Comparative Study of Hematological Parameters of Smoked and Oven-dried Cat fish (Clarias gariepinus)

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ABSTRACT— Catfishes are a diverse group of ray-finned fishes named for their prominent barbels, slender, whisker-like tactile organs near the mouth, which give the image of cat-like whiskers. Since catfish is not normally consumed raw, various processing methods are employed in preparing them for consumption; which have varying effects on their nutrient contents, texture and flavor. In this study, we assayed for the effects of drying (oven and smoked) catfish on the hematological parameters using Mind Ray Hematology Auto-analyzer. The results of this study showed a significant difference (P<0.05) in the red blood cells (TRBC) level in the various groups with the control group having the highest TRBC level while the oven-dried group had the least. However, no significant difference (P>0.05) was observed on the hemoglobin concentration between the oven-dried and smoked catfish, even though the later has the highest value. Similarly, no significant difference (P>0.05) was observed on the total white blood cells (TWBC) levels of the various groups; although oven-dried catfish group had the highest TWBC level while the smoked group had the least. From the results, it could be concluded that oven-dried catfish could be more beneficial for consumption than smoked catfish considering the adverse effect of smoking on the fish.

KEYWORDS: Catfish, oven-drying, smoke-drying, hematology

1. INTRODUCTION
Fish is consumed by a large number of people because of its palatability, flavour and availability [1]. It remains an important part in the diet of Nigerians, especially with the wide publicity on the detrimental effects of dairy meat consumption. Beef has been implicated in coronary diseases and most people have avoided its consumption [2]. Fish is an important class of food and comparatively cheap source of animal protein to majority of people across the developing countries, especially Nigeria [3]. In most local and fishing communities, fish makes up approximately 75% of animal protein consumption [4], which is vital for growth and maintenance of the body tissues. Nigeria, as one of the developing countries depends greatly on animal protein sources such as sea foods for their daily protein needs [5]. The main components of fish are moisture, protein and fat with minerals present in minute quantity. Generally, fish is known to contain low carbohydrate while the moisture content is usually very high. Okpanachiet al. [6] recorded moisture content of 60-80 % for most fish species, 15-26% protein content and 2-13% fat. However, the fat content of fishes varies with species, age, size and also season. It also contains some bioactive compounds with therapeutic properties that are beneficial to human health [7].
Mud catfish consumption is increasingly becoming popular among Nigerians. Catfish is an excellent source of protein and fatty acids. According to Nnaji and Ekwe [7], catfish contains 16.24% protein and 0.50% fat. Since catfish is not normally consumed raw, various processing methods are employed in preparing them for consumption [6]. These processing methods are also employed to extend its shelf life due to its perishability. Some of these methods include freezing, boiling, frying, roasting, smoking, oven-drying; all of which could have varying effects on their nutrient contents, texture and flavour. There have been many reports on changes in hematological parameters routinely used to determine stress associated with environmental, nutritional, and/or pathological factors [8]. The cooking procedures influence the fat content and other nutrients in fish [9]. A common perception is that thermally-cooked foods have lower nutritive value than fresh foods because of the loss of vitamin C and particular physiochemical characteristics [10]. Smoking is the most common and practicable method of preservation [3]. This is due to the fact that it is affordable and improves the organoleptic properties of the final product. Fish processing by traditional method of smoking enables fish to have stability during storage, increases their appetizing appeal, gives special organoleptic profiles to smoked products, and its inactivating effect on enzymes and microorganisms [7]. However, smoking of food directly with wood smoke is known to contaminate the food with carcinogenic polycyclic aromatic hydrocarbons which may cause gastric adenocarcinoma [11, 12]. This processing method may have negative impacts on consumer health due to the fact that it may lead to the deposition of polycyclic aromatic hydrocarbons (PAHs) which has been linked to be a potential cause of cancer [13]. Adverse hematological effects have been observed in animals following oral exposure to high doses of PAHs. Oven-drying method is another means of food processing and preservation which has been described to be the best processing treatment for Tilapia fillets [14]. Researchers have argued on different processing methods to be given to foods [15]. Hence, the need to compare the effect of smoked and oven-dried catfish on the hematological parameters remain crucial.

2. MATERIALS AND METHODS

2.1 Sample collection and preparation
Freshly harvested catfish (Clariasgariepinus) were purchased from Errys fish farm, Agu-Awka, Anambra state, the fish sample were washed with tap water to remove dirt, rinsed with distilled water and divided into two groups. One group was smoked with smoking kiln while the other group was oven-dried using a gas oven.

2.2 Drying procedures
The already washed fish were degutted and eviscerated properly and divided into two batches for the purpose of drying. Gas oven was used for oven drying and a smoking kiln for smoke drying. Prior to drying, both the smoking kiln and Gas oven were cleaned thoroughly and their racks properly oiled to avoid samples getting stuck on them during drying. The first batch was placed inside a kiln and the other placed in the gas oven. The smoke from the kiln was produced by the burning of charcoal and temperature was constantly monitored and regulated in the Gas oven dryer. Fish was checked hourly and flipped occasionally to achieve uniform drying and to avoid charring. Drying took six (6) hours for Gas oven dryer and sixteen (16) hours for smoking kiln. Samples were dried to constant weight and thereafter placed on different trays to cool. The dried samples were homogenized using a kitchen blender, kept in a labeled airtight container and used for feed formulation.

2.3 Animal grouping and treatment
Eighteen albino rats weighing between 120 – 150g were purchased from Diamond Research farm, Nsukka,
Enugu state and used for this study. The animals were housed in standard rat cages in the animal facility of Applied Biochemistry Department, Awka, Anambra state. They were allowed to acclimatize for 7 days and fed with standardized rat pellets and water ad libitum. Thereafter, the experimental animals were randomly distributed into three groups of six animals per group. The rats in Group 1 served as the control group and were fed 100% standard rat pellet while Group 2 and Group 3 served as experimental groups and were fed with formulated diet of 50% standard feed + 50% smoked fish and 50% standard feed + 50% oven-dried fish for 30 calendar days respectively.

2.3.1 Blood sample collection and analysis
The animals were anaesthetized using chloroform soaked in cotton wool and blood collected through cardiac and analyzed using mind Ray hematology auto analyzer.

3. Results

![Graphs showing blood parameters](image)

A: TWBC (Per Cu.mm)
B: TRBC (×10⁶/mm³)
C: HB(g/dl)
D: PCV(%)
Figure. 1: Effect of the formulated feeds on A: Total white blood cell (TWBC); B: Total red blood cell (TRBC); C: Haemoglobin concentration; D: Packed cell volume (PCV); E: Mean cell hemoglobin concentration (MCHC); F: Mean cell hemoglobin (MCH); G: Mean corpuscular volume (MCV); H: Platelets; I: Neutrophils; J: Lymphocytes; K: Monocytes

4. Discussion
The haemoglobin, packed cell volume and Neutrophils were increased in the treatment groups but statistically not significant (P>0.05) when compared to the control group (figure 1c, 1d and 1i). Increase in hemoglobin concentration may be due to direct consequence of high content of iron in smoked catfish that may stimulate synthesis of hemoglobin. Sayad et al. [16] had reported that smoked catfish is a good source of lean meat and trace elements especially iron and zinc. There was, however, a statistically significant decrease (p<0.05) in total red blood cells (TRBC) in the treatment groups with the significant difference occurring when the smoked catfish group was compared with the control group and also when the oven-
dried catfish group was compared with the control group (figure 1b). The significant reduction (p<0.05) in the red blood cell count in the treatment groups suggests an indication of severe anemia caused by constituents of the smoke and oven-drying. The anemic response could be as a result of the destruction or inhibition of erythrocyte production [17] or haemodilution as reported by Sampathet al. [18]. A significant increase (P<0.05) was observed in the mean cell hemoglobin (MCH) level of the smoked group when compared to the control group (figure 1f). A significant difference was also observed when the oven-dried catfish group was compared to the control group (figure 1f). The most common reason for high MCH is macrocytic anemia [19] which is a blood disorder in which the body fails to produce enough red blood cells. In this state, red blood cells that are produced are larger than usual, each carrying more hemoglobin than what normal-sized cells would carry. This condition can be caused by deficient levels of vitamin B-12 or folic acid in the body; nutrients found in foods like fish, liver, green leafy vegetables and fortified cereals [20]. There was a reduction in the platelet levels of the test groups, though not significant (P>0.05) (figure 1h). The control group had the highest platelet level while the oven-dried group had the least. Thrombocytopenia is a condition in which one has a low blood platelet count. This agrees with Akoh and Hearsnberger [21], who reported that the consumption of processed catfish diet caused a decrease in platelet count and prolonged blood clotting time. There was a significant increase (P<0.05) in the mean corpuscular volume (MCV) levels of the test groups with the significant difference occurring when the control group was compared with the smoked catfish group and also when the control group was compared with the oven-dried catfish group (figure 1g). MCV is the average volume of a red blood cell. This is a calculated value derived from the hematocrit and red cell count. An increase in MCV value may be due to swelling of red blood cell (RBC) and/or disturbance of osmoregulation and reduction in erythrocytes. Rise in MCV values seems to be correlated with decline in RBC count [22].

5. Conclusion

The results obtained from this study showed that the two drying methods had a great effect on the hematological parameters. There was significant difference in the red blood cells level of smoked-drying sample with no significant difference on the hemoglobin concentration between the oven-dried and smoked catfish. However, oven-dried sample had the highest level of total white blood cells. Hence, oven-dried catfish could be more beneficial for consumption than smoked catfish because of the adverse effect of smoking on the fish sample.

6. References


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