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EFFECT OF DIFFERENT PERCENTAGES OF PEARL MILLET AND *ACACIA KARROO* LEAVES ON GROWTH AND PROXIMATE COMPOSITION OF BROILER CHICKS

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Abstract
The poultry sector is an important source of protein and contributes significantly to the nutrition of the rapidly growing human population. The experiment was designed to find the effect of different percentages of pearl millet and Acacia karroo leaves on broiler chicks' growth and proximate composition. For this purpose, four treatments having eight birds in each group were made. The first experimental group (T0) was fed with regular diet. The second experimental group (T1) was given a 50% mixture of pearl millet and *Acacia karroo* leaves. The third experimental group (T2) was given 75% mixture diet. The fourth experimental group (T3) was treated with 100% mixture diet. Growth performance was measured weekly. Feed utilization was analysed based on FCR (food conversion ratio). The amount of moisture, crude fat, crude protein, and crude ash in the body was measured by Kjeldahl's method, dry ashing and solvent extraction. Data was statistically analysed by one-way ANOVA. Results in terms of growth parameters weight gain, absolute weight gain and specific growth rate were showed significantly higher ($P<0.05$) in T1, T2, T3 and lower in the results of the mixture diet of pearl millet and *Acacia karroo* leaves compared with control group then T0 (2.36±0.07) showed the highest feed conversion ratio. A maximum level of crude protein was observed in T1 (22.25±2.549) treated with 50% mixture of pearl millet and *Acacia karroo* leaves diet and a minimum level of crude protein was observed in T0 (16±2.44). Maximum crude fat was observed in T0 (24±2.44) and minimum crude fat was observed in T1 (14.66±2.59). Maximum crude ash was observed in T1 (18±2.49) and minimum crude ash was observed in T0 (13±2.439). Maximum moisture content was observed in T1 (66±0.81) and minimum moisture content was observed in T0 (63.5±0.819).T2 and T3 demonstrated significant results in comparison to the control group for crude protein, crude ash, crude fat and moisture. The results of the present study proved that a mixture of pearl millet and *Acacia karroo* leaves diet showed a positive effect on growth.

Keywords: Pearl millet, *Acacia karroo* leaves, weight gain, growth and proximate composition, broiler chicks.

INTRODUCTION

The poultry sector is expanding due to the rising food demand with each passing year. Broilers provide high quality meat at a low cost. The poultry industry grew rapidly and global chicken meat production reaches up to 138 million metric tons (Kumar *et al.,* 2021). Chicken meat has high nutritional value. Chicken meat is inexpensive and simple to produce. Thus it is the world leading supplier of protein meat (Gravel and Doyen, 2020). Poultry production has grown from basic to industrial levels during the last few decades. In addition to the optimal temperature, moisture, air and sunlight are the essential environmental factors for the growth of broilers (Lewis, 2010).

Cereal grains like maize, sorghum and oilseeds like soyabean and sunflower make up the majority of the feed nutrients. (National Research Council, 2004). The most popular grain for broiler diets is maize. As the main source of energy and source of protein maize is combined with soybean meal. (Praharaj *et al.,* 2002). Although maize makes up at least 60% of all types of chicken feed. Feed consist of maize is expensive (Yahav *et al.,* 2004). In chicken diets, soybean meal is utilized as a source of protein. The amount of soyabean produced is extremely low. Shortage of feed ingredients the majority of the materials used in the production of animal feed are imported from nearby nations. High cost of feed like maize and soyabean unaffordable for farmers due to limited resources (Panda *et al.*, 2010).

Pearl millet is the kind of grain that belongs to the Poaceae family. The two main millets used for feed are Finger millet and Pearl millet. Pearl millet originated in Africa.(Baltensperger, 2002). East African sub-humid grasslands are a good source of Pearl millet. (Kaur *et al.*, 2014). It has great nutritional potential. Unlike wheat or maize which are not able to cultivate in harsh climates (Sankar *et al.*, 2008). It can be grown with less soil fertility, the high concentration of salt, very low amount of pH and the high temperature. This crop is adaptive to face climate change and extreme heating rates (Djanaguiraman *et al*., 2018). Tryptophan is the limiting essential amino acid that is present in pearl millet (Teeter and Wiernusz, 2003). Pearl millet diet deliver the proper balance of amino acids and minerals (Appleby, 2010). In particular during hot weather circumstances high quality protein sources are needed for broiler growth (West, 2000).

The main source of both carbohydrates and proteins is pearl millet. It is suggested that pearl millet replace maize grain in the diet of poultry due to its similar energy and nutritional profile. Additionally, it is abundant in vitamins, minerals, fiber and organic antioxidants. (Ghoneim, 2013). Antinutritional factors (ANFs) which are present in PM as dietary energy have an impact on animals feed intake, metabolism and nutrient availability. The chelation of dietary minerals in the gastrointestinal tract caused by the presence of ANFs in PM such as phytate, tannins and polyphenols increases the compounds bioavailability in broiler chickens.(Patil *et al.*, 2021).Pearl millet has high calcium and high phosphorus. The proximate composition of pearl millet is 89.86% dry matter, 39.02% crude protein, 11.92% crude fiber, 3.07% ether extract and 7.15% total ash (Hetland *et al.*, 2002).

Karroo thorn and sweet thorn are related to *Acacia karroo* Hayne. It belongs to the Fabaceae family of plants (Giam *et al.*, 2010). *A.karroo* is the fastest growing tree and produces good quality wood (Mboumba and Ward, 2008). It is also known as a sweet thorn because of the sweet scent of flowers (Brown *et al.*, 2016). Its thorns are medium in size and whitish brown. It has paired nodes (Ng'ambi *et al.*, 2009). In different countries herbivores animals depend on the *Acacia karroo* tree for food, especially during dry seasons. The genus Acacia was renamed *Vachellia. A. karroo* was called *Vachellia karroo. A. karroo* may resist severe defoliation that occurs frequently. Its mineral profile is good. High levels of calcium, magnesium, and potassium are present. (Ecologia and Zoologica, 2012).

Pearl millet and *Acacia Karoo* leaves are most commonly found to produce high quality meat. In the poultry sector pearl millet and *Acacia karroo* are used as a source of energy in chicken feed when replaces maize with pearl millet. (Ngambu *et al.*, 2013). Pearl millet and *A.karroo* mixture increase the chick growth and body composition. It would be affordable and advantageous for the growth of chicks. *A. karroo* contains a large number of tannins and the beneficial amount of protein that reduces the accumulation of extra body fat in broiler chickens. (Totton *et al*., 2012).

MATERIALS AND METHOD

People all around the world depend on poultry meat as a key source of animal protein. Poultry production has recently received more attention worldwide. The research were discussed the effect of different percentages of pearl millet and *Acacia Karroo* leaves on the growth and proximate composition of broiler chicks. The study was done in the area of community college (PARS), University of Agriculture Faisalabad.

Acquisition of material

Acacia Karroo Leaves were collected from Faisalabad. The *Acacia Karroo* leaves were trimmed using a bush cutter and spread out on top of plastic sheets on the ground to dry in the field. Maize grain and pearl millet were purchased from the new grain market in Ghala Mandi Faisalabad.

Experimental conditions

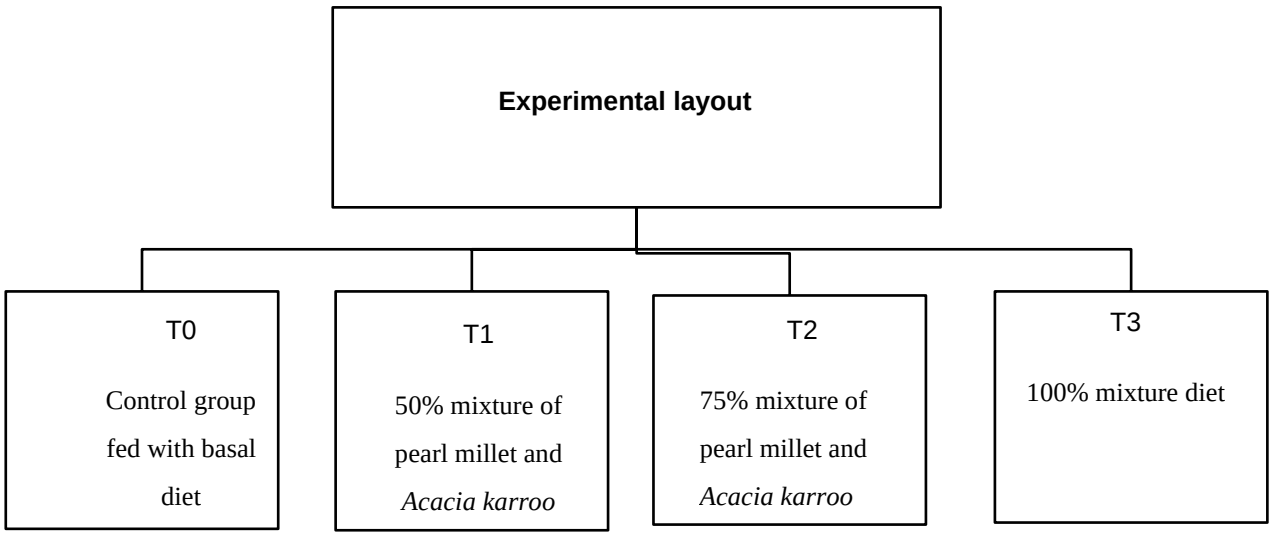
Thirty two broiler chicks of one day old were required for this experiment. For 30 days all of the broilers were kept in cages in the research area of UAF community college PARS. Before the trials the broilers were acclimatized for one week in cages. Then they were divided in to the four groups kept at temperature 27^0 C. Temperature was monitored by thermometer. The chicks were kept in clean and sanitized cages in the birdhouse facility. All the birds were maintained under controlled conditions of humidity (50% ±15%), and regular photoperiod (12-12 h light and dark cycle). The birds were fed a standard chick diet and allowed to drink water. All animal ethics were followed during the whole experimentation set by moral committee of Agriculture University Faisalabad.

Experimental trials

Thirty two broiler chicks will be purchased from the birds market in Faisalabad. Birds were arbitrarily divided into four treatments: control treatment (T0) fed normal feed and water. (T1) fed 50% mixture of pearl millet and *Acacia Karroo* leaves. (T2) given 75% mixture diet. (T3) fed 100% mixture diet. This experiment will be conducted for 30 days and 10 broilers slaughtered after 21 days. Growth will be observed weekly. Samples for proximate composition were collected.

Experimental birds and design

T0=basal diet



T1=basal diet with 50% mixture of pearl millet and *Acacia karroo*
T2= basal diet with 75% mixture of pearl millet and Acacia karroo
T3= 100% mixture of pearl millet and *Acacia karroo*

Calculation of body and organ weight

The initial and final body weight of birds were measured in all treatments.

Growth performance and feed utilization

Growth performance were estimated by having weekly gross weights of broiler chicks for each treatment. Growth performance were determined by following parameters.

Weight gain (%)

Weight gain were determined by the following formula:

$$\text{Weight gain (\%)} = \frac{\text{final weight} - \text{initial weight}}{\text{initial weight}} \times 100$$

Absolute weight gain (AWG)

Absolute weight gain were determined by subtracting the final weight from the initial weight of the chickens.

$$\text{Absolute weight gain (g)} = \text{Final weight (g)} - \text{initial weight (g)}$$

Specific growth rate (SGR)

SGR of broiler chicks were determined as:

$$\text{Specific growth rate} = \frac{\text{initial weight (g)} - \text{final weight (g)}}{\text{experimental days}} \times 100$$

Survival rate (%)

The survival rate of broiler were determined as:

$$\text{Survival rate (\%)} = \frac{\text{final number of chickens}}{\text{initial number of chickens}} \times 100$$

Feed conversion ratio (FCR)

Feed utilization were determined by calculating FCR

$$\text{Daily feed intake} = \frac{\text{total dry feed intake (g)}}{\text{wet weight gain (g)}} \times 100$$

Weekly feed intake

Weekly feed intake was calculated by subtracting the amount of refusal from total amount of feed offered during the week. The following formula was used to calculate feed intake per chick.

Feed intake= feed offered -feed refused

The Proximate composition of broiler chick

Broiler chicks muscle samples were examined using the AOAC (1995) standard procedure. Dry sampling was done in the oven for 12 hours at 105 °C to assess the moisture content. The micro-Kjeldahl method (N=6.25) was used to calculate the amount of crude protein (CP). For the determination of crude fat the Soxhelt method was utilized. It was digested using 1.25% H2SO4 and 1.25% NaOH to create the sample. By putting samples in a muffle furnace for 6 hours at 550C ash was detected.

Moisture

One gram of muscle from broiler chickens was collected and placed in a petri dish (W1). For 12 hours the petri dish was heated to 105 ^{0}C in the oven. The dried sample was moved to the desiccator and left there for five minutes to increase weight. Once again placed in the oven for one to two hours the sample was checked for consistent weight (W2). The moisture content was identified by the weight differential. The percentages of dry matter was determined using the formula below

$$\text{Moisture (\%)} = \frac{W1 - W2}{\text{weight of sample}}$$

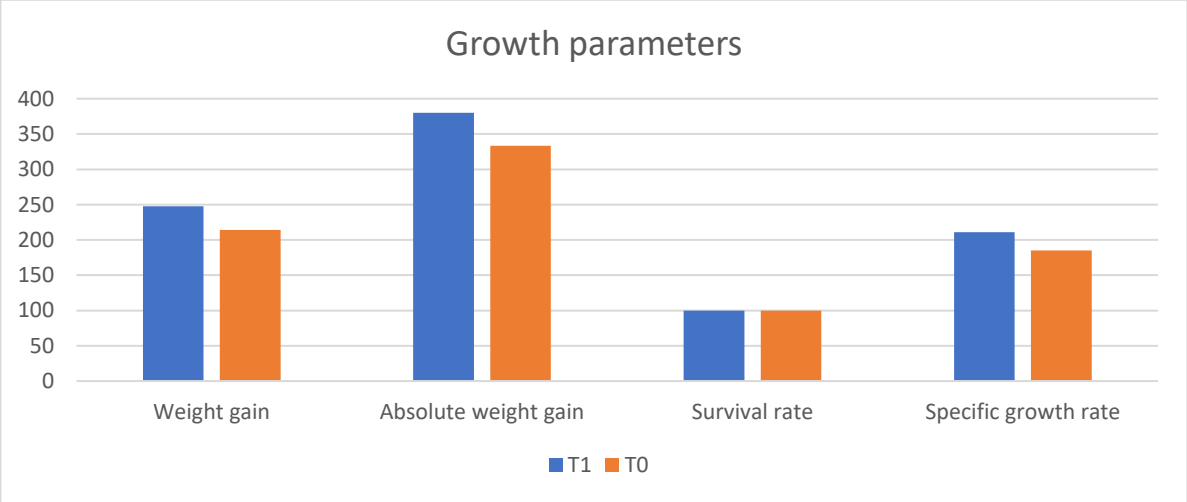
Where
W1 = weight of the petri dish + sample before drying
W2= weight of the petri dish + sample after drying
Dry matter (%) = 100- moisture

Statistical Analysis
Statistical analysis of data was done by applying ANOVA (One-way analysis of variance). For comparing means of data and probability was taken as $p< 0.05$.

Table 1: Effect of different Percentages of Pearl millet and *Acacia karroo* leaves diet on Growth parameters of broiler chicks.

Growth parameters	Maximum	Minimum
	T1	T0
Weight gain	247.75±197.766	214.15±173.700
Absolute weight gain	380±236	333.3±207
Survival rate	100%	100%
Specific growth rate	211±253	185±222

Graphical representation

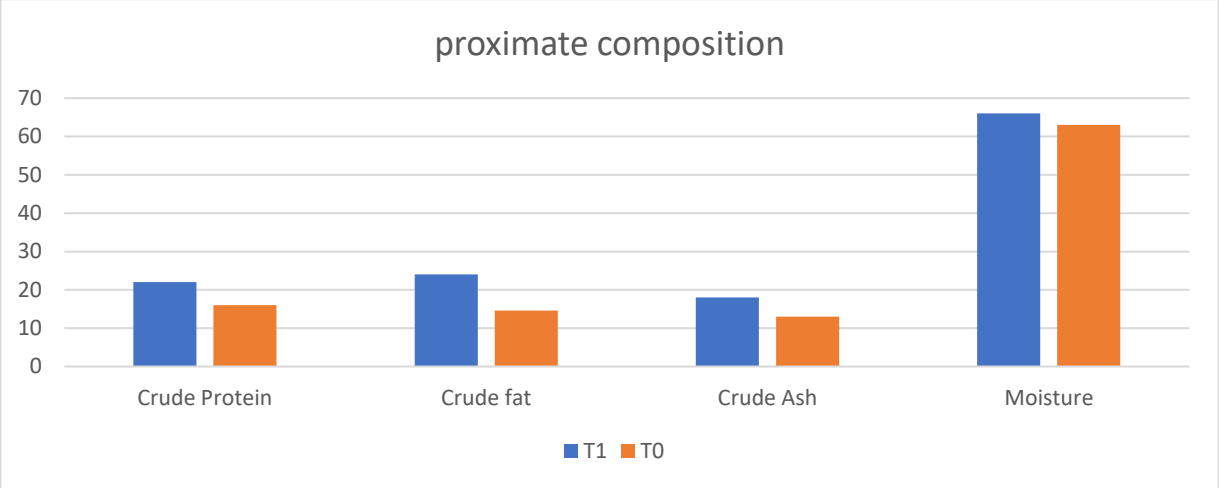


Growth Performance
Growth performance of broiler chicks was given in table 1. Growth performance was checked through weight gain, absolute weight gain, survival rate and specific growth rate. Maximum weight gain was observed in T1 with 247.75 ±197.766g and minimum in T0 (214.15±173.700g) weight in broiler chicks respectively. Maximum absolute weight gain was observed in T1 380±236 and minimum in T0 (333.3±207) in broiler chicks. Maximum specific growth rate was observed in 211±253 (T1) and185 ±222 (T0) respectively in broiler chicks.

Table 2: Effect of different Percentages of Pearl millet and *Acacia karroo* leaves diet on proximate composition of broiler chicks.

Proximate composition	Maximum	Minimum
	T1	T0
Crude Protein	22±2.44	16±2.4494
Crude fat	24±2.499	14.6±2.594
Crude Ash	18±2.499	13±2.43948974
Moisture	66±0.819	63±0.816

Graphical representation



Proximate Composition

Proximate composition of broiler chicks was given in table 2. Proximate composition was checked through crude protein, crude fat, crude ash and moisture. Maximum crude protein was observed in T1 with 22 ±2.44 and minimum in T0 16±2.44 in broiler chicks respectively. Maximum crude fat was observed in T1 24±2.499 and minimum in T0 (14.6±2.594) in broiler chicks. Maximum crude ash was observed in 18± 2.499 in (T1) and 13 ± 2.43 in (T0) respectively and maximum moisture was observed T1 66±0.819 and minimum in T0 63±0.816 in broiler chicks.

Discussion

The outcome of present research also investigated comparative effect of pearl millet and *Acacia karroo* leaves on proximate composition of broiler chicks. Maximum level of crude protein observed in treatment T1 (22.25±2.549) treated with 50% mixture pearl millet and *Acacia karroo* leaves diet and minimum level of crude protein was observed in treatment T0 (16.62±2.44).T2 and T3 were showed significant growth. Mixture of pearl millet and *Acacia karroo* leaves have isonitrogenous and isocaloric contained large amount of amino acids that increased the level of crude protein in chick body. This might be due to the amount of protein in food must influence lipid metabolism either directly or indirectly. The presence of CP protein content increased the expression of malic enzyme and mRNA expression then increased malic enzyme activity in broiler livers and decreased the expression of FAS mRNA in broiler chicken livers. In a comparison of low-protein diets feeding broilers a diet with a high CP content decreased the mRNA expression of hepatic malic enzyme, acetyl coenzyme carboxylase (ACC), and FAS. Body fat accumulation was directly impacted by dietary protein levels. Therefore, it is preferable to provide for the protein needs of birds in order to produce high-quality meat with minimal fat deposition. (Hetland and Svihus, 2007).Mehri *et al.*, (2010) showed resemblance with results of present research 50% inclusion of pearl millet in the diet of chick when compared with experimental control diet which is based on maize and soya beans contained 21% crude protein that increased growth rate.

Mixture of Pearl millet and *Acacia karroo* leaves diet has significant effect on body composition. Maximum crude fat was observed in treatment T0 (24±2.499) having basal diet and minimum crude fat was observed in T1 (11±14.66) having 50% mixture of pearl millet and *Acacia karroo* diet. This might be due that mixture diet of pearl millet and *Acacia karroo* contained the variety of mechanisms zinc (Zn), copper (Cu), and iron (Fe) influence the body lipid metabolism. These mechanisms include the stimulation of lipolysis by activating the gene expression of lipogenic enzymes which stimulate fatty acid oxidation and control the expression of genes involved in fatty acid synthesis the inhibition of lipogenesis in adipocytes, and the regulation of lipid transport which lowers the level of crude fat in chick. Davis *et al.*, (2003) determined that lipogenic enzymes present in the 50% diet of the chicks

that reduced the ability of fat deposition in chick body. Results showed resemblance with present study.

All levels of the treatment have good effect on crude Ash as compared with control group. Maximum ash was observed in treatment T2 (18±2.499) having 50% mixture of pearl millet and *Acacia karroo* leaves diet and minimum crude ash was observed in T0 (13 ±2.439) having basal diet. The ash component of the mixture feed has mainly contained minerals .This might be due to that mixture diet contained cytochrome c oxidase, succinate dehydrogenase that increased the ash content. Ashes indicate muscle mineral content. These minerals are associated to the organic compounds involved in the muscle contraction process and its values increase as the animal grows. Ash content also prevent from blood clotting and helps in egg shell formation. Leksrisompong *et al.*, (2009) reported that males present higher ash content as their muscle tissue percentage values is higher as compared to females Ristic (2005).Ravindran, 2019 reported that low ash content of feed predisposes birds to sickness and egg shell production according to research on the nutrients needed in specific amounts of ash in the chicken diet to strengthen bone, prevent blood clotting, activate enzymes, and cause muscular contraction.

Mixture of pearl millet and *Acacia karroo* leaves diet has significant effect on body composition. All levels of the treatment have good effect on moisture as compared with control group. Maximum moisture content was observed in treatment T1 (68±1.29) fed with 50% mixture diet and minimum moisture content was observed in T0 (64.5±1.73) having basal diet. This might be due to the mixture diet contained triple interaction that was present in lysine, cystine, glycine, alanine, isoleucine, leucine, serine, and valine. A better digestibility of amino acids was seen in the triple interaction breakdown for mixture diet that produced a higher moisture content in chicks. The moisture in the meal may interact with other ingredients to facilitate the thermomechanical processes that take place inside the chick body. Water molecules enter a higher energy state when the temperature rises, which helps to destabilize proteins and boost their digestibility. Growth of the broiler chicks were increased. Liu *et al.* (2009) demonstrated that the moisture content of feed determines the amount of water in feed samples. It was an indicator of quality and a key to safe storage that showed resembles. NRI, (1995) determined the high moisture content of feed with high temperature and poor aeration during storage predisposes feed to mycotoxins and spoilage.

It has been found that mixture of pearl millet and *Acacia karroo* leaves diet maximum weight gain was observed in treatment T1 (247.75±197.76) having 50% mixture of pearl millet and *Acacia karroo* leaves diet and minimum weight gain was observed in T0 (214.15±173.700) treated as control group. T2 and T3 were showed high weight gain as compared to control group. This might due the mixed diet that includes multi-carbohydrates (MC) including xylanase, β-glucanase, and arabinofuranosidase can enhance the use of energy and protein, as well as the digestibility of nutrients and growth rates. This is mostly due to the fact that these exogenous enzymes increase the availability of nutrients by decreasing the viscosity of the intestinal digesta by breaking down non-starch polysaccharides. Makkar, (2003) revealed that when maize was replaced with pearl millet during the grower and finisher stages and *Acacia karroo* leaves as an additive of energy source. This raised linked to broilers improved digestive health and increased enzymatic secretion. The addition of *Acacia karroo* leaves meal enhance metabolic process and nutrients absorption are responsible for the improvements in body weight and growth of broiler chicks.

It was observed that in comparison of pearl millet and *Acacia karroo* leaves with control group the maximum specific growth rate shown in T1 ((211±253)) treatment was fed with 50% mixture of pearl millet and *Acacia karroo* leaves. Minimum specific growth rate shown in T0 (185±222) was fed with basal diet. This might be due to the protein spearing effect in the body of chick due to the rich concentration amino acids in pearl millet and *Acacia karroo leaves* diet. The protease enzymes break down cellular carbohydrates and alteration the structure of intracellular starch increased the nutrient value in chick .Ultimately specific growth rate increased. The findings of the study are similar to Hernandez, 2010; Shafey, 2004.

It was found that when comparing the mixture of Pearl millet and *Acacia karroo* leaves diet with control group. The treatment T1 (2.36±0.07) exhibited the highest feed conversion ratio. This was may be due to the addition of pearl millet and *acacia karroo* leaves in chick diet increased the level of probiotics like *S. thermophilus* providing assistance to gut microbes which lead to enhance the growth rate of broilers ultimately improved FCR. This improvement may be also due the essential amino acids present in pearl millet which function against the oxidative stress leading to better growth and feed conversion ratio. The outcomes are consistent with Baurhoo *et al.,* (2011)

Average mortality rate for birds fed diets T0, T1, and T2 were tracked throughout the trial was 0% with the exception of T3 having 100% pearl millet and *Acacia karroo* leaves diet that had a 25% mortality rate. This might be due to a metabolic disorder known as ascites. Ascites syndrome is a condition characterized by excessive accumulation of fluid in the abdominal cavity and causes high mortality in chicks. This was in line with Mashamaite, (2004) support the present study as the quick growth excellent feed efficiency and massive pectoral muscle mass Ascites was the primary cause of mortality (Afsharmanesh *et al.,* 2009). Mendonca *et al* .,(2005) stated that no mortality was seen in broilers given Pearl millet and soyabean meal in place of maize at different levels so their results showed dissimilarities with the present study. In broilers diets show dissimilarities our results as the different dietary treatments comprising the oil cakes had no appreciable impact on mortality rate was only 2.32 percent.

The majority of operating expenditures including labor and chick purchases come from feed. The cost per unit of crop is determined by dividing these totals by the number of units (Branciari *et al.,* 2009).The findings of our present study showed that the total cost of chick starter diet is higher in case of standard diet approximately 170-185 PKR.Mixture diet of pearl millet and *Acacia karroo* have intermediate per unit feed cost which is approximately 120-150 PKR. Feed cost accounts for 60% of the total per unit market cost.

The results of the present study proved that mixture of pearl millet and *Acacia karroo* leaves diet showed positive effect on growth performance and body composition of broiler chicks.

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