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# Effect of Feeding on Albino Rats and the Nutritional Quality of Processing Chickpea (*Cicer arietinum*) Flour

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**Abstract**

The study examined the effects of autoclaved, cooked, and uncooked chickpea flour on experimental animals, comparing it to commercial feed and basal diets. The study involved sorting, washing, sun-drying, milling, and comparing the results. About 30 kg of chickpeas were milled into powder using a blender, and three 700g portions were separated and placed in a sterile container. Using uncooked chickpea flour as a control, the fraction of ground seed was autoclaved for 15 minutes and cooked for 1 hour. The study found that animals fed autoclave chickpea flour, cooked chickpea flour, and un9cooked chickpea flour livers and kidneys had varying levels of nitrogen retention, growth response, muscle weight, and kidney weight. The protein quality of the animals showed net protein retention of 74.33 ±0.57 g, 80.33 ±0.58 g, and 74.67 ±0.58 g, respectively. Visceral organ weights in experimental animals given liver made from autoclaved chickpea flour, cooked chickpea flour, and uncooked chickpea flour ranged from 2.50±0.01 g to 2.74 ±0.12 g. While muscles increased from 0.50 ±0.00 g to 0.50 ±0.00 g, the kidney decreased from 0.60 ±0.01 g to 0.60 ±0.00 g. Animals can be fed with the cooked chickpea flour.

**Keywords**: Chickpea, flour, feeding, wistar rats

## Introduction

Chickpeas supply an adequate amount of protein for individuals that are vegetarians or who normally have no access to animal protein. Chickpeas also are loaded with minerals (calcium, -carotene, fibre and unsaturated fatty acids, iron), zinc, magnesium and phosphorus. Chickpeas in addition considerably aid in the protection of soil fertility by setting nitrogen at rates of up to 140 kg / hectare / year [1]. This plant thus demands fairly little nitrogen inputs, because it gets 75 % of its N from symbiotic N2 fixation, as well as benefits other cereals [2].

In accordance to [3], the desi variety makes 80 - 85 % of all the chickpeas and it is mainly grown in Africa and Asia, while the kabuli type is mainly raised in West Asia, North America, North Africa, and Europe. Biotic and abiotic stress from the outside environment oftentimes delays the development and growth of plant life, like chickpeas. Stressors within the environment may also be leading to a considerable reduction in crop productivity. Plants tend to be nevertheless furnished with a few mechanisms which can improve their resistance against such shocks [4].

Chickpea (*Cicer arietinum L.*) is an annual grain legume or maybe Pulse harvest that's commonly used for food consumption [3]. *Cicer arietinum L.*, or maybe chickpeas, is a favorite in numerous places and is a prominent part of vegan diet programs worldwide. Pulses supply an important source of nourishment and when they're combined with cereals they offer a nutritionally balanced combination of proteins with a ratio which is optimum for humans [5]. Chickpeas can also be packed with antioxidants [5] and also include a number of proteins, vitamins, and nutrients which are vital for a good lifestyle.

Chickpeas are usually a plant that grows throughout the cold season from 1 - 2 feet high. It possesses an indeterminate and branching growth pattern, erect and spreading, with hairy leaves, stems as well as seed pods which generate extremely acidic exudates [6].

Though they possess a trypsin inhibitor amount, chickpeas can be a great protein source and also energy for cattle, and also are employed in diets to replace soy meal. As reported by [7], they may be consumed raw, dehulled, boiled or even extruded. The weight of the Wistar rats' internal organs and their growth performance are the two main goals of this study.

## Materials and Methods

### Sample collections

The investigation used chickpea seeds that had been bought in August 2022 from Ojaja Market in Ife Central Local Government, Osun State, Nigeria.

### Preparation of a chickpea seed

After being separated, rinsed, and sun-dried, chickpea seeds Blender was used to grind them. About 30 kg of chickpeas were milled into powder using a blender. Three 700 g portions of the ground chickpea flour were divided and kept in a plastic jar until needed. The 700 g of flour made from chickpeas had been placed in six beaker containers and sealed with aluminum foil to protect it. When the other three were cooked in a cooking pot for 1 hour the other three were placed in an autoclave and heated to 121°C for fifteen minutes. While in the autoclave, cooked and uncooked chickpea flour was used to feed experimental animals [8, 9].

### Growth performance of wistar albino rats

The College of Health Science Animal Breeding Center at Obafemi Awolowo University in Ile-Ife, Nigeria, provided fifty (50) weanling albino rats were for us to utilize. Weighed albino rats were divided into metabolic cells at random. There is a range of 44.23 g to 45.78 g and 4 weeks for both weight and age. In order to allow for unlimited feeding, albino rats were kept in digestive chambers fitted with a feeding plate and a tiny plastic bottle.

After that, the rats were weighed again and divided into ten groups at random. At the start of the investigation, there were no appreciable differences between the ten (10) experimental animals per group, ranging in weight from one to ten (1–10). For 28 days, groups one to five were fed an experimental diet. Water in a plastic bottle fastened to the cage and the observed quantity of each experimental meal, which was fed ad libitum in the feeding dish, were given to them. The weight was recorded and the daily feeding with the cooked, autoclaved, and uncooked chickpea flour was meticulously tracked. Every three days, a balance was used to determine each experimental animal's weight. Adopting the process of dissection, the life mass of the rats as well as various organs (muscle), liver, and kidney were closely monitored [8].

**Ethical consideration of the study**

This study was approved by the Joint Ethical Review Committee of the Obafemi Awolowo University, Ile- Ife, Osun State, Nigeria and University of Ilesa Research Council, Ilesa, Osun State, Nigeria.

**Statistical analysis of data obtained in the study**

Three repetitions and a fully randomized design were used for the trials. After confirming that all data were normal, they were first subjected to analysis of variance (ANOVA), and then the Turkey and LSD tests were used to find significant differences between the significant treatments at $p<0.05$. IBM SPSS 24.0 was used to perform the statistical analysis (SPSS Science, Chicago, IL, USA).

## Results

**Growth response during 28 days of experimental animals fed with autoclave chickpea, cooked chickpea, uncooked chickpea flour, commercial feed and basal diet**

The growth performance of experimental animals given commercial feed, basal diet, cooked or uncooked chickpea flour, and chickpea flour that has been autoclaved. The weight of the test subjects varied from 44.23 g to 45.78 g. When compared to experimental animals fed autoclaved and uncooked chickpea, those fed cooked chickpea had a greater value, while those supplied commercial feed had a higher value (Figure 1).

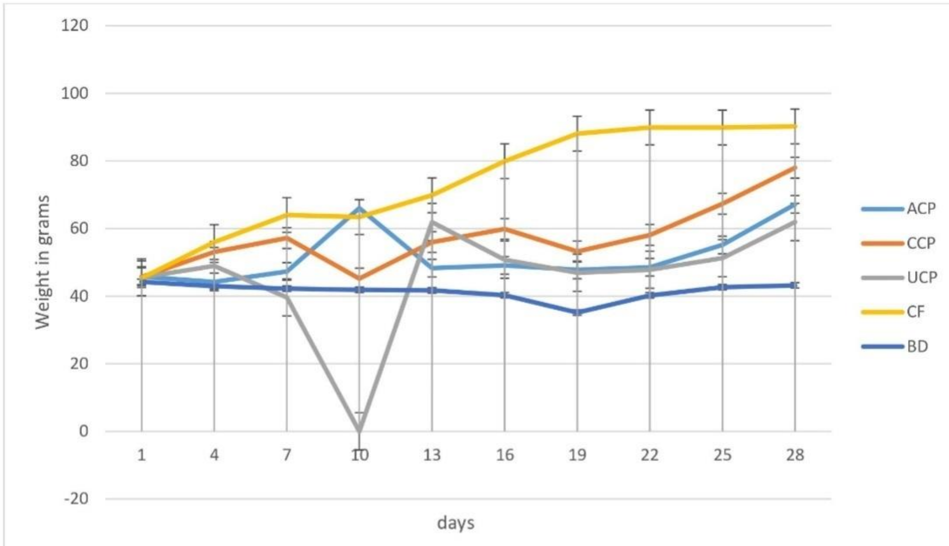


**Figure 1. Growth Performance of Animals Fed with Autoclave Chickpea, Cooked Chickpea, Uncooked chickpea flour, Commercial feed and Basal diet**

Key:

ACP - Autoclaves Chickpea

CCP - Cooked Chickpea

UCP - Uncooked Chickpea

CF – Commercial feed

BD – Basal diet

**The nitrogen retention of animals in different tissues of the internal organs feed with autoclave chickpea, commercial feed, uncooked chickpea, cooked chickpea, and basal diets**

The nitrogen retention (NR) of test animals was seen in a variety of internal organ tissues and waste products, including urine, feces, commercial feed, autoclaved chickpea flour, cooked chickpea flour, and uncooked chickpea flour. Table 1 displays the nitrogen retention in the urine, feces, and various internal organ tissues of the experimental animals fed commercial feed, autoclaved and uncooked chickpea flour, and basal diet.

The nitrogen content in the intestines of experiment animals provided autoclaved chickpea flour was 75.83 ± 0.58 g, less than that of animals fed cooked chickpea flour (80.33 ±0.57 g), better than that of animals fed uncooked chickpea flour (75.60 ±0.58 g) as well as less than that of animals fed commercial food (75.33 ±0.60 g).

The animals ingested on autoclaved chickpea flour experienced nitrogen retention of 75.66 ±0.58 g, that had been lower than those given on cooked chickpea flour, which had a nitrogen retention of 80.33 ±0.57 g, that had been greater than those fed on uncooked chickpea flour 75.66 ±0.00 g. The importance of nitrogen retention in animals given a base diet of 20.33 ±0.58 g was less than that of animals fed commercial food 76.33 ±0.57 g.

In comparison with the muscle of animals given cooked chickpea flour, that had a nitrogen retention of 80.33 ±0.58 g, the muscle of animals fed with autoclaved chickpea flour experienced a nitrogen retention of 74.33 ± 0.58 g. This had been significantly lower compared to the nitrogen retention in muscle mass of cattle fed commercial feed plus was almost the same as the worth of feed which contains autoclaved chickpea flour. Nitrogen retention was reduced in rats given a base diet of 19.66 ±0.58 g than in rats fed 75.33 ±0.58 g.

**Table 1. The nitrogen retention of animals in different tissues of the internal organs feed with autoclave chickpea, uncooked chickpea, cooked chickpea, basal diet and commercial feed**

| GROUPS | ACP | CCP | UCP | CF | BD |
|---|---|---|---|---|---|
| Liver (g) | 75.33±0.58$^{a}$ | 80.33±0.57$^{b}$ | 75.66 ±0.58$^{a}$ | 77.33 ±0.60$^{c}$ | 20.33 ±0.57$^{b}$ |
| Kidney (g) | 75.66 ±0.58$^{a}$ | 80.33±0.57$^{b}$ | 75.66 ±0.00$^{c}$ | 76.33 ±0.57$^{b}$ | 20.33 ±0.58$^{a}$ |
| Muscle (g) | 74.33±0.58$^{a}$ | 80.33±0.58$^{a}$ | 74.33 ±0.58$^{a}$ | 75.33 ±0.58$^{a}$ | 19.66 ±0.58$^{a}$ |

The values are presented as the mean ± deviation from the standard deviation. The data with distinct superscripts in a row tend to be significantly different (p 0.05).

Key:

ACP - Autoclaves Chickpea

CCP -Cooked Chickpea

UCP - Uncooked Chickpea

CF – Commercial feed

BD – Basal diet

**The bioassay of the experimental animals fed with autoclave chickpea, cooked chickpea, uncooked chickpea, commercial feed, and basal diet**

The protein content of experimental animals given autoclave, raw and cooked chickpea flour, basal diet and commercial feed. Table two presents the protein value of experimental animals fed commercial feed, a base diet, prepared and uncooked chickpeas and autoclaved chickpeas. Animals given autoclaved chickpea flour experienced a lessened natural value (BV) of protein quality (75.33 ±0.57 g) as compared to animals fed with cooked chickpea flour (80.33 ±0.57 g), that had been much higher when it came to protein quality than animals fed with uncooked chickpea flour (75.67 ±0.58 g).

This had been higher than the natural value of the protein content of animals given a base diet (20.33 ±0.57 g) however much less than the biological value of animals fed commercial food (77.33 ±0.58 g). The protein efficiency ratio (PER) of protein quality of animals given autoclaved chickpea flour was 75.66 ±0.58 g; the PER of protein quality of animals fed cooked chickpea flour was 80.33 ±0.58 g; this great was more compared to the worth of animals fed raw chickpea flour (75.00 ±0.57 g).

This protein content was less than that of animals receiving commercial feed had a weight of 76.33 ±0.58 g, when compared with animals whose diet had a base diet of 20.33 ±0.58 g. Results suggest the total protein ratio (NPR) of protein content was decreased in animals given autoclaved chickpea flour (74.33 ±0.57 g) compared to animals fed with cooked chickpea flour (80.33 ±0.58 g). This quantity was larger than that of pets given raw chickpea flour (74.33 ±0.58 g) as well as much lesser than that of animals consuming commercial animal food (75.33 ±0.57 g).Animals given a basic diet demonstrated a much lower NPR of the protein content (19.67 ±0.58 g). The gain/loss of protein quality of animals consumed with autoclave chickpea flour was 0; the gain/loss of protein quality of animals fed with cooked chickpea flour was zero; as well as animals fed with raw chickpea flour and commercial feed; as well as the gain/loss of protein quality of animals fed with a basal diet was -1.03 ±0.00 g.

**Table 2. The bioassay of the experimental animals fed with autoclave chickpea, cooked chickpea, uncooked chickpea, commercial feed and basal diet**

| GROUPS | ACP | CCP | UCP | CF | BD |
|---|---|---|---|---|---|
| BV (g) | 75.33$\pm$0.58$^a$ | 80.33$\pm$0.57$^b$ | 75.67 $\pm$0.58$^a$ | 77.33 $\pm$0.58$^a$ | 20.33 $\pm$0.57$^b$ |
| PER (g) | 75.66 $\pm$0.58$^a$ | 80.33$\pm$0.58$^a$ | 75.00 $\pm$0.57$^b$ | 76.33 $\pm$0.58$^a$ | 20.33 $\pm$0.58$^a$ |
| NPR | 74.33$\pm$0.57$^a$ | 80.33$\pm$0.58$^b$ | 74.33 $\pm$0.58$^b$ | 75.33 $\pm$0.57$^a$ | 19.67 $\pm$0.58$^a$ |
| Gain/loss | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

The values are presented as the mean ± deviation from the standard deviation. The data with distinct superscripts in a row tend to be significantly different (p 0.05).

Key:

BV – Biological Value

PER – Protein Efficiency Ratio

NPR – Net Protein Ratio

ACP - Autoclaves Chickpea

CCP -Cooked Chickpea

UCP - Uncooked Chickpea

CF – Commercial feed

BD – Basal diet

**The weight of visceral organs of experimental animals fed with autoclave chickpea, cooked chickpea, uncooked chickpea, commercial feed, and basal diet in grams**

Weight of visceral organs of experimental animals fed with autoclave chickpea, cooked chickpea, uncooked chickpea, commercial feed, and basal diet in grams. Table 3 displays the weight of the experimental animals' visceral organs after they were fed commercial feed, autoclaved chickpeas, cooked chickpeas, and basal diet.

The weights of the livers of the animals fed autoclaved chickpea flour were 2.50 ±0.01 g; the animals fed cooked chickpea were 2.74 ±0.12 g, which was greater than the animals fed uncooked chickpea, which weighed 2.67 ±0.01 g; the animals fed commercial feed were 3.00 ±0.00 g, and the animals fed a basal diet were 1.77 ±0.01 g.

Animals fed autoclaved chickpeas had kidney weights of 0.60 ±0.01 g, animals fed cooked chickpeas had kidney weights of 0.60 ±0.00 g, animals fed uncooked chickpeas had kidney weights of 0.62 ±0.00 g, animals fed commercial feed had kidney weights of 0.62 ±0.00 g, and animals fed a basal diet had kidney weights of 0.50 ±0.01 g.

The muscle of the animals fed autoclaved chickpea weighed 0.50 ±0.00 g; the muscle of the animals fed cooked chickpea weighed 0.50 ±0.00 g; the muscle of the animals fed uncooked chickpea weighed 0.50 ±0.01 g; the muscle of the animals fed commercial feed weighed 0.50 ±0.00 g; and the muscle of the animals fed basal diet also weighed 0.50 ±0.00 g.

**Table 3. The weight of visceral organs of experimental animals fed with autoclave chickpea, cooked chickpea, uncooked chickpea, commercial feed and basal diet in grams**

| GROUPS | ACP | CCP | UCP | CF | BD |
|---|---|---|---|---|---|
| Liver (g) | 21.50 $\pm$0.01$^a$ | 2.74 $\pm$0.57$^b$ | 2.67 $\pm$0.01$^a$ | 3.00 $\pm$0.00$^c$ | 1.77 $\pm$0.01$^a$ |
| Kidney (g) | 0.60 $\pm$0.01$^a$ | 0.60 $\pm$0.00$^b$ | 0.62 $\pm$0.00$^b$ | 0.62 $\pm$0.00$^b$ | 0.50 $\pm$0.01$^a$ |
| Muscle (g) | 0.50 $\pm$0.00$^a$ | 0.50 $\pm$0.00$^a$ | 0.50 $\pm$0.01$^b$ | 0.50 $\pm$0.00$^a$ | 0.50 $\pm$0.00$^a$ |

The values are presented as the mean ± deviation from the standard deviation. The data with distinct superscripts in a row tend to be significantly different (p 0.05).

Key:
ACP - Autoclave chickpea
CCP - Cooked chickpea
UCP - Uncooked chickpea
CF - Commercial feed
BD - Basal diet

**Discussion**

The research investigated the growth reaction of experiment animals fed on a 28 day period commercial feed, basal diet, prepared and uncooked chickpeas and autoclaved chickpeas. The research animals consuming cooked chickpea flour experienced a greater value, which value is in line with that of [10]. Based on [10] report, the amount of experiment animals offered professional feed was above that of animals given feed on autoclaved chickpea flour, fried chickpea flour, uncooked chickpea flour along with a base diet.

The nitrogen retention within the liver of experimental animals given cooked chickpea was greater than animals fed with autoclave chickpea flour, a basal diet, commercial feed, uncooked chickpea flour, that is in opposition to the research of [11] who present on the protein value of fermented mung bean flour.

When compared, the kidneys of experiment animals given commercial food retained more nitrogen as compared to the kidneys of animals fed chickpea flour (autoclaved, boiled) or uncooked. Lawal *et al*., 2022 findings regarding the protein value of unfermented and fermented mung bean flour was in line with the basal diet. The nitrogen retention of muscle mass in experimental animals fed cooked chickpea flour possessed a greater worth in contrast to animals fed with autoclave chickpea flour, a basal diet, commercial feed, uncooked chickpea flour, that had been consistent with the research of [11].

The amount of the experiment animals offered commercial feed, a diet containing steamed or unseasoned chickpea flour, and also autoclaved chickpea flour. According to the quality of [12], the physiological value of experiment animals given cooked chickpea flour had the greatest value as when compared with autoclaved chickpea flour, commercial feed, uncooked chickpea flour and general diet.

The animals consuming cooked chickpea flour experienced the greatest protein - efficiency ratio, followed by the animals given commercial feed, autoclaved chickpea flour along with a base diet [13]. It had been suggested it was lacking in crucial amino acids, in contrast to the conclusions of [13]. According to [14], the liver of experiment animals given commercial feed possesses the greatest value as compared to basal diet, uncooked chickpea flour as well as chickpea flour which has been autoclaved.

According to [14, 15], the kidneys of experimental animals fed commercial feed and uncooked chickpea flour had the highest value when compared to cooked chickpea flour, autoclaved chickpea flour, and basal diet. Contrary to a research by [16], the muscle of experimental animals fed uncooked chickpea flour has a higher value than that of cooked chickpea flour, autoclaved chickpea flour, commercial feed, and basal diet.

## Conclusion

The study demonstrates how different types of chickpea flour autoclave, cooked, uncooked as well as commercial feed and basal diet affected the experimental animals' growth performance, ability to retain nitrogen in their organs, weight of their visceral organs, and quality of their protein. The analysis of all treatments increased chickpea flour's protein efficiency content. Reviewers deemed animals fed cooked chickpea flour to be of a high weight.

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