EFFECT OF FEED AND CAGE TYPES ON GROWTH PERFORMANCE OF WISTAR ALBINO RATS

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Abstract:

Wistar albino rats are an essential component of today's biomedical research. Body weight, age, feed type, and developmental stage of the animals are all factors to consider that can have an impact on drug metabolism, gene expression, and metabolic parameters in animal studies. This research evaluated the effect of the type of feed and cage type on the growth performance of Wistar albino rats. A total of 60 Wistar albino rats with an average initial weight of each were taken during the experiment. A total of 20 females and 40 males, where the experimental design allows, were grouped into two groups. Each subgroup had five cages and was fed three treatments (Chikun, Sunseed, and Supreme) with chaff as the negative control. The data obtained was analyzed using ANOVA. The result shows that the feed type given to the white albino rats all shows effectiveness on the weight gain of the white albino rats since their respective p-values ($P<0.05$) are at the 95% level of significance. And from the analysis conducted, it can be deduced that sunflower was more effective compared to the effectiveness of other feed types since the mean difference is high compared to other types of feed. The cage types have no effect on the growth performance of the white albino rat with a p-value > 0.05. High feed consumption was recorded when temperatures were low, while at high temperatures, low feeding activity of the Wistar Albino rats was observed. It can be concluded that feed type and temperature affect growth performance, while the type of cage has no effect on the growth performance of Wistar Albino rats. It is recommended that this research can be of help to support biomedical when combine with other factors to know the optimum condition for a control growth performance.

Keywords: Cage, Feed, Wistar-rats, Weight-gain,

1. INTRODUCTION

The laboratory wistar albino rat is an unavoidable component of today's biological research. They are widely regarded as the gold standard in a variety of fields, including neurobehavioral research, cancer research, and toxicity (Leskanicova *et al*., 2020). The number of animals used in scientific research each year is difficult to estimate. Several tens of millions every year are estimated, including 15 million in the United States, 11 million in Europe, five million in Japan, two million in Canada, and less than one million in Australia. Almost 80% of the animals used in experiments are rodents such as mice, wistar albino rats, guinea pigs, and others (10% are fish, amphibians, reptiles, and birds) (Lu *et al*. 2022).

Body weight, age, feed type, and developmental stage of the animals employed can all have an impact on the study's findings (Adeoye *et al*., 2022). Drug metabolism, gene expression, metabolic parameters, and other dependent variables examined in animal research can all be affected by the animals' age, feed type, and body weight (Jackson *et al*., 2017). The current study is carried out to evaluate the effect of cage type and feed type on the weight gain of Wistar Albino rats for research purposes.

Considering the increase in the number of diseases in the world, it is pertinent to look

into production of healthy and standardized animal model for the drug and vaccine trial to cure most of these diseases, this research evaluates factors such as, type of feed, cage type and postnatal developmental stages in wistar albino rat as it relates changes in their feeding behaviour, and body weights.

2. METHOD

Animals Collection

A total of 60 Wistar Albino Rats were purchased from ABU animal house and taken to the Animal House Unit of the Department of Biology and Microbiology, School of Applied Sciences at the main campus of Nuhu Bamalli Polytechnic, Zaria, where the experiment was carried out. These wistar albino rats were just weaned and were about four weeks old. They were separated into males and females in separate cages.

Weight of the Animals

Each rat was weighed using the weighing balance. An empty plastic mini bowl was place on the weighing balance and the weight reset to zero after which each rat place inside the rubber and the weigh was recorded. Permanent marker was used to mark on the back to differentiate between male one and male two in each cage. The female in each cage had no colour marked. Wistar albino rats were weighed on daily bases and the records were well documented. The Weight gain was obtained at the end of the research.

Weighing feed

Feeds were measured using the weighing balance and administered to the rats and the leftover was weighed and the difference between the two gave the feed intake. This was taken on daily basis.

Experimental Animals Management

A total of 60 Wistar Albino Rats with average initial weight of each were taken during the experiment. A total of 40 females and 80 males where the experimental design allows that the wistar albino rats were grouped into two groups. Group 1 and Group 2 with a total of 20 females and 40 males in each group. Each group had a total number of 20 cages (10 aluminum cages and 10 plastic cages) with each cage having 2 males and a single female. The 20 cages that form each group were divided into four sub groups with five cages. Each subgroup had five cages and were being fed with Chikun, (CK) Sunseed, (SS) Supreme (SP) and chaff (CF) feed. Therefore, each subgroup was being fed with different feed type and the subgroups being fed with compounded feed (Chaff) forms the control of the experiment.

Experimental Feeds

Routine

The feeds used for this experiment were basically commercial top feeds and compounded feed (maize chaff), which served as the control for the experiment. There were three company brands of commercial top feed used for this experiment, which are chikun, sunseed, and supreme feed pellet.

The feeds were purchased from commercial dealers and used for the experiment. The following cages were being fed with Chikun feed (Ck) with cage codes ($C1_{i,}$ $C2_{i}$, $C3_{i}$, $C1_{p,}$ $C2_{p}$), Sunseed feed (SS) with cage codes ($C3_{p}$, $C4_{p,}$ $C5_{p}$, $C4_{i,}$ $C5_{i}$), supreme feed (Sp) with cage code ($C6_{i,}$ $C7_{i,}$ $C8_{i,}$ $C6_{p,}$ C7p), and Negative control (Chaff) (CF) with cage codes ($C8_{p,}$ $C9_{p,}$ $C10_{p,}$ $C9_{i,}$ $C10_{i}$).

Routine Management

Routine management operations such as regular cleaning, changing of sawdust, and disinfection of cages, feeders, and waters were carried out regularly throughout the experimental period. The physical, dietary, and general biological components of the environment impacting the animals

throughout this phase are all present. Noise, temperature, humidity, ventilation, and the light/dark cycle—all elements that influence the health and welfare of animals—were well checked. Noise and vibration, optimal temperature, and humidity for the animals were optimally controlled. The recirculation of air in an animal housing is known as ventilation, which was checked because dust and microorganisms could be widely distributed. Clean and drinkable water was provided at two-day intervals, and proper hygiene practices were practiced by cleaning every week. The sawdust changed, thus keeping the environment clean.

Measurements of the Parameters

Temperature

Wet and Dry thermometer was used to take the daily average temperature of the animal house, their feeding behavior were recorded base on temperature variation.

Measurement of growth parameters

The performance of the Wistar Albino Rats was determined for each experimental cage, the initial weight, subsequent weekly weights and final weight will be taken with a weighing balance scale to determine weight changes of the rats.

Feed

Daily feed intake was calculated by the difference between the daily feed supplied and the feed left over.

Weight gain

The rats were all weighed before the experiment began, and their starting weight were recorded. At the end of the experiment, the rats' final weights were recorded, and the total weight was calculated by subtracting the initial weight from the final weight.

Statistical analysis

The acquired data was subjected to analysis of variance (ANOVA) using Statistix 9.0, and post hoc test was used to separate the means when there is a significant difference.

RESULTS AND DISCUSSION

Table 1: ANOVA table showing the Effect of feed type and Cage type on the weight gain of wistar Albino rats

	Sum of Squares	df	Mean Square	F	p
Overall model	608482	71	8570	4.677	< .001
feed type	202455	3	67485	35.022	< .001
CAGE TYPE	2721	1	2721	1.412	0.235
WEEKS	273283	8	34160	17.728	< .001
feed type ✻ CAGE TYPE	21976	3	7325	3.801	0.010
feed type ✻ WEEK	87276	24	3636	1.887	0.007
CAGE TYPE ✻ WEEK	7405	8	926	0.480	0.870
feed type ✻ CAGE TYPE ✻ WEEK	13366	24	557	0.289	1.000
Residuals	901817	468	1927		

Interpretation: From the **Post Hoc Test** above it shows that each feed type in any of the cage type was statistically significant (p-value < 0.05) since compound feed is the control factor

Table 2: Showing the Effect of feed type on the weight gain of wistar Albino rats

Comparison								
feed type		**feed type**	**Mean Difference**	**SE**	**df**	**t**	**p_{tukey}**	**$p_{scheffe}$**
SS	-	SP	5.69	5.45	468	1.04	0.724	0.780
CK	-	CF	50.46	5.45	468	9.25	< .001	< .001
	-	CK	25.50	5.45	468	4.68	< .001	< .001
SP	-	CF	44.77	5.45	468	8.21	< .001	< .001
	-	CK	19.81	5.45	468	3.63	0.002	0.005
CF	-	CK	-24.96	5.45	468	-4.58	< .001	< .001

Keys: SS-Sunseed, **CK**-Chikun, **SP**-Supreme, **CF**-MaizeChaff

DISCUSSION

Table 1. Shows the post hoc test, and our negative control is the maize chaff (CF) which was compare with other feed types (treatments). Therefore, from the result it shows that the feed type given to the Wistar albino rats all show effectiveness on the weight gain since their respective p-value are all less than 0.05 (P<0.05) at 95% level of significant. From the analysis conducted it can be deduced that sunseed (SS) is more effective compare to other feed types since the mean difference is high compare to other feed types. This observation is most likely attributable to the high-calorie diet's impairment of the metabolic process, which was alleviated by the three commercial feeds. The findings of Okobi *et al*. (2022), who showed an increase in the mean body weight of diabetic rats (p<0.05) at varied levels of supplementation with *C. olitorius* leaf extracts, supports the higher weight gain of rats in the treatment groups compared to the negative control. Furthermore, the significant moderate weight gain by the *S. bifrae*-fed group supports the findings of Lienou *et al*., who reported a low body weight gain in rats, confirming the traditional health benefit claim of *S. biafrae* in lowering plasma total cholesterol, body mass index (BMI), and total triglycerides in plasma in pre-obese subjects (Olaniyan 2019).The weight loss observed in the *C. crepidioides* group could be attributed to the vegetable's significant antihyperlipidemic activity, as reported by Bahar *et al.* (2016), and confirmed by Musa *et al*. (2011), who reported a nonsignificant increase in the weight gain of rats fed *C. crepidioides*. The post hoc test for type of cage shows that the cages have no effect on white albino rat this could be due to no significant difference in the effect of temperature and humidity on the plastic and iron cage.

There was no significant difference in average feed consumption between the test and control groups (p < 0.05). The feed conversion ratios of the test groups were significantly (p >0.05) higher than those of the control groups. The test groups gained significantly less weight (p <0.05) than the control group (Table 2). The non-significant difference in feed consumption among groups is noteworthy, showing that commercial feeds taste and feel pleasant. According to Farran *et al*. (2005), the flavour and texture of finished meals influence animal intake and satiety. Freshness,

appearance, mould, spoilage, moisture, temperature, and odour could all have an impact on feed consumption. The feed conversion ratio (FCR) assesses an animal's ability to convert eaten feed into weight gain.

It was observed that temperature variation affects their feeding behaviour. High feed consumption was recorded when temperature is low while at high temperature, low feeding activity of the Wistar Albino rats were observed. Temperature could influence their feeding behaviour thus varied their growth performance. Therefore, this research recommend that further research should be conducted on the variation of physical factors (temperature, light humidity etc.) on the growth performance of Wistar albino rats

CONCLUSION

It can be deduced from this research that the commercial feeds have significance effect on the weight gain of wistar albino rats and their feed in behaviour affected. There was no significance in the weight of the rats in relation to the type of cage (Iron and plastic cage used). This research can be of help to support biomedical when combine with other factors to know the optimum condition for a control growth performance.

AUTHOR CONTRIBUTION

Author 1: conceptualization, methodology, software, validation, formal analysis, investigation, resources, data curation, writing – original draft preparation, writing – review and editing, visualization, supervision, project administration, funding acquisition.
Author 2: conceptualization, supervision, validation, funding acquisition.
Author 3: validation, supervision, funding acquisition.

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