Determination of Chemical Composition On Some Wheat Cultivars Grown in Sudan Sahel Savannah, Geidam Yobe State, Nigeria

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Abstract:

This research compared the levels of nutritional composition of two varieties of wheat (Common and Spelt wheat) and ascertained their nutritional compositions of the two varieties. The findings were compared to those of the World Health Organization (WHO) in relation to the following categories: fat, ash, protein, moisture, and carbohydrate contents. Using a mortar and pestle, two-kilogram samples were taken from the well mixed composite of each variety, and the dry Ashing method was used in this investigation. A few drops of strong nitric acid were added to each 10kg ground sample in a porcelain crucible to aid in the Ashing process, which was then carried out in a furnace at 45°C. After that, using a few drops of water, the ash was moistened, dried, and then ashes again; this procedure was continued until the ash was carbon free. Sample "A" consisted of Common wheat and had the largest percentages of ash, fat, and protein (7.0989, 1.7578, and 23.9439, respectively). Sample "B" had the highest percentage of carbohydrates (89.3433), which was more than the 13.57 suggested by the WHO for the maximum percentage of moisture content. For home and industrial usage, it is recommended that Spelt Wheat and Common Wheat be used.

Keywords: *Wheat, Fat, Moisture, Protein, carbohydrate content, Proximate analysis.*

Introduction

According to Tama et al. (2009), wheat (Triticum spp.) is the largest often produced grain and one of the most significant stable food crops worldwide. Although the crop thrives best between the latitudes of 30° - 60° N and 27° - 40° S, wheat was one of the first domesticated food crops and has been the staple meal of the major civilizations of Europe, West Asia, and North Africa for over 800 years (Nuttonson, 1995). Approximately 25°C to 40°C and 30°C to 32°C, respectively, are the ideal growing temperatures for wheat, which can be grown beyond these limits from the Arctic circle to higher elevations near the equator (Briggle, 1980). Despite being harvested worldwide in any given month, wheat is adapted to a wide range of moisture conditions, from xerophytic to littoral. In the temperate zone, harvesting takes place between October and January in the Southern Hemisphere and between April and September in the Northern Hemisphere (Perianal, 1921). Additionally, wheat is categorized as either spring or winter wheat. Spring wheat is more prevalent and traditionally refers to the season in which the crop is cultivated for winter wheat; heading is postponed until the plant experiences a period of cold winter temperatures, between 0°C and 5°C. It is sown in the fall to germinate and grow into a young plant that spends the winter in the vegetative phase before starting to grow again in the early spring. As its name suggests, wheat is often planted in the spring and gets wet in the late summer. However, in regions with mild winters, such South Asia, North Africa, the Middle East, and the lower latitudes, it can also be sown in the fall (Percival, 1921). One reason wheat is unique is that it is grown on more than 240 million hectares, more than any other crop, and its global trade exceeds that of all other crops combined. Another reason is that wheat kernels contain gluten, an elastic protein that traps minute bubbles of carbon dioxide (CO2) during fermentation, which causes the dough to rise (Hanson et al., 1982). It is the best of the cereal food and provides more nourishment for human than any other food sources. Wheat is a major diet component because of the wheat plant agronomic adaptively, ease of grain storage and ease of covering grain into flour making edible, portable, interesting and satisfying food dough produce from bread, wheat flour differ from those made from other cereals in their unique visco – elastic properties (Orth and Shellenbegar, 2000).

For the majority of countries, wheat is the main source of carbohydrates. The majority of wheat proteins and carbohydrates are easily digested. With a tiny addition of highly nutritious animal or legume protein, wheat also includes minerals, vitamins, and fats (lipids). A diet that mostly consists of wheat has more fibre than one that primarily consists of meat (Johnson et al., 1978).

Due to the high temperatures and humidity in Nigeria, the local climate is not conducive to the best growth and yield of wheat. Wheat is also a crop of great interest in Nigeria because it is the primary ingredient in bread and other wheat-based products like cakes, biscuits, macaroni and spaghetti pasta, etc. Because of the consistently high temperatures and humidity, the climatic potentials for wheat production tend to decline equatorward (Oche, 1998). As a result, production is now limited to regions between latitudes 10 and 14 1/2 N, which include the Sahel and Sudan savannah zones, and the months of November through February when there is irrigation during the cold harmattan period (Abbas, 1998). According to Anonymous, (2006) the increasing consumption of and demand for wheat was largely due to increase and expansion in bread and pasta industries, and for the manufacture of cracker noddles *etc.* As things stand right now, the nation's domestic wheat demand exceeds its supply. That means that 90–

95% of the wheat consumed is imported from the United States of America. For instance, in 2007 the nation imported 4.5 million tons of wheat, compared to 3.8 million tons in 2008. It is necessary to research the crop's needs in advance of increasing wheat production in Nigeria. In places with relatively low technology as obtainable in developing countries like Nigeria, a naturally favourable environment is paramount for optimum production even where all production input could be met the choice of appropriate genotype is impassive. Peterson (1965), had indicated that wheat varieties with broad adaptation to climate should be adopted for high productivity. Early wheat variety screening trials at Kadawa, Northern Nigeria by Fisher and Mauries, (1978); Orakwue *et al*, (1991), indicated that varieties with superior drought tolerance gave high yield more especially under sub-optimal growing condition a recent study by Miko *et al.* (2006), at some location also found differential responds of two Mexican wheat varieties to the growing condition which was attributed to their varied reaction to applied fertilizers and adaptability to harsh environment.

The most commonly grown variety of wheat, known as bread wheat, differs from Spelt wheat in that the former produces bags of flour while the latter is used to make bread. Last but not least, there is Spelt wheat, which translates to "hard," and is a commercially important type of wheat with six sets of chromosomes. Spelt wheat is produced widely nowadays and has a higher protein and gluten content than other raw varieties of wheat. It is a tetra haploid variation of wheat.

Methodology

Study Area

This study was carried out in Yobe State's Geidam Local Government Area, which is located between latitude 11o 55' 49"E and longitude 12o 53' 49"N. As of the 2006 census, its area was 4,357 km^2, and its population was 157,295.

Sample Collection

The samples (Common wheat and Durum wheat) were form lake Chad Research Institute and taken to the NAFDAC laboratory for further analysis.

Sample Preparation

Sample composition, the dry Ashing method was used in this investigation, where 2kg of composite material was taken from the thoroughly mixed mixture and ground with a mortar and pestle. To promote the Ashing process, a few drops of strong nitric acid were given to each 10g ground sample in a porcelain crucible. The process was then continued in a furnace set at 45°C, increasing in temperature by 50°C per hour to prevent the sample from flaming. After that, the ash was dampened with a few drops of deionized water, dried, and then re-ashed. This process was continued until an ash free of carbon was obtained, albeit with some colour and no burned particles. The ash was then allowed to cool before being dissolved in 40mls of 20% HCl. The ashed suspension was passed through a voltmeter flask filter, and de-ionized water was used to dilute the filtrate to the desired level.

Determination of moisture content

1. Crucible was dried in an oven and allowed to cooled in a desiccator.
2. The cooled dish was weighed (W_1).
3. 5g of the sample was introduced into the dish and weighed accurately (W_2).
4. The dish was transferred into an air tired oven at 105° C for 3hrs.
5. The container was placed inside the desiccator and weighed using a pair of tongs. (W_3).

i. **Calculation for sample "A"**

$$\% \, Moisture = \frac{W1 - W3}{W2 - W1} \times 100$$

$$= \frac{100.459 - 100.1795}{100.4959 - 95.5342} \times 100$$

$$= \frac{0.3164}{4.9617} \times 100$$

$$= \underline{6.3768\ \%}$$

ii. **Calculation for sample "A"**

$$\% \, Moisture = \frac{W2 - W3}{W2 - W1} \times 100$$

Where W_1 = Weight of empty crucible

W_2 = Weight of crucible + sample

W_3 = Weight of cool dish and treated sample.

$$\% \, Moisture = \frac{62.9936 - 62.6459}{62.9936 - 57.2360} \times 100$$

$$= \frac{0.3477}{5.7576} \times 100$$

$$= 6.0389\%$$

Determination of fat

1. 2g of a sample was weighed (W_0)
2. The extractor was mount on the flat bottomed flask and weighed (W_1)
3. The thimble was placed on top of the sample or the filter into the extractor.
4. The solvent was poured to about 2/3 of the flask and continuously extracted for 5 hours when the extraction is completed, the solvent was then evaporating on water bath.
5. Cool and weight the flask and residue (W_2).

i. **Calculation for sample "A"**

$$\% \, Fat = \frac{W1 - W3}{W0} \times 100$$ where W_0 is the weight of the sample taken.

$$= \frac{109.5980 - 109.5613}{2.0878} \times 100$$

$$= \frac{0.0367}{2.0878} \times 100$$

$$= 1.7578\%$$

ii. **Calculation for Sample "B"**

$$\% \, Fat = \frac{W2 - W1}{W0} \times 100$$

$$= \frac{72.0740 - 72.0572}{2.0634} \times 100$$

$$= \frac{0.0168}{2.0634} \times 100$$

$$= 0.8141\%$$

Determination of Ashed content

1. Empty dish was cool in a desiccator and weighed accurately (W_1)
2. 5g of the samples containing in a dish was weighed (W_2)
3. The container was transferred into muffled furnace at 500° C until fully ashed.
4. The Ashed was cooled in a desiccator and weighed (W_3).

i. **Calculation for sample "A"**

$$\% Ash = \frac{W3 - W1}{W2 - W1} \times 100$$

$$= \frac{24.5575 - 24.4143}{26.4315 - 24.4143} \times 100$$

$$= \frac{0.1432}{2.0172} \times 100$$

$$= 7.0989\%$$

ii. **Calculation for Sample "B"**

$$\% Ash = \frac{W3 - W2}{W2 - W1} \times 100$$

$$= \frac{26.1992 - 26.1646}{28.4621 - 26.1646} \times 100$$

$$= \frac{0.0346}{2.2975} \times 100$$

$$= 1.5059\%$$

Determination of Protein content

1. Weigh a part of the sample equivalent to about 0.2g protein and transfer it into Kjeldahl flask.
2. Add 1g of Sodium Sulphate and 0.1g of Copper Sulphate.
3. Using a measuring cylinder and add 25ml of concentrated Sulphuric acid into the flask.
4. Heat the flask gently in a fume cupboard using a flame or heating mantle. The flask must be in an inclined position.
5. Swirled the flask occasionally when the initial vigorous reaction has died down. Increase the heat and continue digestion until the liquid is clear and free from black or brown colour.
6. Swirl the flask from time to time to wash down charred particle from the sides of the flask.
7. The flask is then allowed to cool and dilute content and 85ml of 50% NaOH to make the liquid distinctly alkaline.
8. Attach a vertical condenser to which a straight delivery tube is linked, and connect the distillation apparatus, which consists of a 500 ml flask, a splash head adaptor, and a stopping funnel.
9. A portion of the boric acid solution was measured out into a 500 ml conical flask. A few

drops of screened Methyl Red indicator were added, and the flask was then put on the receiver so that the delivery tube's end dipped slightly below the boric acid level.

10. Boiled vigorously until about 250ml have distilled over. Remove the receiver with delivery tube.
11. Open the dropping funnel tap and remove the sources heat.
12. Titrate with a standard acid to pink colour and take the titre value.

i. **Calculation for sample "A"**

By using the following formular;

$$\% N = \frac{\text{T.V} \times 0.0014}{\text{W}} \times 100$$

Where; W is the weight of the sample taken.

% Protein = N X F

Where; F is a factor equal to 6.25

Weight of sample = 1.1292g

Titre Value (T.V) = 30.9

$$\% N = \frac{30.9 \times 0.0014}{1.1292} \times 100$$

N = 3.8310

$$\% Proteins = N \times F$$

= 3.8310 X 6.25

= 23.9439%

ii. **Calculation for Sample "B"**

Where; Titre Value = 10.4

Weight of the sample = 1.0419

$$\% N = \frac{\text{T.V} \times 0.0014}{\text{W0}} \times 100$$

$$= \frac{10.4 \times 0.0014}{1.0419} \times 100$$

$$= \frac{0.01456}{1.0419} \times 100$$

% N = 1.3945%

% Content of Protein = N x F

= 1.3945 x 6.25

= 8.7156 %

Determination of Carbohydrate Content

Carbohydrate calculated by difference *i.e*

= 100% – (% M.C + % A.C + % P + % F)

i. **Calculation of Carbohydrate in sample "A"**

= 100 – (6.3765 + 7.0989 + 23.9439 + 1.7578)

= 100 – 39.1771

= 60.8229%

ii. **Calculation of Carbohydrate in Sample "B"**

= 100 – (6.9390 + 1.5059 + 1.3945 + 0.8141)

= 100 – 10.6535

= 89.3465%

Results and Discussion

Table 1: The result of this analysis shows the percentage composition from two varieties of wheat with that of WHO.

S/N	Sample	%Ash	%Moisture	%Fat	%Protein	%Carbohydrate
1.	Common wheat	7.0989	7.0768	1.7578	23.9439	60.8229
2.	Durum wheat	1.5059	7.9390	0.8141	8.7156	89.3465
3.	WHO 2017	0.73	13.5700	0.92	9.51	82.7080

The study's findings indicate that there are two varieties of wheat with different levels of Ash, Fat, Moisture, Protein, and Carbohydrate, as indicated in the above table. Sample "A" had an ash content of 6.8029%, while sample "B" had an ash content of 2.3059%. Some of the values are higher than the World Health Organization's (WHO) 2017 average of 0.73%.

Ash is one of the component in the proximate analysis of biological materials consisting mainly of salty inorganic constituent it includes metals which are important for processing requiring ions such as Sodium ion, Potassium and Calcium ions. Moisture content was found to be 6.3768 in sample "A" while that of sample "B" was 6.93897% all are below the permissible limit of World Health Organization(WHO) as stated in 2017. Moisture is H_2O liquid diffused in a small quantity as vapour. It is important of your body to loose water through breathing, sweating and digestion. It also helps in depending on a variety of factor climatic you live.

The fat content of sample "A" in the table above was found to the 1.7578% while in sample "B" was 0.8141 some of the values are higher while others are lower as compared to World Health Organization (WHO) with the value of 13.57% in 2017. All types of fat provide same number of calories (9Kcal/g) regardless of where they emanate from; this means that too much of any type of fat can give weight gain.

The protein content was found to be 23.94395% in sample "A" while that of sample "B" was 8.7156 both samples has value as compare to the value of world health organization of 9.51%.

Protein plays a vital role in both human and animal life the human body use protein for many things include repairing and building tissue and enzymes. It is also important in building block of bones, muscles, cartilage, skin and blood.

The two varieties of sample contained quantities of carbohydrate between 60.8229% and 89.3465% in the table above as compared to the value stated by WHO as of 2017 with the value of 82.708%.

Carbohydrate provides energy to the body particularly through glucose, it is a simple sugar that is found in basic food such as grain vegetable fruit, bean and milk.

Conclusions

This study has shown that proximate analysis was done, leading to the conclusion that the common wheat had the largest percentages of ash, fat, and protein, at 7.0989, 1.7578, and 23.9439, respectively. In comparison to the highest 13.57 percent moisture content that the WHO recommends, the highest percentage of carbohydrates found in spelt wheat was 89.3465.

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