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Effect of different extruded feeds varying in ingredient composition on the performance of laboratory rats

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Abstract

This study evaluated the impact of five different extruded feed formulations on body weight gain and feed intake in laboratory rats. The formulations (T₁-T₅) were prepared using ingredients such as maize, soybean meal, rice flour, roasted Bengal gram, and de-oiled rice bran. The chemical compositions of the raw materials were analysed. A 21-day feeding trial was conducted on 25 male Albino rats divided into five groups, each fed ad libitum with one of the feed formulations. Results showed significant variation in weight gain and feed intake among the groups, with T₄ (+21.80%) and T₅ (+17.40%) exhibiting superior performance compared to T₁ (+8.77%) and T₂ (+5.54%). T₄ and T₅, which included roasted Bengal gram and reduced broken rice, outperformed maize-soybean-dominant diets (T₁ & T₂). The findings highlight the importance of incorporating diverse ingredients such as roasted Bengal gram and de-oiled rice bran alongside maize and soybean for better palatability and weight gain in laboratory rats. This study underscores the potential for optimizing extruded feed formulations to enhance laboratory animal nutrition and suggests broader applications in cost-effective feed production.

Keywords: Rat feed, Bengal gram, weight gain, feed, soybean

1. Introduction

Animal feed formulation is critical in research involving laboratory rats, as nutritional intake directly influences the health and growth. In experiments, the design and composition of animal diets can significantly impact results, particularly in studies focused on weight gain and health outcomes. Maize, soybean, rice flour, roasted bengal gram, and various supplements are commonly used as ingredients in animal feeds. These components not only provide essential nutrients but also serve as sources of energy and protein, which are crucial for growth. Very few feeding experiments were conducted in laboratory animals.

A balanced ration is necessary for the normal life of laboratory animals, and it is important for the researcher to make sure that the experimental results are not influenced by factors caused by nutrition (Kozul *et al.*, 2008) [4]. The nature of the feeding diet of laboratory animals is one of the most uncontrolled parameters that affects the experimental work and leads to differences between the data obtained by different authors in similar studies (Keenan *et al.*, 1996) [3]. Hence the objective of this study was designed to evaluate the impact of five different feed formulations on body weight maintenance and feed intake in laboratory rats. Each formulation varied in the proportion of maize, soybean meal, rice flour, and other key ingredients. Understanding the optimal balance of these ingredients can contribute to better animal nutrition and overall health, which is essential for laboratory animal research and pave way for broader applications in laboratory animal feed production.

2. Materials and Methods

2.1 Preparation of extruded feed

Five different types of laboratory animal feed (T₁-T₅) were formulated as per the ingredient composition given in Table 1. All feed ingredients were ground to pass through 1 mm sieve and mixed well. During mixing conditioning was done by adding portable water to increase the moisture content to 25.0%.

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Table 1: Feed ingredient composition (%) of extruded feed ration fed to laboratory rats

Ingredients	T ₁	T ₂	T ₃	T ₄	T ₅
Maize grain	63	43	51	58	50
Soybean meal	33	33	30	28	30
Rice flour	0	20	10	0	10
Roasted Bengal gram	0	0	0	10	6
Deoiled rice bran	0	0	5	0	0
DL- Methionine	0.2	0.2	0.2	0.2	0.2
Mineral mixture	3	3	3	3	3
Common salt	0.5	0.5	0.5	0.5	0.5
Vitamin mixture	0.1	0.1	0.1	0.1	0.1
Additives	0.2	0.2	0.2	0.2	0.2
Total	100.0	100.0	100.0	100.0	100.0

Extruded feed was prepared using double screw extruder at the temperature of 120 degree Celcius through 6 mm die and dried in an electrical dryer at 90 degree Celcius to bring the moisture content to less than 8%. The feed formulation was done to meet nearly the BIS (1970) ^[2] specification.

2.2 Chemical composition analysis

The crude protein, crude fibre, crude fat, ash, soluble carbohydrates including moisture content were analysed as per AOAC (2006) ^[1].

2.3 Feeding trial

A total of 25 healthy laboratory male Albino rats with average body weight of above 200 g were selected and randomly allotted into five groups, with five rats in each group. Each group was assigned a different feed formulation (T₁-T₅). The rats were housed in individual cages and were fed ad libitum (free feeding) for 21 days. During the feeding period, the rats'

body weights were measured weekly to monitor changes. Each rat was weighed in empty stomach before feeding at the beginning of the study and then at weekly intervals.

3. Results

The analysis reports of five different extruded feeds fed to rats is presented in Table 2.

Table 2: Chemical composition (% on as fed basis) of extruded feed ration fed to laboratory rats

Parameters	T ₁	T ₂	T ₃	T ₄	T ₅
Moisture	9.64	7.92	8.56	7.37	8.24
Crude protein	19.22	19.67	18.78	18.80	18.34
Ether extract	1.21	1.07	1.02	1.13	0.93
Crude fibre	3.29	2.94	2.93	3.08	3.08
Total ash	5.87	5.90	5.95	6.08	6.18
Nitrogen free extract	60.77	62.50	62.76	63.54	63.23
Calcium	1.00	0.90	0.90	0.80	0.90
Phosphorous	0.81	0.80	0.81	0.84	0.84
Gross energy* (Kcal/kg)	3763	3830	3785	3834	3776

*calculated

The moisture content of extruded feed was less than 10%. The crude protein content of all the experimental extruded rat feed ranged from 18.34 to 19.67% on as fed basis. The crude fibre content (3.5%) was less than the BIS (1970) ^[2] maximum permissible level of 6%.

Rats in all five groups experienced weight gain throughout the feeding period, with gains ranged from +21.80% (T₄) to +5.54% (T₂) of their initial body weight. The weight gain was poor in T₂ followed by T₁. In T₅, T₃ and T₄, the body weight gain is higher. The same trend was also observed in feed intake.

Table 3: Body weight changes and average feed intake of laboratory male rats fed with different extruded feeds

Treatments	Initial body weight (g)	Final body weight (g)	% change in body weight	Average feed intake/ day / head (g)	Feed intake as% of body weight
T ₁	209.6± 8.58	228.0± 9.38	+8.77	15.86±1.78	7.25
T ₂	220.0± 8.79	232.2±10.90	+5.54	15.89±1.51	7.03
T ₃	211.4 ±6.65	248.6 ±8.33	+17.59	16.94±1.62	7.36
T ₄	213.6± 7.31	235.4±7.51	+21.80	18.54±0.87	8.26
T ₅	213.4 ±6.77	230.8±5.94	+17.40	17.83±1.23	8.03

4. Discussion

The results indicated that the feed composition plays a significant role in the weight gain of laboratory rats. Formulations with a higher proportion of energy sources (maize and broken rice) as in T₁ and T₃, showed poor performance in terms of body weight and palatability in terms of feed intake as% of its body weight. Better results in terms of weight gain and feed palatability observed in T₄ followed by T₅ and T₃ suggested that inclusion of roasted Bengal gram and less proportion of broken rice with de oiled rice bran improved the performance in rats compared to only maize and soybean based diets (T₁ & T₂). The substitution of maize with rice flour in T₂ resulted lower weight gain, likely due to the more consistency and density of the extruded feed compared to other treatments. However, the feed intake in all the treatment groups were comparable with NRC (1995) ^[5] quoted dietary intake quantity for adult rat at maintenance (15 g/d/h). Overall, the results of this study demonstrated that a combination of maize and soybean with less proportion of broken rice, de-oiled ricebran, roasted Bengal gram in the diet of rat promoting better performance. However, the results also

highlight the importance of inclusion of variety of feed ingredients other than maize-soybean based formulation.

5. Conclusion

This study provides insight into the role of extruded feed ingredients composition for laboratory rats in maintaining the body weight and palatability in laboratory rats. The results suggested that in addition to maize and protein-rich ingredients like soybean meal, roasted Bengal gram, de-oiled rice bran are the key components in rat extruded feed for better performance. Future studies may focus on optimizing the balance of these ingredients and exploring the impact of other additives to further enhance the outcomes in laboratory animal's nutrition research. Such research can also have practical applications in the development of cost-effective and nutritionally balanced feeds for other laboratory animals.

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Conflict of Interest

Not available

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7. References

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