b) x V]/W

Where, W = weight in grams of samples

V = Volume in ml of extract

A = concentration in micro gm/ml of sample solution

B = concentration in micro gm/ml of blank solution.

3.6. Determination of functional properties

3.6.1 Oil and Water Absorption Capacity Determination

2g of the samples was mixed with 10ml of distilled water for 5 minutes respectively on a magnetic stirrer. The mixture was centrifuged at 3500rpm for 30minutes and the volume of the supernatant will be measured by using 10ml measuring cylinder on each of the sample. The water density was \taken to be 1g/ml.

WAC=$volumeofwaterabsorbed$/Weight of the sample used× 100

FC (%) =$(\boldsymbol{AW-BW})/\boldsymbol{BW}\times \mathbf{100}$

Where, AW = after whipping, BW = before whipping

EC (%) =$\boldsymbol{H2/H1}\times \mathbf{100}$

Gruel solid loss

To measure the gruel solid loss, approximately 2 g of wheat grains was cooked in 20 ml of distilled water for minimum cooking time. The gruel obtained was transferred to beakers (50 ml) after few was (3-5 times), and the volume will be made up with distilled water. Further, the aliquot was evaporated in a vacuum oven (at 110°C) until it was completely dried. The solid obtained was weighed and the percentage of gruel solid loss was calculated.

3.7. Anti-nutritional factors determination

3.7.1. Determination of tannin content

Quantitative estimation of tannin was carried out using the modified vanillin – HCl method according to Price. The vanillin HCl reagend was prepared by mixing equal volumes of 8% concentrated HCl in methanol and 1% vanillin in methanol. The two solvents of the reagent were mixed just prior to use; it was discarded if a trace of color appeared. Catechin will be used to prepare the standard curve; this will be done by adding 100mg of catching to 50 ml of 1% HCl in methanol. From this solution a series of dilutions was prepared. Five milliliters of vanillin/HCl reagent was added to 1 ml of each dilution. The absorption was read using spectrophotometer at 500nm after 20 min from addition of the reagent at 300C. The absorbance was plotted against catching concentration. A 0.2g of the sample was placed in a test tube, and then 10ml of 1% HCl/ methanol are added. The test tube will be capped and continuously shaken for 20 min. and then centrifuged at

5000 rpm for 5 min. one milliliter of the supernatant was pipetted into the tube and then proceeding as was described in the standard curve above. For zero setting before absorbance will be read, 1 ml of blank solution (1% HCl in methanol) was mixed with 5ml 4% concentrated HCl and 5ml of vanillin – HCl reagent in a test tube and incubated for 20min at 300C. Absorbance was read at 500nm and the concentration of condensed tannin was determined from the standard curve. Tannin concentration was expressed as % as follows:

$$CE\ (\%) = \frac{C \times 10 \times 100}{200}$$

Where:

CE = Concentration corresponding to the optical density

C = Concentration

10 = Volume of extract (ml)

200 Sample weight (mg)

3.7.2. Determination of Phytic acid:

Phytic acid content was determined by the method described by Wheeler and Ferrel Two grams of milled dried sample were weighed in 125ml conical flask with 50ml of 3% trichloroacetic acid (TCA) for 3 hrs with mechanical shaking. The suspension was centrifuged for 5 min. Ten milliliters aliquot of the supernatant was transferred to 50ml boiling tube; 4ml of FeCl3 solution (made to contain 2 mg ferric ion per ml in 3% TCA) was added to the aliquot. The tube was heated in a boiling water bath for 45min. One or two drops of 3% sodium sulphate in 3% TCA) were added. Then the tube was cooled and centrifuged for 10-15 min at 2500 r. p .m. The clear supernatant was carefully decanted. The precipitate will be washed twice by dispersing well in 25 ml 3% TCA, heated for 10 -15 min in a boiling water bath, then centrifuged again. Washing was repeated once more with water. The washed precipitate was dispersed in a few ml of water and 3 ml of 1.5N NaOH was added and the volume completed to 30 ml with water. The tube was heated in a boiling water bath for 30 min and hot filtered using Whatman No. 1; the precipitate was washed with 60ml hot water; the washings was decanted. The precipitate was dissolved from the filter paper with 40 ml 3.2N HNO3 (hot) into 100ml volumetric flask. The paper was washed with hot water. The washing was collected in the same flask then completed to the volume. Then 0.5 ml aliquot will be taken from the above solution and trans.

ferred into 10 ml volumetric flask, then 2 ml of 1.5N potassium thiocyanate (KSCN) was added and the volume was completed to 10 ml with distilled water. The density of colour was read im-

mediately at 480 nm using spectrophotometer (Jenway 6305 uv/vis). A standard curve of different $Fe(NO_3)_2$ concentrations was plotted to calculate the ferric ion concentration assuming 4:6 iron: potassium molar ratio.

Phytate (mg/100g) = $\frac{6/4[A \times C \times 20 \times 10 \times 50]\ mg/100g\ sample}{1000 \times 2}$

Where:

A = optical density

C = concentration corresponding to optical density

10 = volume of extract taken from supernatant

1000 = to convert from g to mg

4:6 = iron to phosphorus molar

20 = dilution factor

50 = volume of T.C.A

3.8. Statistical analysis

All the analysis was performed in duplicates (unless stated otherwise) and presented as mean ± standard deviation. Statistical significance of the data obtained was analyzed and modeled usuing genets ® version 6.0.2, Minneapolis, USA. The level of significance was accepted at probability ($p<0.05$)..

CHAPER FOUR

4. RESULT AND DISCUSSION

4.1. RESULT

4.1.1. Macronutrient contents of different Wheat varieties

The proximate composition/macro-nutrient contents of different wheat varieties are indicated in table 1 below. The moisture content of K-Fantale was found the lowest 7.71% while the T-Bardheer has the highest moisture content was found 11.21%. The moisture were statistically different among T-bardheer (11.211), T-Qunfo (7.968), T-jay (9.609) at $p<0.05$. The moisture content is also significantly different in between T-Jay (9.609) and k-fantail &t-xiryane respectively at $P<0.05$. On the other hand, there is no significant difference in moisture content among T-shid (8.370), T-local (8.315) control (8.841), L-Nasired (8.886) Qunfo (7.968)) at $P <.0.05$.

Ash content of nine varieties under study were in the of range of 0.673 to 2.643. The T- jay" has the lowest while the fantail has highest. The ash content is significant different among the Bardheer (0.948), T- Fantail(k) (2.643), T-jay (0.673) at $p<0.05$. The Ash is also significantly different in between T-Jay (0.673) and k-fantail & Nasired respectively at $P<0.05$. On the other hand, the Ash content is not significantly different among Bardheer (0.948) T-local (1.049), control (1.072), Qunfo (1.073) Xiryane (1 2.509)) at $P<0.05$.

The crude fat content T-Jay has the lowest (1.46 %) while Xiryane varieties has highest (2.51%). The crude fat for all wheat varieties were significantly different at $p<0.05$. When it comes to protein content, it ranges from 6.36% to 13.23%. Fantail has the lowest in protein while Qunfo has the highest protein and all sample were significantly different at $p<0.05$. T- local has the lowest (1.10%) the crude fiber content while the control has highest (1.75) and there are no significant different in between most of the varieties. With carbohydrate content K-fantail has the highest in carbohydrate (79.41) while Xiryane has the lowest 73.76. The carbohydrate for all varieties are not significantly different except two varieties which are T-local (76.50) Fantail (k) (79.41), at $p<0.05$. Finally, when it comes to energy obtained from 100g of wheat varieties it is in the range of 350.47(Xiryane) to 368.8 kcal (Qunfo). There is no significant different in energy in between most of the samples. But the energy is significantly different in between Bardheer (352.58) and Qunfo (368.8) & Jay (352.51) respectively at $P<0.05$.

Table 1: Macronutrient contents of different wheat varieties.

Varieties	Parameters						
	Moisture %	**Ash %**	**C .fat %**	**C. protein %**	**C. Fiber %**	**CHO %**	**Energy %**
Bardheer	11.21 ±0.0^{d}	0.95±0.10 ^{ab}	1.62±0.01^{bc}	10.55±0.20^{b}	1.72±0.005^{c}	73.95±0.10^{a}	352.58 ±0.5 ^{a}
Fantail(k)	7.71±0.35 ^{a}	2.64±0.30^{c}	2.26±0.02^{f}	6.36±0.14 ^{a}	1.62±0.01 ^{c}	79.41±0.48^{c}	362.34 ±2.7 ^{bc}
Jay (t)	9.61±0.1^{cd}	0.67±0.12 ^{a}	1.46±0.02 ^{a}	12.34±0.5^{e}	1.64±0.005^{c}	74.28±0.18^{a}	352.51±0.08 ^{b}
Nasired	8.89±0.52^{abc}	1.32±0.02 ^{b}	1.80±0.04^{d}	12.41±0.28^{e}	1.38±0.17^{b}	74.20 ± 0.5^{a}	362.64±1.47^{bc}
Qunfo	7.97± 0.55^{b}	1.07±0.03 ^{ab}	1.88±0.03^{e}	13.23±0.1 ^{f}	1.11±0.003^{a}	74.74 ± 0.7^{a}	368.8±2.3^{c}
Shiidit(t)	8.37±1.01^{abc}	1.25±0.100^{b}	2.32±0.03^{g}	11.67±0.257^{d}	1.64±0.018^{c}	74.75±0.83^{a}	365.75±4.3^{bc}
Xiryane	9.79±0.37 ^{cd}	1.27±0.05^{b}	2.51±0.02 ^{h}	11.00±0.07^{bc}	1.67±0.007^{c}	73.76±0.32^{a}	350.47±1.57^{bc}
Local(t)	8.31±0.02^{abc}	1.05±0.05^{ab}	1.67 ±0.04 ^{c}	11.37±0.16^{cd}	1.10±0.028^{a}	76.50 ± 0.8^{b}	360.93±0.25^{bc}
Control	8.84±0.547^{abc}	1.07±0.02 ^{ab}	1.61 ±0.03 ^{b}	11.42±0.175^{cd}	1.75±0.019^{c}	75.31±0.36^{ab}	361.41±2.29^{bc}
CV %	7.7	13.5	1.2	2.3	5.6	0.9	0.8
LSD %	1.567	0.3845	0.05017	0.5879	0.1915	1.588	0.7806

4.1.2. Mineral contents content of different Wheat varieties

The mineral content of the wheat varieties is indicated in table 2 below. Regarding the calcium content, bardheer has the lowest 35.71mg/100g while fantail varieties has highest 55.77mg/100g in calcium content. Except the bardheer and fantail varieties which is significantly different as compared to the other varieties under study, there is no significantly different in calcium content among the other seven varieties at $p<0.05$. When it comes to Iron content, it ranges 3.245mg/100g up for 7.474mg/100g. J-local has the lowest iron while fantail has the highest in iron content and the iron content is statistical different among fantail (7.474), nasired (4.489) and T- local (3.245) at $p<0.05$ On the other hand, the Iron is not significantly different among Bardheer (3.494) control (3.996), Jay (3.491), shid (3.989) Xiryane (3.991) at $P<0.05$. With respect to potassium**,** the "fan-tail" varieties has the highest (406mg/100g) while the "Qunfo" sample has the lowest which is 204mg/100g. There is significant difference in potassium content among Fantail, Qunfo, and con-

trol varieties at P<0.05. But there is no significant difference in potassium content in between "Nasired", "Bardheer" and "Jay" varieties at P<0.05.

When it comes to Zinc content, the Jay variety has the highest (6.95mg/100g) while the T-local variety has the lowest (2.53mg/100g). There is significant difference in Zinc content among" Jay", "Qunfo", and "local" at P<0.05. On the other hand no significant difference in Zinc content among "Bardheer," "Fantail", "Nasired,"" Xiryane" and control varieties at P<0.05. Lastly, regarding magnesium content, fantail has highest (193mg/100g) while the jay has lowest (62.18mg/100g). There is significant difference in magnesium content among "Fantail", "Bardheer," "Nasired," "Qunfo" and" control" at P<0.05. But other is no significant in magnesium among Xiryane, local, and Shiidit at P<0.05.

Table 2: The mineral content of different wheat vareities

Varieties	Parameters minerals in mg/100 gm				
	Calcium	**Iron (Fe)**	**Potassium**	**Magnesium**	**Zinc**
Bardheer	35.71±0.322^{a}	3.494±0.006 ^{ab}	236.5±14.46^{ab}	63.98±0.55 ^{a}	2.979± 0.03 ^{bc}
Fantail(k)	55.77±0.63^{c}	7.474 ± 0.0074^{d}	406.8±41.65^{c}	193.16±2.83 ^{e}	2.933±2.05^{abc}
Jay (t)	45.74 ±0.03 ^{b}	3.491 ± 0.003^{ab}	221.5±0.22^{ab}	62.18± 2.79^{a}	6.958±0.033^{d}
Nasired	45.74 ± 2.30^{b}	4.489±0.044 ^{c}	241.3±0.103^{ab}	104.36±8.57 ^{d}	2.775±0.04^{abc}
Qunfo	45.74±1.29 ^{b}	4.492±0.0056 ^{c}	204.3±12.14 ^{a}	79.24±2.22 ^{b}	3.059±0.16 ^{c}
Shiidit(t)	45.74 0.79 ^{b}	3.989 ± 1.414 ^{bc}	256.1±9.71 ^{ab}	87.62±2.020^{bc}	3.096±0.203 ^{c}
Xiryane	45.74 ± 1.70^{b}	3.991±0.0027^{bc}	268.6±2.68 ^{b}	82.06±1.56^{bc}	2.615±0.00 ^{ab}
Local(T)	45.74 ± 0.17^{b}	3.245 ± 0.248 ^{a}	276.3±5.096^{b}	84.02 ± 1.56^{bc}	2.536± 0.04 ^{a}
control	45.74 ±0.55^{b}	3.996 ±2.826 ^{bc}	276.3±2.59 ^{b}	92.20±4.44 ^{c}	2.981± 0.001 ^{bc}
CV %	1.5	6.1	8.5	5.5	5.2
LSD %	3.045	0.5969	50.31	11.84	0.3886

4.1.3. The Anti-Nutritional Content of different Wheat varieties

The anti-nutritional contentof the wheat varieties is indicated in table 3. below the Phytate of Bardheer and Xiryane was the same and found the lowest 3.481mg/g while the K-Fantail has the highest Phytate content was found 6.381mg/g. There is no significant different among varieties like bardheer, xiryane at $p<0.05$. On the other hand, the Phytate is significantly different among K-Fantail (6.381 %) Nasired (4.40%), Bardheer (3.481%), T- Jay (3.597), Qunfo (3.713) at $P<0.05$. When it comes to Tannin content range 0.0355% up for 0.0775% Xiryane has the lowest Tannin while L- Local has the highest and no significant different among all varieties at $p<0.05$.

Table 3: Anti nutritional of different wheat varieties

Varieties	Parameters	
	Phytate %	**Tannin %**
Bardheer	3.481± 0.002[a]	0.03903 ± 0.01 [a]
Fantail(k)	6.381 ±0.116[c]	0.04754 ± 0.004[a]
Jay (t)	3.597 ±0.116[a]	0.04902 ± 0.01[a]
Nasired	4.409 ±0.464[b]	0.07454 ± 0.01[a]
Qunfo	3.713 ±0.003[a]	0.06704 ± 0.003[a]
Shiidit(t)	3.945 ±0.002[ab]	0.05904 ± 0.01[a]
Xiryane	3.481 ± 0.003 [a]	0.03552 ± 0.023[a]
Local(J)	3.597 ± 0.116[a]	0.04854 ± 0.03[a]
Control	3.713 ± 0.002 [a]	0.07752 ± 0.006[a]
Grand Mean	4.035	0.055
CV %	5.9	30.5
LSD %	0.5393	0.0382

4.1.4. The physical properties of different Wheat varieties

The physical properties of different wheat varieties are indicated in table 4 below. Regarding 100 seed weight, T-jay (2.65g) has the lowest while T-Bardheer has the highest (3.900g). The 100 seed weight were statistically different among T-bardheer (3.900g), T-xiryane (3.350+0.150g), T-jay (2.65+0.150g) at $p<0.05$. The 100 seed weight is also significantly different in between T-Jay (2.650g) and T-Xiryane & J-control respectively at $P<0.05$. On the other hand, the 100 seed weight is not significantly different among T-shid (3.100g), T-Xiryane (3.350g), L-Qunfo (3.250g), L-Nasired (3.450g), L-local (3.400g) and J-control.

Regarding bulk density weight, k-fantail (0.635g/ml) has the lowest while T-jay has the highest (0.7294ml). the bulk density statistical different among T-jay (0.7294g/ml), L-local (0.7275g/ml), k-fantail(0.6351g/ml) at p<0.05 the bulk density is also significance different between k-fantail and L-local respectively at P<0.05. On the other hand, bulk density is not significant among (Qun-fo 0.7020g/ml, J-control 0.6674g/ml, bardheer 0.7020g/ml, xiryane 0.6782g/ml, and T-shid 0.6674g/ml k- fantail.

Table 4: physical properties of different wheat varieties

Varieties	Parameters	
	100 seed weight	**Bulk density**
T-shid	3.100±0.100^{bc}	0.6674±0.02^{ab}
T-xiryane	3.350 ± 0.15^{b}	0.6782±0.01^{ab}
T-jay	2.650± 0.150^{c}	0.7294±0.04^{a}
L-bardheer	3.900±0.100 ^{a}	0.7020±0.01^{ab}
L-qunfo	3.250± 0.250^{b}	0.7020±0.01^{ab}
L-nasired	3.450±0.050^{ab}	0.6559±0.01^{b}
k-fantail	3.400±0.100^{ab}	0.6351±0.01^{b}
L-local	3.400±0.10^{ab}	0.7275±0.01^{a}
J-Control	3.250±0.25^{b}	0.6674±0.02^{ab}
Grand Mean	3.306	0.6850
CV %	6.6	4.0
LSD %	0.49	0.06

4.1.5. The Functional Properties Different Wheat Varieties

The Function properties of different wheat varieties are indicated in table 5 below. Regarding water absorption capacity J-control (0.620) has the lowest while L-local has the highest (1.400). The water absorption capacity was statistical different among T-control (0.620), L-local (1,400),) at p<0.05. The water absorption is also significantly different between k-fantail and J-control respectively at P<0.05 and also among between the T-jay (0.927), k-fantail (1.282) on the other hand it was not significantly different among (Qunfo 0.7020, J-control 0.6674, bardheer 0.7020, xiryane 0.6782, and T-shid 0.6674 k- fantail).

Table 5: Functional Properties of different wheat varieties

Varieties	Parameters	
	WAC	OAC
T-shid	1.047 ±0.1025^{bc}	1.380 ± 0.04^{a}
T-xiryane	1.245 ±0.135^{abc}	1.095± 0.115^{a}
T-jay	0.927 ±0.0225^{cd}	1.145± 0.03^{a}
L-bardheer	0.953 ±0.0075^{bc}	1.558± 0.8475^{a}
L-qunfo	1.220 ±0.09^{abc}	0.775±0.205^{a}
L-nasired	1.220 ±0.11^{abc}	0.862± 0.862^{a}
k-Fantail	1.282 ±0.1175^{ab}	1.120± 1.120^{a}
L-local	1.400 ±0.135^{a}	1.350± 1.120^{a}
J-control	0.620 ±0.15^{d}	0.695± 0.695^{a}
Grand Mean	1.102	1.11
CV %	12.7	38.4
LSD %	0.3160	0.962

4.2. DISCUSSION

4.2.1. The Macronutrient content of different wheat varieties

Table 1 indicates the macro nutrient content of different wheat varieties. Regarding the moisture contents, Bardheer variety which is significantly different as compared to the other varieties under study and there is no significant difference in moisture content among the other varieties $P<0.05$. It is highest level of moisture is present in L-Bardheer T- Xiryane and T-Jay with values of (11.21%), - (9.79%) and (9.61%) respectively. Our value is higher than moisture contents of wheat varieties determined 9.67%. (45) that was conducted in Pakistan. The results show that wheat has a lower amount of moisture content can be stored for a long time and micro-organisms can't grow easily (9.67%). (45).

On the other hand, the ash content of the wheat is significantly higher and ranged between 0.673 - 2.643 which implies that higher ash content the higher important in mineral sources also, the study is an inline study that was conducted in Pakistan. The result indicated that the ash content of 2.16% is indicative that the flour sample could be important sources of minerals.

The fat content is in the range of 1.46 -2.51% as indicated in table 1. The fat content is significant-ly different among all wheat varieties under study at $P<0.05$. The difference may be due to the fact

that being different in variety types, origin of the seed, farm management and some other reasons. The result obtained for fat content is in line with the research done by [46] for the wheat grown in Pakistan. The wheat protein content is ranged from 13.23% - 6.36% % which indicates a higher concentration of protein compounds and these results can be used for solving many malnutrition problems, especially protein-energy malnutrition cases such as marasmus and kwashiorkor.

The fiber content of this study was found between 1.10% and 1.75% of T- Jay and T- Shid respectively. Fiber has many benefits for humans and can prevent constipation as well as can cut the risk of chronic disease such as cancer also this finding agreed with the reported results by (45) and the authors revealed 1.85% of fiber content.

Results of the study indicated significantly higher carbohydrate content of range between 79.41-73.76 percent. These can be promising results that can be used for managing protein energy malnutrition because of higher carbohydrate content the body can manage protein, fat, and mineral substance to use for bodybuilding, repairing damaged tissues rather than using them as a source of energy. This study is in line with the reported results by (49) and he showed that high carbohydrate content ranges between 73.74-71.61percent.

Energy is calculated with standard factors designed for carbohydrate, fat and protein. The energy was calculated in calorie unit and is in the range of 368.8 - to 350. 47. Significance difference was observed in energy content among some of the wheat varieties in this research at $P<0.05$. This difference come as result of being different in macro component (Protein, fat and CHO) which in turn due to being different in variety and some other reasons.

4.2.2. Mineral Content of wheat

The mineral contents of different wheat indicated in table 2. The calcium content in Fantail and Nasired wheat were 55.77and 45.74 mg/100 g, respectively. The results are greater than 36.2mg/100 g and 35.8 mg/100 g of the wheat reported by [46]. These results can be developed for many products like complementary foods for infants and pregnant women because calcium helps to build strong bones and teeth of infants and pregnant women since calcium is one of the main components of teeth and bones. This study is in line with the research result of (46) which indicated that calcium is responsible for teeth and bone formation.

The results indicated the highest iron content (7.47%) and the lowest indicates (3.24%) from Fantail and J- Local respectively. According to the finding of this indicates a promising results compared to study that was conducted by (47) and results shows that the highest (4.45%) and lowest (3.82) from RSP-561 and PBW-396 respectively. K- Fantail indicating a superior result this can be used for better management of Iron deficiency in vulnerable groups like lactating mothers, young children, and adolescent girls also this agreed with (47) which indicates that iron plays a vital role for red blood cells that carry on and release oxygen.

When it comes to potassium, the result indicated the highest potassium content (406.8%) and the lowest (204.3%) from Fantail and Qunfo respectively. According to the finding of this indicates a promising results compared to study that was conducted by (46) and results shows that the highest (503.4%) and lowest (395%) from Ogolcho and kingbird respectively. K- Fantail indicating a superior result this can be used for better management potassium content helps to maintain body weight and regulate water and electrolyte balance in the blood.

Magnesium indicated significantly higher content and magnesium helps our body for enabling protein formation and plays a role in holding calcium content to the teeth as well as helping to release energy. The results of study indicated that zin content the range from (6.95%- 2.53%) from jay and J- Local respectively. according to the different literature zinc has many health benefits and this research is in line with research that indicated magnesium helps protein-making and energy releasing and zinc helps the immune system fight off invading bacteria and viruses (46).

4.2.3. Physical properties

The physical properties among different wheat varieties are depicted in table 4. There is more or less some significance difference between different wheat varieties with respect bulk density. The bulk density ranged from 0.635 to 0.729 as shown in table 4. The difference in bulk density may be due to the intrinsic characteristics of each variety. Density values are useful in design of silos and storage bins. Hundred seed weight showed significant difference and varieties from 2.650 to 3.900 g. Low hundred seed weight may due to the low moisture content which increases the probability of more damaged grains during milling.

4.2.4. Functional Properties

The functional properties of different wheat varieties indicated in table 5 above. The water and oil absorbing capacity of the wheat varieties shows no differences in their association with oil and water except the control sample. Water absorption capacity (WAC) is the capacity of the flour to absorb water and swell for enhanced consistency in food (48). The WAC of a food product measures the water holding ability by the starch after the swelling in excess water, which corresponds to weight of the gel formed, and therefore is an index of degree of starch gelatinization. It depends on the availability of the hydrophilic groups which bind the water molecules and also on the gel-forming capacity of the macromolecules (48).

Water absorption capacity is an important functional property required in food formulations especially those involving dough handling. The observed mini variation in water absorption capacities between different varieties maybe attributed to different protein concentrations, their degree of interaction with water and their conformational characteristics (48). This effect could be as a result of the loose association of amylose and amylopectin in the starch granules and weaker associative forces maintaining the granular structure. Water absorption capacity is important in bulking and consistency of products as well as in baking applications. Thus, the sample with the highest water absorption capacity is best accepted in baking applications.

Oil absorption capacity (OAC), also called oil absorption, is the binding of fat by the proteins' non-polar side chain. Oil absorption capacity (OAC) is mainly attributed to the entrapment of oils physically. It is an indication of the rates at which proteins bind to fat in food formulations (48). Oil absorption capacity is an important functional property that enhances the mouth feel while retaining the flavors of food products which is important in food formulation (48). The oil absorption capacities of the flours were different among the different wheat varieties as shown in table 5 above. From statistical analysis, there was no significant difference ($p < 0.05$) in the oil absorption capacity of the flour samples. Absorption of oil by food products improves mouth feel Physical properties and minimum cooking time.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATION

5.1. CONCLUSION

The study was conducted with aim of analyzing the macro and micronutrient content of the different wheat varieties grown in Somali Region especially Fafan zone. The protein, fat, fiber, moisture carbohydrate content were analyzed in this study. The moisture content is in the range of 7.71-11.21% and this indicated for shelf stability of the wheat while the ash and the fiber of content of wheat under study were too low which is an indicated for its lower minerals content. The protein content of the wheat are in the range of 6.36-13.23% which make more or less better in protein content for same kind of varieties the energy in caloric unit is up the standard as most part of cereals. Generally, wheat with variety name K-fantail and Qunfo is good in almost all parameter such as fat protein carbohydrate ash moisture minerals

5.2. RCOMMENDATION

Based on the result of the study on the finding and identified gaps, the following points are recommended;

- Further research should be done by expanding the area coverage and adding more samples from different areas of the region including the control samples.
- Fantail, Qunfo, are highly promotable for developing many food products like bread, flour, past, for people and solved food and nutrition insecurity
- Further study is also required to see the agro-ecology effect on nutritional composition of wheat.

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