



Formulation of Different Moist Pet Foods and Evaluation for their Acceptance and Utilization in Wistar Rats

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ABSTRACT: While dry kibble has been a popular choice for pet owners, moist pet food has gained significant attention in recent years. In this article, we explored the benefits of moist pet food, shedding light on why it is becoming a preferred choice among pet owners.

A study was conducted to assess the performance of various moist pet food formulations in weaned Wistar rats. The food group included C (control with vegetarian formula), T₁ food consisting of chicken boneless breast with heart and liver, T₂ food consisting of whole chicken with heart and liver, and T₃ food containing chicken offal meal with heart and liver. The weaned rats were fed with the formulated diet for 21 days and evaluated for its acceptance and utilization in rats. The moist pet food feed intake in the Wistar rat groups is in descending order T₃>C>T₁>T₂ and the FCR of control and treatment group rats fed with the moist pet food in 1-3 weeks is in ascending order is T₂<T₃<T₁<C.

In conclusion, the rats fed with whole chicken along with heart and liver based formulations had a higher weight gain, than the other formulated foods.

Keywords: Moist pet food formulation, Wistar rats, Feed intake, Feed Conversion Ratio.

INTRODUCTION

Dogs have earned the status of being the most popular companion animals globally. While the majority of pets are fed dry pet food, which is commercially available in India and across the world, the availability of moist pet food remains less common. However, various moist pet food varieties, such as semi-moist, moist, and moist dog foods, have demonstrated significantly higher palatability compared to traditional dry kibble. The primary advantage of moist pet food lies in its palatability, as the soft and moist consistency appeals to pets, particularly older ones with dental issues or picky eaters who may face challenges chewing dry food. The enhanced palatability of moist pet food can encourage finicky eaters to consume a balanced diet, ensuring they receive the necessary nutrients for optimal health. The heightened palatability of moist pet food plays a vital role in encouraging finicky eaters to consume a balanced diet, ensuring they receive essential nutrients for optimal health and well-being. Furthermore, moist pet food contains a higher water content in comparison to dry kibble, which offers an added benefit in promoting hydration in pets. Moist pet food is typically easier to digest than dry kibble. The moisture content in these foods helps soften the texture, making it gentler on the digestive system. This can be particularly beneficial for pets with sensitive stomachs, digestive issues, or those recovering from surgery. The easily digestible nature of moist food allows for better

absorption of nutrients, ensuring that pets receive optimal nourishment from their meals.

However, due to their higher water content, moist dog food recipes have a much shorter shelf life. Moist pet food offers various advantages such as it boosts energy, builds and tones the muscles, builds lean mass and keeps the pets healthier at times. The moist nourishments are ideal for young and old pets that are unable to chew due to missing teeth, inadequately adjusted jaws, or smaller mouths. A key factor driving the moist pet food market is the preference of owners towards buying superior products to ensure good health, care, and proper nutrition. All these advantages make the global moist food market more popular and attractive in the current pet food market. Gradually, the demand for pet food is increasing, which creates significant opportunities for the global moist pet food market. India has an estimated 19 million pets, with dogs accounting for 80 per cent of the total. According to industry estimates, the pet food business is growing at a rate of 13-15 per cent each year, with just 10-12 per cent of households participating (Venkata Susmita Biswas - Financial Express (2020)). The pet food category is valued at Rs 2,284 crore, according to Euro monitor International, with dog food accounting for roughly 85 per cent of the market. Moist pet food made up just over one per cent of the dog food market in 2018 across India and the market value of the moist dog food sector was approximately 3.6 million U.S. dollars in the year 2018 and further, this was forecast to reach

approximately seven million dollars by 2023. So far in the Indian subcontinent, the moist pet food industry didn't encompass positive access for the moist pet food commercial market due to lack of technology, affordability, and returns. By considering the gap, the present study was aimed to formulate affordable moist pet food using simple techniques that incorporate chicken boneless breast, whole chicken, and chicken offal meal, and compare it with a control group of vegetarian origin. The objective is to assess the growth performance in Wistar rats as a model for potential benefits in companion animals.

MATERIALS AND METHODS

The selection of meat-based ingredients for the preparation of moist pet food was carried out carefully, considering the specific formulation requirements. In this study, the base test ingredients, namely chicken boneless breast meat, whole chicken with skin, and poultry offal meal, were chosen to create the moist pet food samples. To ensure the safety and nutritional value of the meat-based ingredients used in the preparation of the moist pet food samples, high-quality meat-based ingredients were analysed and purchased carefully.

Non-meat-based ingredients for the preparation of moist pet food. The soybean meal, maize, deoiled rice bran, rice flour, dicalcium phosphate, methionine, choline chloride, salt, additives, calcite powder and antioxidants were purchased in the Feed mill unit, Department of Animal Nutrition, Veterinary College and Research Institute, Namakkal. Vegetables and millets were purchased at the local grocery store. While soybean meal, de-oiled rice bran, and rice flour were tested for proximate composition, calcite powder was tested for its calcium content. All the materials were analyzed in the Animal Feed Analytical and Quality Assurance Laboratory, Veterinary College and Research Institute, Namakkal.

The moist pet food diet formulations were divided as (C) control with a vegetarian diet, T₁ food consists of chicken boneless breast with chicken liver and heart, T₂ food consists of whole chicken with chicken liver and heart; and T₃ food contains chicken offal meal with chicken liver and heart. All the control and moist pet food samples contained 12 to 13 per cent protein and 67 to 69 per cent moisture content.

Procedure for manufacturing of moist pet food. The ingredients selected for the preparation of moist pet food were accurately weighed based on the formulated inclusion levels, using an electronic digital balance. The meat was minced, along with the selected ingredients, employing a meat mincer (Mado Primus, Germany). Non-meat ingredients were blended with the coarse ground meat and then cooked in a pan at a controlled temperature of 63°C for 30 minutes. Subsequently, the cooked pet food slurries were cooled to room temperature. To package the moist pet food, 250 g of the prepared slurries were meticulously filled into four laminated retort pouches. The retort processing of the moist pet food diets was conducted at the Department of Livestock Product Technology, Veterinary College

and Research Institute, Namakkal, Tamil Nadu, following the procedure described by Rajan *et al.* (2014). The hermetically sealed pouches were loaded onto trays and placed into the retort machine (M/s. Lakshmi Engineering Works, Chennai). The thermal processing was carried out at 121.1°C, corresponding to an F₀ value of 5.2, for a total duration of 36 minutes, with a constant pressure of 20 psi throughout the process. After thermal treatment, rapid cooling was applied, lowering the temperature to 55°C. Finally, the processed retort pouches were stored at ambient temperature (35±2°C) for further analysis.

Experimental design and diet for Wistar rats. Day-old Wistar rats (*Rattus norvegicus*) were procured from the Biogen Laboratory Animal Facility (CPCSEA Reg No. 971/PO/RcBiBu/S/2006/CPCSEA), Bangalore, India, to assess their growth performance by feeding them different pet foods. A randomized block design was adopted, and a total of 24 rats with the same age group and weight were evenly distributed into four groups, each containing six rats (n=6), consisting of three males and three females. All rats were housed individually in separate cages, and each rat was assigned a unique identification mark with corresponding tags attached to their respective cages. An identification mark was given to each rat, tags were prepared with a respective identification mark and attached to the cages. The Wistar rats were kept in the laboratory animal shed, where they had access to an *ad libitum* potable, wholesome drinking water supply. After a 21-day weaning period and a 3-day adaptation period, the Wistar rats were fed the respective pet foods of the control and various treatments until they reached 45 days of age. All the moist control and pet foods contained approximately 12-13% protein and 67-69% moisture content (Min Hu and Charlotte, 2016). Table 1 presents the various formulations of moist pet food used in the study. The performance parameters of Wistar rats, such as feed intake (g), feed conversion ratio, were assessed at the 0th week, 1st week (24-31st days), 2nd week (32-38 days) and 3rd week (39-45 days).

Prior to commencing the feeding trial, the initial weight of each Wistar rat was recorded. Throughout the trial, rats in each group were fed *ad libitum* with their respective diets daily. Individual daily intake of moist pet food was meticulously recorded by weighing the food served to each rat, as well as the split and leftover pet food. This enabled an accurate calculation of the amount of moist pet food consumed by each rat. The feed conversion rate (FCR) was then calculated following the procedure outlined by Manjula *et al.* (2016).

RESULTS AND DISCUSSION

The initial body weights of the Wistar rats were observed to be uniform across all groups: C 48.00 ± 2.24, T₁ 48.00 ± 2.49, T₂ 47.50 ± 2.79, and T₃ 47.83 ± 3.05, showing no significant difference (P > 0.05) among the groups. The feed intake (g) of the Wistar rats fed with various moist pet food formulations is presented in Table 2. Over the three-week trial, the

control and treatment groups of rats exhibited significant variations ($P > 0.05$) in their food intake. In the first week, the T₁ group rats consumed the most food, followed by T₃, the control group C, and finally T₂. In the second and third weeks, the food consumption of the T₂ group showed lower intake, followed by T₁ and T₃, with the highest feed intake noticed in the control group. Comparing the moist pet food intake over the three weeks, the T₂ rat group consumed the least, followed by T₁, T₃, and the control group C. The control group exhibited the highest quantity of moist pet food consumption during the 3-week feeding trial compared to the other groups. The observed differences in food intake among the groups are likely influenced by the body's growth and developmental requirements (FAO, 2011) and the ability of the foods to meet these needs. The study demonstrates a prudent similarity in the selection of moist pet food samples among the Wistar rat groups. Similarly, the feed conversion ratio (FCR) also showed statistically significant differences ($P > 0.05$) among the control and treatment groups from the first to the third week of the feeding trial. In the first week, the FCR of

the control and treatment groups followed an ascending order: T₂ < T₃ < T₁ < C. This pattern persisted in the second and third weeks as well, with T₂ displaying the lowest FCR and the control group showing the highest. The variation in ingredient composition is a major reason for the differences in FCR among the different groups. Notably, the moist pet food based on whole chicken (T₂) provided the optimum nutrients required for animal growth, leading to a lower FCR. Providing precise nutrients needed by the animals can improve the feed conversion ratio. Manipulation of diet ingredients is the most effective way of regulating not only the animal growth rate but also its reproduction and survival rates (Olufunke and Toyin 2012). Comparing these findings with Manjula *et al.* (2016) study on the FCR of *Spirulina* and rice diets in Wistar rats, where *Spirulina* showed higher utilization compared to the rice diet, our current findings align with their results. The current study's results regarding FCR of control and treatment pet food utilization by Wistar rat groups are consistent with Manjula *et al.* (2016) findings and support the opinions of Olufunke and Toyin (2012).

Table 1: Ingredient and nutrient composition of various pet food formulations (Percentage) as moist basis.

Ingredients	Control	T1	T2	T3
Chicken product	0	40	40	11
Chicken liver and heart	0	15	15	25
Carrot	10	2.5	2.5	2.5
Beetroot	18.5	2.5	2.5	2.5
Jiggery	1.0	1.0	1.0	1.0
Soybean meal	**	**	**	**
Rice polish	1.5	1.0	1.6	5.0
Rice flour	0	9.5	5.2	6.0
Chicken egg	0	5.5	5.5	6
Rajma	5.0	0	0	0
Cowpea	5.0	0	0	0
Soybean white	**	0	0	0
Cucumber	10	0	0	0
Water and others	20	20	20	38.5
Total	100	100	100	100
Nutrient composition*				
Crude protein %	12.77	12.71	12.64	12.13
Gross or Digestible Energy (Kcal)	1067	1061	1165	1170
Moisture %	64.48	67.31	66.96	66.88

*Calculated values

C: Control - vegetarian diet; T1: Chicken boneless breast with chicken liver and heart; T2: Whole chicken with chicken liver and heart; T3: Chicken offal meal with chicken liver and heart.

Table 2: Feed intake (g) (Mean ± SE) in Wistar rats fed with different formulations of moist pet food.

Type of Food	Weeks		
	1 st week (24-31 st day)	2 nd week (32-38 th day)	3 rd week (39-45 th day)
C (Control)	121.50 ^b ± 2.01	192.00 ^b ± 2.63	210.00 ^b ± 4.47
T1	130.50 ^c ± 1.19	185.00 ^b ± 1.34	190.50 ^b ± 3.35
T2	112.50 ^a ± 1.57	163.50 ^a ± 2.46	186.00 ^a ± 0.45
T3	125.50 ^{bc} ± 0.67	189.50 ^b ± 6.93	221.50 ^b ± 3.35
P-Value	<0.001	<0.001	<0.001

Means within column bearing common superscript did not differ significantly (* $p > 0.05$)

C: Control - vegetarian diet; T1: Chicken boneless breast with chicken liver and heart; T2: Whole chicken with chicken liver and heart; T3: Chicken offal meal with chicken liver and heart

Table 3: Feed conversion ratio (Mean ± SE) in Wistar rats (*Rattus norvegicus*) fed with different formulations of moist pet food.

Type of kibble (n = 6)	Weeks (After 21 days weaning period +3 days adaptation period)		
	1 st week(24-31 st day)	2 nd week(32-38 th day)	3 rd week(39-45 th day)
C (Control)	7.88 ^c ±0.29	10.57 ^c ± 0.49	10.62 ^c ± 0.29
T1	6.59 ^b ±0. 07	8.38 ^b ± 0.26	9.28 ^b ± 0.29
T2	4.32 ^a ±0.12	6.20 ^a ± 0.31	6.78 ^a ± 0.35
T3	6.30 ^b ±0.19	9.09 ^b ± 0.21	9.62 ^b ± 0.10
P-Value	<0.001	<0.001	<0.001

Means within column bearing common superscript did not differ significantly (*p> 0.05)

C: Control - vegetarian diet; T1: Chicken boneless breast with chicken liver and heart; T2: Whole chicken with chicken liver and heart; T3: Chicken offal meal with chicken liver and heart

CONCLUSIONS

From the present study, the consumption of moist pet food by Wistar rats in the treatment groups was found to be comparatively lower than that of the control group. Comparing the moist pet food intake over the three weeks, the T₂ rat group consumed the least, followed by T₁, T₃, and the control group. The control group exhibited the highest quantity of moist pet food consumption during the 3-week feeding trial compared to the other groups. The observed differences in food intake among the groups are likely influenced by the body's growth and developmental requirements (FAO, 2011) and the ability of the foods to meet these needs. However, the feed conversion ratio (FCR) in the treatment groups was better. Based on these observations, it can be concluded that the Wistar rat groups fed with moist pet food formulations containing whole chicken exhibited the highest weight gain, followed by pet food with chicken offal meal and chicken boneless breast, while the control group, which consumed a vegetarian-based moist pet food, showed the lowest weight gain among all groups. The use of chicken offal meal in the moist pet food formulation was found to be an effective and potentially economical source for promoting weight gain in growing dogs. Based on the above findings it is suggested that incorporating chicken offal meal in moist pet food could be a viable and cost-effective option to enhance the growth performance and nutritional value of pet food for companion animals.

FUTURE SCOPE

The identified chicken raw material in this study can be used commercially to increase the quality and cost effective moist pet food.

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