

EFFECT OF DIFFERENT ENERGY LEVELS OF DIET (RAW MATERIAL, POULTRY FEED AND PEARL MILLET) ON WEIGHT AND OTHER PARAMETERS OF BODY OF PIGEON (*COLUMBA LIVIA DOMESTICUS*)

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ABSTRACT

An experiment was carried out to estimate the effect of different energy levels of diets on weight of body and other parameters of the body of pigeon (*Columba livia domestica*). The three treatments pearl millet, raw material and poultry feed were used for different groups of pigeons. Total 108 male pigeons were used in all the experimental groups of which each experiment consists of three groups including two replicates and each group has 12 male pigeons with the range of 245 days. Current study showed that the percentage of weight gain of pigeon was highest with pearl millet than raw material and poultry feed. The pigeon-pearl millet experiment showed average weight of the body 261.42 ± 20.16 , length of the body 32.08 ± 0.73 , height of the body 11.73 ± 0.58 , wing span 29.33 ± 1.09 and length of the foot 6.30 ± 0.51 . The pigeon-pearl millet experiment increased the interaction and significance ($p < 0.05$) from different parameter (N=105) of the body of pigeon. The pigeon-raw material experiment showed the average weight of the body 241.02 ± 25.09 , length of the body 31.52 ± 0.78 , height of the body 11.58 ± 0.46 , wings span 29.50 ± 1.20 and length of the foot 6.67 ± 0.84 . Similarly pigeon-poultry experiments showed average weight of the body 228.65 ± 25.24 , length of the body 31.82 ± 0.98 , height of the body 11.97 ± 0.64 , wings span 28.90 ± 1.22 and length of the foot 6.32 ± 0.41 . The result showed that the food preference and wastage of Pigeon for pearl millet was 41.3%, 58.7% respectively, similarly for raw materials and poultry feed was 84.65% and 91.1% whereas was 15.4% and 8.86% respectively. Based on the results it was concluded that pearl millet pronounced significant weight gain in pigeons by high nutritive value fulfilling the requirement of growth. Further detail study is highly recommended.

Key words: Pearl Millet, Raw materials, Poultry feed, Pigeons.

INTRODUCTION

Pigeons (*Columba livia domestica*) have been usually used for meat production, ornaments, sports and experimental animals over the last decade but very limited information was available on their nutrition requirements and feeding behavior and effects of different diets on the growth rate of different parts of body (Sales and Janssens, 2003). Potentials of pearl millet could replace popular energy sources like maize in poultry ratios; use of pearl millet by replacing maize at specific level in broiler ratios with respect to the weight gain, pearl millet protein has more lysine methionine and tryptophan than other food grain and recognized as low fat diet. Pearl millet contains thiamin (Vitamin B₁) and iron (Tornekari *et al.*, 2009). Poultry diet are prepared from mixture of ingredients, including cereal grain, cereal by products, fats, plant protein sources, animals by product, vitamins and minerals supplements, crystalline amino acids and feed additive. The predominant feed grain used in poultry feeds worldwide is maize. This is mainly because its energy source is starch, which is highly digestible food for poultry. In addition it is highly palatable, is a high-density source of readily available

energy, and is free of anti-nutritional factors. The metabolizable energy value of maize is generally considered the standard with which other end sources are compared (Ravindran and Blair, 1991-1992). The amount of food must be consumed to meet the requirements is related to the losses in digestion and metabolism. Ingested (consumed) food is digested, assimilated and metabolized which increase the body weight. It shows that extensive variation ranging from less than a 20% in some herbivores to almost 100% in nectarivores (Bairlein, 1999). It is evident that a bird will not gain maximum weight from any lower weight diet unless all necessary factors are supplied. From theoretical standpoint, it is likely that an animal will not maintain unless traces of all necessary factors are present. Robbins (1993) and Xie *et al.*, (2013) observed the tendency of energy assimilation efficiency which was affected by the amount of food ingested and assimilated. There were a number of studies showing some relationships between food ingestion, meal size and energy assimilation efficiency, but the patterns are not consistent. Although diet quality may limit growth rate, this should not be a factor in selecting programs, because high quality diet can be provided. Rate of food assimilation apparently

also is limiting, but it can be improved experimentally by force feeding and presumably is sufficiently selectable (Reckleef, 1985). Swennen *et al.*, (2004) observed that energy deposition is the net result of energy intake and expenditure and is controlled by various regulatory processes. Next to genetic factors, exogenous factors such as environmental conditions and diet quantity and composition interact strongly with the control and regulation of the energy flow. It is found that protein had a significant effect on weight of body on 14, 29 and 43 day of age. At 43 and 54 day of age, body weight was significantly influence by sex and protein source (Nagaraj *et al.*, 2007). Mature and adult pigeons are mostly feed mixtures of raw materials including grains. It was also found that pigeons could consume lipid better than carbohydrates as energy sources (Sales and Janssen, 2003)

Hildagoet *al.*, (2004) research indicates that feeding pearl millet can improve starch digestibility and it was not detrimental to feed utilization. Satyanarayana *et al.*, (1991) found that both 50 and 100 percent replacement groups could not exert any significant influence on body weight and feed intake but, birds with 5 percent ground and ungrounded pearl millet recorded better body weights.

MATERIALS AND METHODS

The experiment was conducted in the animal house of the Department of Zoology University of Karachi, Karachi-Pakistan.

Experimental Design: Three different experiments were carried out for three types of diets i.e., pearl millet, raw material and poultry feed. Poultry feed was purchased from Gharo (Thatta District) whereas pearl millet and raw materials from Empress Market Karachi. Each experiment consists of three groups of pigeons including two replicates and each group has twelve male pigeons. The experiment continued for 35 weeks. A total of 108 male pigeons of seven months old purchased from Empress Market were used in all the experimental groups. The experiments were designed as follows:

Pigeon Pearl Millet (Bajra) Experiment: In these groups, pigeons were fed with 40 g of pearl millet feed twice a day with fresh water with fresh water. Composition of this diet is shown in Table i.

Pigeon Poultry Experiment: In these groups, pigeons were fed with 40 g of commercial poultry feed twice a day with fresh water. The composition is presented in Table ii.

Pigeon Raw Materials Experiment: Pigeons of these groups were fed with 40 g of raw material feed twice a

day with fresh water. Composition of raw materials nutritional value per 100 g is shown in Table iii.

Pigeons of each experimental group were kept in separate wide iron cages of 305 cm high × 244 cm broad. Cages were washed on regular basis for maintenance of health thus sheltered and protected from hygienic conditions.

Data Collection: Pigeons were made to fold their wings and placed on electrical weight machine (Shimadzu) and then readings were taken in grams whereas using a measuring tape wing span, length of foot, length of body from beak to tail tip and height were measured in centimeter. Amount of wasted diet from all experimental groups were collected and weighted for food preference and food wastage. Readings were taken on daily basis and average value was derived weekly. Fresh water and selected feed were offered to the pigeons of each groups and mortality rate was recorded on daily based whereas weight of body and other parameters of body were recorded on weekly based and then finally evaluate the percentage of decrease or increase by using general percentage method.

$$\text{Percent Change} = \frac{\text{Original value increased or decreased}}{\text{Original value}} \times 100$$

Statistical analysis: All the statistically analysis were performed with the aid of statically software IBM SPSS (for windows) version 21.0 IBM corporation. The data were presented as mean ± SD and analyzed by Analysis of variance (ANNOVA) and performed with Duncan's Multiple Range Test. A p-value of <0.05 was considered as statistically significant and p<0.01 means greatly significant.

RESULTS AND DISCUSSION

The current study aims to determine the effect of different energy levels of diet on body weight, length of foot, wing span, length and height of the body of pigeon. Different birds achieved maximum body weight by providing ample supply of better diet. Different kinds of food (diets) have optimum nutritional value (Table i, ii and iii). Pigeons have high metabolic rate due to which they need sufficient amount of food in proportion to their body weight. They are consuming more food constantly as compare to their body size and weight.

Table (iv-vi) showed the effects of different energy levels of diet on body weight, wing span, length of foot, length and height of the body of Pigeons. In the current study group I, II and III of pigeon-pearl millet feed experiments showed the average body weight of pigeons at initial stage was 248 g, 203 g and 248.5 respectively. During eight months of study, pigeons of group I showed average weight increase 9.67%, length

5.6%, wing span 5.35%, foot 23.81% and height 13.63% whereas pigeons of group II showed average weight increase was 42.8%, length 5.6%, wing span 12.5%, foot 16.6% and height 11.3% and pigeons of group III showed the average weight increase rate was 13.48%, length 8.2%, wing span 7.14%, foot 21.7% and height 20.9% respectively. The groups of I, II and III of pigeon-pearl millet experiment (Table iv) showed significance ($p < 0.05$) between time and different parameters. The significance value obtained from different parameters of body was less than 0.05 ($p < 0.05$). It was found that the weight of body, height of body and length of foot were significant from all the parameters of body ($p < 0.05$) whereas length of the body decreases the significance from wing span.

Group I, II and III of pigeon-raw material experiments showed the initial weight on raw materials was 228 g, 254 g and 231 g respectively and after third month of treatment it was decreased to become 222 g and 250 g for group I and group II respectively whereas group III showed increase weight to 272 g respectively. During study, pigeons of the group I and III of this experiment showed 16.22% and 4.329% decrease in average weight respectively whereas group II showed 11.02% weight increase similarly body length, wing span, foot length and height average percent increase of group I was 6.66%, 14.81%, 25%, and 6.97%, group II was 6.45%, 9.56%, 10.7%, and 13.63%, similarly group III was 3.22%, 7.1%, 11.53% and 8.88% respectively.

(Table v) relationship between the different groups I, II, III of pigeon-poultry feed experiment was highly significance ($p < 0.05$). Group I of this experiment increase the significance with group II ($p < 0.05$) whereas it decreased significance with group III or vice versa. The length of body decreases the significance with wing span whereas it increased the significance from other parameters ($p < 0.05$). The length of foot of body increased the significance ($p < 0.05$) from all other parameters of body ($p < 0.05$) except from height of body. The wing span decreased the significance ($p < 0.05$) from length of body while they were significant from all others parameters ($p < 0.05$). The weight of body increased the significance from all other parameters of the body ($p < 0.05$). Group I, II, III of pigeon-poultry feed experiment showed initial weight 235 g, 182 g and 221g respectively. During eight month of treatment, pigeons of group I showed percent weight loss 8.51% whereas body length, wing span, foot length and height of the body increased rate was 6.66%, 10.52%, 18.18% and 6.81% respectively. Pigeons of group II of this experiment showed the percent weight increase 31.86%, length 2.30%, wing span 11.11%, foot 12% and height 11.11% respectively. Pigeons of the group III of this experiment showed the percent weight increase 17.47%, length 4.91%, wing span 9.25%, foot 17.3% and height 15.21% respectively.

(Table vi) showed high level of significance interaction among different groups of I, II, III of pigeon-raw materials ($p < 0.05$) as it produced significant changes in different parameters of body with the passage of time. The group I of this experiment showed significance ($p < 0.05$) with groups II and group III. The length of foot and height of body decreases the significance ($p < 0.05$) from each other whereas they showed significance with all other parameters of body ($p < 0.05$). Similarly length of body decreases the significance from wing span or vice versa while they showed significance with other parameters of the body. The weight of body increased the significance from all parameters of the body ($p < 0.05$).

Fig. 1 indicated that group I of pigeons has gained greater weight with pearl millet feed whereas raw materials and poultry feed treatments shows weight lost. Similarly greater effects on lengths of body with poultry food and raw materials than pearl millet whereas greater height of body was achieved with pearl millet feed than raw materials and poultry feed. In the present research study it was found that group I of pigeons have gained better wing span with raw materials than raw poultry and via pearl millet. Similarly improved length of foot was achieved with raw materials than pearl millet and poultry feed but pearl millet have gained better length of foot than poultry feed.

Fig. 2 presented that pigeons of this group gained greater weight with pearl millet than poultry feed however pigeons showed weight lost with raw materials. Similarly pigeons of group II showed poultry feed had better effects on wing span and length of foot than raw materials. Similarly raw materials have greater effects on the length of body and height of body then pearl millet and poultry feed.

Fig. 3 showed that pigeons of this group gained greater weight with poultry feed than pearl millet whereas pigeons shows weight lost with raw materials. Group III of pigeons showed the greater length of body, foot, and height with pearl millet feed while greater wing span was achieved with poultry feed.

Table vii showed the percentage of preference and wastage for food material provided to the pigeons during all the experiments. Current study showed that the poultry feed was most preferred diet than raw material and pearl millet i.e., Poultry feed > Raw materials > Pearl millet.

In the present investigation dietary treatment induced changes in weight of body, length of body, wing span, length of foot and height of body of pigeons. The pearl millet showed percent change in length of body 5.808%, wing span 7.621%, length of foot 17.125% and height of body 13.171% respectively. The raw material showed changes in length of body 5.145%, wing span 9.397%, length of foot 14.366%, and height of body

8.895% respectively, similarly poultry feed showed 4.731% length of body, 9.333% wing span, 13.638% length of foot and 9.864% height of body respectively. Pearl millet showed 16.901 % weight gain whereas poultry feed showed 9.995% weight increase but weight lost rate was 13.968% recorded with raw materials. Current study showed that pigeons gain greater weight and height of body with pearl millet than poultry feed and raw materials whereas raw materials shows weight lost. Similarly length of body and length of foot was greater with pearl millet whereas wing span was greater with raw materials. In this study pigeons preferred the raw material most but did not improve the weight of the body as compared to pearl millet feed and poultry feed. Changes in body weight and variation in different parameters of the body showed that different kinds of feed shaped pronounced effect on the growth of pigeon. There was no mortality throughout the experimental period.

Table (i). Composition of Pearl millet (Abdullah *et al.*, 1998).

Diet	Composition / Minerals	Proportion
Pearl Millet (<i>Pennisetum glaucum</i>)	Dry Matter	88-91%
	Ash	1.6-2.4%
	Crude Fiber	2.6-4.0 %
	Crude Protein	8.5-15.1%
	Oil	2.7-7.1%
	Starch	58-70%
	Phytic Acid	354-796 mgg ⁻¹
	Calcium (Ca)	10-80 mgg ⁻¹
	Magnesium (Mg)	180-270 mgg ⁻¹
	Phosphorus (P)	450-990 mgg ⁻¹
	Copper (Cu)	10-18 μgg ⁻¹
	Iron (Fe)	70-180 μgg ⁻¹
	Manganese (Mn)	18-23 μgg ⁻¹
	Potassium (K)	70-110 μgg ⁻¹
	Sodium (Na)	4-13 μgg ⁻¹
	Zinc (Zn)	53-70 μgg ⁻¹

Table (ii). Composition of Poultry feed.

Diet	Composition	Proportion
Poultry feed (3250 k.cal/kg)	Crude protein	22%
	Calcium	1.0%
	Crude Fat	8.0%
	Crude Fibre	5.0%
	Phosphorus	0.72%
	Calcium	0.9%
	Potassium	0.2 -0.4%
	Sulpho amino acid	0.90%
	Lysine	1.18%
	Argine	1.4%
	Salts	0.45%
	Fish meal	5-10%
	Meat scarp	5-10%
Vitamin (A, B,D, E& K)	0.5-1.0 mg/kg	
Antibiotic feed supplement	0.1-0.5%	

Table (iii). Composition of Raw materials.

Composition (Nutritional value/100 g)	Bread	Whole wheat based Bread (Chapatti)	Rice
Energy	1113 KJ/100 g	1034 KJ/100 g	1527 KJ/100 g
Carbohydrates	51 g	41 g	80 g
Dietary fiber	2.4 g	7 g	0.13 g
Fats	3 g	3 g	0.66 g
Protein	8 g	13 g	7.1 g
Other nutritional minerals	35.6 g	36 g	9.3 g

Table (iv). Effect of Pearl millet on different parameters of the Body of the Pigeon.

S. No.	Groups	No. of Birds	Mortality	Weight of Body	Length of Body	Height of Body	Wing Span	Length of Foot
1.	Group I	12	-	260.72 ± 15.96 ^a	32.14 ± 0.57 ^{a,b}	11.78 ± 0.48 ^{a,c}	28.67 ± 0.51 ^{a,b}	5.96 ± 0.54 ^{a,c}
2.	Group II	12	-	257.0 ± 30.53 ^a	32.28 ± 0.58 ^{a,b}	11.60 ± 0.47 ^{a,c}	30.21 ± 1.31 ^{a,b}	6.57 ± 0.40 ^{a,c}
3.	Group III	12	-	266.57 ± 1.68 ^a	31.82 ± 0.98 ^{a,b}	11.82 ± 0.79 ^a	29.10 ± 0.70 ^{a,b}	6.39 ± 0.42 ^a
4.	Total	36	-	261.42 ± 20.16	32.08 ± 0.73	11.73 ± 0.58	29.33 ± 1.09	6.30 ± 0.51

n=40 for each parameters of each group (ΣN=120), ANOVA analysis with significant p<0.05 Mean ± standard deviation Value in a row having superscript ^a are significant to each other, superscript ^{b, b} and superscript ^{c, c} are not significant to each other but they are significant with others.

Table (v). Effect of poultry feed on different parameters of the Body of the Pigeon.

S. No.	Groups	No. of Birds	Mortality	Weight of Body	Length of Body	Height of Body	Wing Span	Length of Foot
1.	Group I	12	-	238.42 ± 17.39 ^a	31.10 ± 0.67 ^{a,b}	11.46 ± 0.26 ^{a,c}	29.96± 1.10 ^{a,b}	6.07 ± 0.37 ^{a,c}
2.	Group II	12	-	207.17 ± 28.0 ^a	32.82 ± 0.27 ^{a,b}	11.92 ± 0.18 ^{a,c}	28.39± 0.99 ^{a,b}	6.60 ± 0.31 ^{a,c}
3.	Group III	12	-	240.35 ± 15.09 ^a	31.53± 0.58 ^{a,b}	12.53 ± 0.61 ^{a,c}	28.35±0.89 ^{a,b}	6.28 ± 0.39 ^{a,c}
4.	Total	36	-	228.65± 25.24	31.82 ± 0.98	11.97 ± 0.64	28.90 ± 1.22	6.32± 0.41

n=40 for each parameters of each group (ΣN=120), ANOVA analysis with significant p<0.05

Mean ± standard deviation Value in a row having superscript ^a are significant to each other, superscript ^{b, b} and superscript ^{c, c} are not significant to each other but they are significant with others.

Table (vi): Effect of Raw Materials on different parameters of the Body of the Pigeon.

S. No.	Groups	No. of Birds	Mortality	Weight of Body	Length of Body	Height of Body	Wing Span	Length of Foot
1.	Group I	12	-	216.57±15.80 ^a	31.0±0.86 ^{a,b}	11.21±0.36 ^{a,c}	29.0±1.55 ^{a,b}	5.64±0.47 ^{a,c}
2.	Group II	12	-	265.85±11.39 ^a	31.92±0.78 ^{a,b}	11.71±0.41 ^{a,c}	30.03±1.10 ^{a,b}	7.39±0.28 ^{a,c}
3.	Group III	12	-	240.64±17.37 ^a	31.64±0.37 ^{a,b}	11.82±0.40 ^{a,c}	29.46± 0.74 ^{a,b}	7.0±0.28 ^{a,c}
4.	Total	36	-	241.02±25.09	31.52±0.78	11.58±0.46	29.50±1.20	6.67±0.84

n=40 for each parameters of each group (ΣN=120), ANOVA analysis with significant p<0.05

Mean ± standard deviation Value in a row having superscript ^a are significant to each other, superscript ^{b, b} and superscript ^{c, c} are not significant to each other but they are significant with others.

Table vii. Food Wastage & Preference of Pigeon.

DIETS	% of Wastage & Preference of diet.	Number of Weeks					
		1 st	7 th	14 th	21 st	28 th	35 th
Pearl millet	Preference	76.3%	33.75%	26.1%	51.5%	36.9%	23.5%
	Wastage	23.7%	66.25%	73.9%	48.5%	63.1%	76.5%
Raw materials	Preference	95%	96.61%	80.9%	70.2%	93%	72.2%
	Wastage	5%	3.39%	19.1%	29.8%	7%	27.8%
Poultry Feed	Preference	93%	91.5%	93.1%	89%	90.9%	89.3%
	Wastage	7%	8.5%	6.9%	11%	9.1%	10.7%

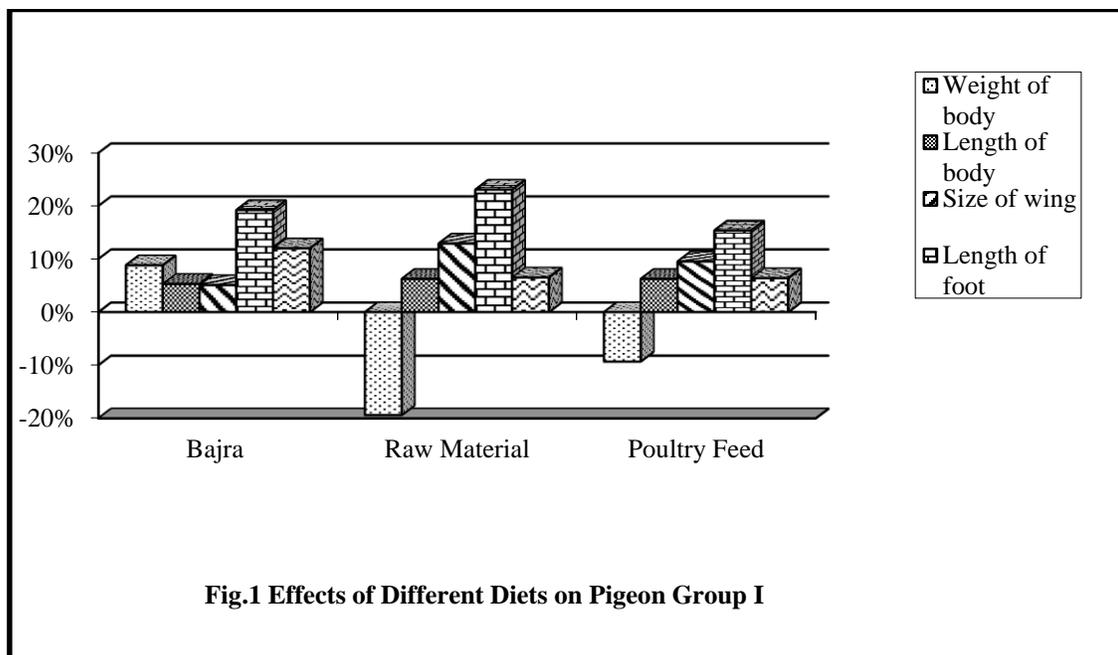


Fig.1 Effects of Different Diets on Pigeon Group I

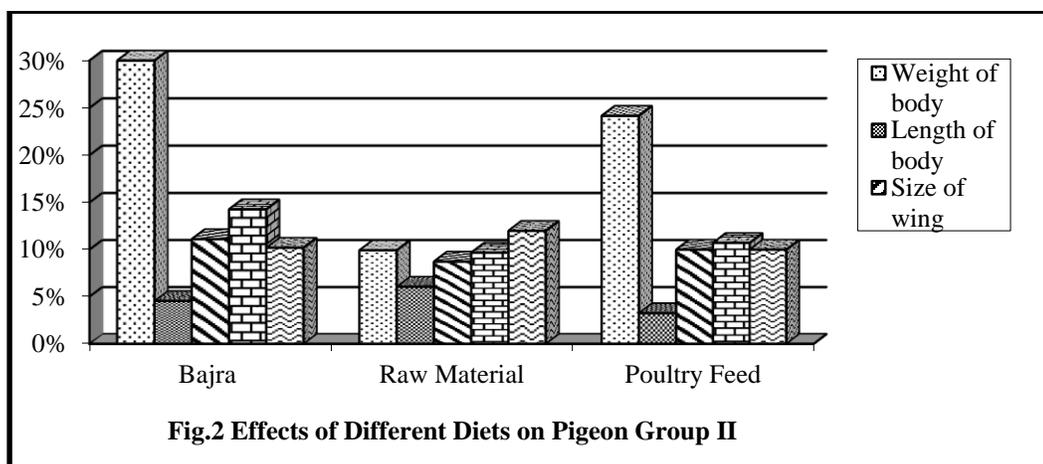


Fig.2 Effects of Different Diets on Pigeon Group II

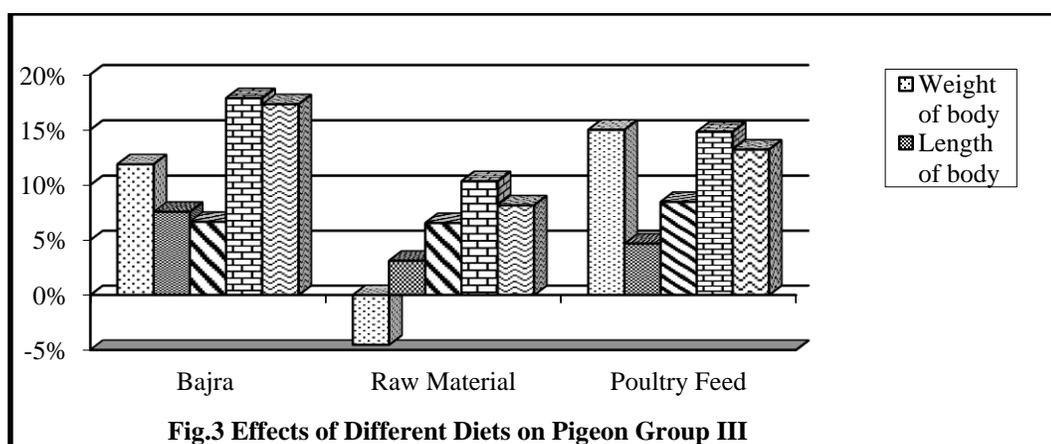


Fig.3 Effects of Different Diets on Pigeon Group III

Conclusion: On the basis of the result of this study, it was concluded that the pigeon showed less preference to the pearl millet than poultry feed and raw material but pearl millet showed great weight gain as it has high nutritive value fulfilling the requirement of growth. A comparative study among different members of pigeons indicates that weight gain capability varies among members of pigeons by providing different energy level diets. Further studies should be carried out to evaluate the effect of different energy levels of diets on body weight, length of foot, wing span, length and height of the body of pigeon (*Columba livia domestica*).

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