

Original Research Article

Effect of long term consumption of graded levels of powdered stored *Ocimum gratissimum* supplementation on the weight performance in Wistar rats

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ABSTRACT

Background: The influence of *Ocimum gratissimum* leaf supplementation on feed intake; weight change via growth performance of Wistar rats was investigated.

Methods: A total of twenty (20) rats (average weight of 80 g±10 g), housed in a well-ventilated cages and given feed and water *ad libitum* for 2 weeks after which they were randomly allotted to four dietary treatments comprising 0%, 2.5%, 5% and 10%, of powdered stored *Ocimum gratissimum* leaf inclusion.

Results: Group of rats fed with the lowest supplementation (2.5%) of *Ocimum gratissimum* showed significant increase ($P < 0.05$) in weekly feed intake than group fed with the highest supplementation (10%). While, there was no significant difference ($P > 0.05$) between the groups fed with 0% and 5%. Also, the weight gain by the rats with 2.5% *Ocimum gratissimum* diet supplementation had highest weight gain which was significantly different to 10% supplementation and non-significantly different to 5% supplementation. Animals which received 2.5% of leaf of *Ocimum gratissimum* had the fastest growth rate, followed by those that received 5% and 10%. However, the control feed had higher body weight gain than 10% supplementation. The observable increase in the feed intake, weight gain and feed efficiency seen in the lowest supplementation level (2.5%) can be attributed to the spicing and seasoning of food with *O. gratissimum* and as such could also increase the palatability of the food. Furthermore, 2.5% has the highest dietary lipid which increases the palatability of food by absorbing and retaining flavor.

Conclusions: It can be concluded that 2.5% *O. gratissimum* supplementation has a better palatability than other experimental diets which reflected on the performance characteristics of this treatment.

Keywords: *Ocimum gratissimum*, Feed intake, Feed efficiency, Weight performance, Wistar rat

INTRODUCTION

Plant foods especially vegetables contribute substantially to both local diets and ethno-medicine in developing

countries especially Nigeria.¹ In Africa *Ocimum gratissimum* belongs to the family laminacea and is widely distributed in tropical and warm regions of the world.² It is an erect, multi-branched perennial shrub that

grows up to a height of two meters with a taproot and much adventitious side rootless. The leaves are simple, opposite or whorled with several oil glands and possess a peculiar scent smell due to its composition of volatile essential oils. It produces an inflorescence that capitates and reduces apical dominance while increasing branching. The flowers are zygomorphic, bilobal and bisexual with five petals and sepals and four stamens.

Leaf of *O. gratissimum* have been found to contain methylchavicol, linalool, eugenol, thymol and xanthamicrol and the amount produced is dependent on the area that it is cultivated as well as part of the plant, its other constituents include saponins, steroids, camphor, estragole, terpenes.^{3,4} *O. gratissimum* has both culinary and medicinal uses.⁵ It is mainly used as a spice to flavor foods and meats.⁶ Their use as spice is known to reduce microbial load and extend the shelf life of foods. The components of *O. gratissimum* has biological activities such as antidiabetic, autireptic, antitussive and the Igbo name of *O. gratissimum* Nchuawu literally means mosquito repellent and thus, its presence around the home is believed to repel mosquitoes as a basis for the prevention of malaria. The hypoglycemic activity of the plant has been reported.⁷

A lot of research has been done on *O. gratissimum* especially on its medicinal properties generating an abundance of information. However there is a need to see the effect of long term consumption of this plants on growth performance and its palatability via the intake.

METHODS

Procurement of experimental animals and groupings

Twenty (20) wistar rats (average weight 80 ± 10 g) were procured from the Department of Pharmaceutical Science, Ahmadu Bello University, Zaria, Nigeria. They were acclimatized for 2 weeks on a standard rat feed (Vital feed growers mash) and water *ad libitum*. The animals were then randomly allotted into 4 groups with group one (1) being the normal control group (0% *Ocimum gratissimum* supplement) while group 2-4 consist of the 2.5%, 5% and 10% *Ocimum gratissimum* supplementations.

Preparation of leaf of Ocimum gratissimum

Fresh leaves of *O. gratissimum* were harvested from Angwan Jeba farm, Zaria, North western Nigeria and were identified at the herbarium session, Department of Biology, Ahmadu Bello University with a voucher number 1285. The leaves were picked and air dried at room temperature (25° C). The dried leaf was then homogenized to a powdered form using an automated grinding machine at Institute of Agricultural Science, Ahmadu Bello University, and Zaria. The powdered leaf were then stored in an air-tight container prior to the supplemental formulation

Formulation of experimental diets

Four experimental diets namely the control diet which contain 0% inclusion of *Ocimum gratissimum* and the *Ocimum gratissimum* supplemented diet which was varied at 2.5%, 5%, and 10%.⁸ The analysis of proximate constituents of the varied supplementation levels were taken alongside the pure leaf of *O. gratissimum*.

Proximate analysis

The proximate analysis of the samples for moisture, ash, fibre and fat were performed using the method of AOAC.⁹ The nitrogen was determined by micro-Kjeldahl method as described by Pearson, the percentage Nitrogen was converted to crude protein by multiplying 6.25.¹⁰ All determinations were performed in triplicates.

Determination of feed intake

The average feed intake (AFI) in the various supplemented groups and the control group for 8 weeks was calculated by summing up the Feed intake for the eight weeks divided by eight to (g/week)

$$\text{Feed intake (g/week)} = \frac{\text{Average feed intake of eight week (g)}}{2 \times 8}$$

Determination of weight performance (weight change)

The weekly weight change was evaluated by subtracting the initial average weight of the animals (IAW) from the final average weight of the animal (FAW) on weekly basis

$$\text{Average weekly weight change} = \text{FAW} - \text{IAW}$$

The average cumulative weight change (ACWC) was evaluated by summing up the result obtained from (FAW-IAW)

Determination of feed efficiency

The weight changes by the animal in respective groups were summed up on weekly basis to the end of the study (8 weeks). The weekly feed intakes were calculated for the supplemented and control groups and the feed efficiency is evaluated as

$$\text{Feed efficiency} = \frac{\text{weight gain (g/rat)}}{\text{Feed intake (g/rat)}}$$

Statistical analysis

The statistical significance between the control and other groups of experimental animals were determined by one-way analysis of variance (ANOVA) followed by Bonferroni t-test for multiple comparisons. The results are presented as mean \pm SD at confidence interval of 95% ($p \leq 0.05$).

RESULTS

The result obtained on the feed intake of Wistar rats fed with different levels of *Ocimum gratissimum* diet supplementation as seen in Table 1 which shows that there is a significant increase in the feed intake of group fed with 2.5% *Ocimum gratissimum* supplement (600.43 ± 23.78) when compared with the normal control feed (0% *O. gratissimum* supplementation) (545.43 ± 7.75), while there was decrease in the feed intake of corresponding groups with increasing supplementation. 10% *Ocimum gratissimum* being the highest supplementation gave the lowest intake by the animal (542.50 ± 27.68).

Table 1: Cumulative feed intake of long term consumption of *Ocimum gratissimum* leaf supplementation (g/week) on wistar rats for the 8 weeks.

Treatment	Weekly feed intake (g/week)
Group 1 (0% supplementation)	545.43 ± 7.75^{ab}
Group 2 (2.5% supplementation)	600.43 ± 23.78^b
Group 3 (5% supplementation)	576.43 ± 24.60^{ab}
Group 4 (10% supplementation)	542.50 ± 27.68^a

Values are expressed as means \pm SD and are mean of three replicates (n=5); values mean with different superscript down the column are significantly different ($P < 0.05$).

Feed efficiency

The result obtained showed that animals fed with lowest *O. gratissimum* supplementation (2.5%) gave the highest feed efficiency (0.3940 ± 0.035), while group fed with 5% supplementation and 0% supplementation show no significant difference in the feed efficiency whereas, 10% *Ocimum gratissimum* supplementation gave the lowest feed efficiency (0.3047 ± 0.051).

Table 2: The feed efficiency (gain/feed) of Wistar rats fed with *Ocimum gratissimum* diet inclusion in Wistar rats.

Treatment	Body weight gain (g/rat)	Feed intake (g/rat)	Feed efficiency (gain/feed)
Group 1 (Control feed)	41.60 ± 3.60^{ab}	109.09 ± 1.55^a	0.3813 ± 0.056^a
Group 2 (2.5% <i>O. gratissimum</i> diet supplementation)	47.32 ± 4.99^a	120.09 ± 1.56^b	0.3940 ± 0.035^a
Group 3 (5% <i>O. gratissimum</i> diet supplementation)	44.77 ± 1.77^a	115.29 ± 4.92^{ab}	0.3893 ± 0.042^a
Group 4 (10% <i>O. gratissimum</i> diet supplementation)	33.07 ± 6.20^b	108.50 ± 5.54^a	0.3047 ± 0.051^b

Values are expressed as means \pm SD and are mean of three replicates (n=5); values mean with different superscript down the column are significantly different ($P < 0.05$).

The weekly body weight gain (g)

The weekly weight gain of Wistar rats fed with different levels of *Ocimum gratissimum* diet inclusion as shown in Table 3. Group of animals fed with 2.5% *Ocimum gratissimum* gave a consistent weight gain on weekly basis while the highest *Ocimum gratissimum* diet inclusion (10%) showed the lowest weight gain on weekly basis. As the experimental weeks increase, the highest weight gain was recorded for treatment with lowest *O. gratissimum* diet. Cumulatively, the weekly weight gain of 2.5% *Ocimum gratissimum* diet supplementation gave the highest weight gain among others supplementations.

The body weight gain in percentage (%)

The body weight performance of Wistar rats fed with different levels of *Ocimum gratissimum* diet inclusion as seen in Table 5 was evaluated in percentage (%). From the result obtained, a consistent increase was observed in the weight performance of animal fed with normal control (0% *Ocimum gratissimum* inclusion) and 2.5% *O. gratissimum* diet inclusion while the highest *Ocimum gratissimum* diet inclusion (10%) showed a decrease in its weight performance as the supplementation tally to 6-8 weeks when compared to groups fed with lowest *Ocimum gratissimum* diet inclusion

The quantitative constituent of proximate analysis carried out on the different levels of *Ocimum gratissimum* diet inclusion in vital feed.

The quantitative constituent of proximate analysis carried out on the different levels of *Ocimum gratissimum* diet inclusion in vital feed as demonstrated in Table 6, showed that the percentage of carbohydrate (CHO) and protein decreases with increasing level of supplementation while 2.5% level of supplementation gave the highest lipid value. The normal control (vital feed with 0% *Ocimum gratissimum*) gave the lowest moisture content, ash and crude fiber while other levels of supplementation showed an increase in the nutritional constituent with increasing supplementation.

Table 3: The biweekly weight gain (g) for long term consumption of *Ocimum gratissimum* diet inclusion in Wistar rats.

Treatment	Week (1-2)	Week (3-4)	Week (5-6)	Week (7-8)
Group 1 (Control feed)	10.41±2.57 ^a	7.48±1.17 ^{ab}	5.32±2.91 ^{ab}	23.55±2.06 ^a
Group 2 (2.5% <i>O. gratissimum</i> diet supplementation)	13.68±1.80 ^b	9.53±1.99 ^a	8.25±0.15 ^a	26.43±2.05 ^a
Group 3 (5% <i>O. gratissimum</i> diet supplementation)	7.63±2.33 ^a	9.50±3.69 ^a	8.50±0.97 ^a	25.03±2.72 ^a
Group 4 (10% <i>O. gratissimum</i> diet supplementation)	7.16±1.56 ^a	5.04±1.99 ^b	2.32±1.81 ^b	21.92±1.98 ^a

Values are expressed as means± SD and are mean of three replicates (n=5); values mean with different superscript down the column are significantly different (P<0.05).

Table 4: Cumulative weight gain for long term consumption of *Ocimum gratissimum* leaf supplementation (g/week) on Wistar rats for 8 weeks.

Treatment	Cumulative weight gain (g/week)
Group 1 (0% supplementation)	41.62 ± 3.609 ^a
Group 2 (2.5% supplementation)	47.323 ± 4.994 ^a
Group 3 (5% supplementation)	44.771 ± 1.774 ^a
Group 4 (10% supplementation)	33.075 ± 6.203 ^b

Values are expressed as means± SD and are mean of three replicates (n=5); values mean with different superscript down the column are significantly different (P<0.05).

Table 5: The body weight performance in percentage (%) of long term consumption of *Ocimum gratissimum* diet inclusion in Wistar rats.

Treatment	Weeks 0-2 (%)	Week 3-5 (%)	Week 5-8 (%)
Control feed	20.604	24.918	35.759
2.5% <i>O. gratissimum</i> diet supplementation	12.372	20.222	51.418
5% <i>O. gratissimum</i> diet supplementation	0.577	16.157	6.695
10% <i>O. gratissimum</i> diet supplementation	20.777	14.626	0.987

Table 6: Proximate analysis of experimental diets and leaf of *Ocimum gratissimum*.

Level of Supplementation	Moisture (%)	CHO (%)	Protein (%)	Ash (%)	Lipid (%)	Crude fiber (%)
0% supplementation	2.35	58.58	17.88	5.66	8.04	7.49
2.5% supplementation	4.86	53.03	18.81	7.09	9.14	7.07
5% supplementation	5.08	52.20	19.06	7.91	7.41	8.34
10% supplementation	5.78	49.37	22.44	8.04	6.22	8.155
Pure leaf	6.92	48.96	22.44	9.04	5.39	8.25

DISCUSSION

The long term consumption of *O. gratissimum* diet inclusion by male Wistar rats had some considerable effect on the weight/growth performance and also on the rate of their feed intake as seen in the results obtained from the studies. The increase in the feed intake which was in favor of 2.5% observed in Table 1 and 2 could be explained from the fact that *O. gratissimum* leaves are appealing and appetizing as a spice (2.5%).¹¹ when compared to other high dosages and this is due to the bioactive compounds found in leaf samples which are bitter, acrid or astringent and therefore aversive to the consumer at a very high amount. *O. gratissimum* are rich

in minerals and vitamins,¹² which can stimulate appetite of the rats but can also be aversive due to the bitterness at high dosage. It was also observed that 2.5% *O. gratissimum* diet inclusion resulted in an increase weight gain seen in Table 3, 4, and 5 which is attributed to the nutrient composition of the leaves of *O. gratissimum* and the palatability of the dosage and also the level of the feed intake seen in Table 1 and 2. *O. gratissimum* contain nutrient that can increase weight such has carbohydrate, protein and lipid, minerals and vitamin, as seen in Table 6.¹³ Dietary fat especially increases the palatability of food by absorbing and retaining flavor. *O. gratissimum* could be used for spicing and seasoning of food and as such could also increase the palatability of

food which is in agreement with the result obtained in this experiment showing 2.5% supplemented diet group having the highest intake.^{14,15} The aroma from the *O. gratissimum*, which are mainly eugenol methylcinnamate, camphor and thymol, might have some feed digestive properties that increase the appetite of the rats.¹⁶ The increase in the weight gain is understandable because of the additional nutrients from *O. gratissimum* leaves as well as increase in the feed consumption of the rats. Medicinal plants are plants which contain substances that could be used for therapeutic purposes or which are precursors for the synthesis of useful drugs.¹⁷ Other than its medicinal role it can also play the role in growth performance resulting from the palatability potentials of the spice (2.5%) of *O. gratissimum*.

CONCLUSION

The results of this study revealed that *O. gratissimum* leaf can best be used as a spice with an improve growth performance and feed intake observed at (2.5%).

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