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The Influence of Addition Fat on Poultry Performance and Carcass Lipids Profile. A Review

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Abstract:- Most of the carcass fat and the saturated ones in particular, have a great effect in raising blood cholesterol concentration, which contributes to the process of coronary atherosclerosis, the main cause of coronary heart disease. In most cases, the lesions attract platelets and fibrin which block the coronary artery and cause ischemia. The consumer has been aware of the health problems associated with consuming the broiler chickens, carcass fat, and so a demand for leaner birds. Accordingly, the poultry industry has been faced with the problem of producing leaner birds and reducing fat deposition in the broiler carcasses in order to meet the consumer demand. At the research level, many scientists have investigated ways of decreasing abdominal and broiler carcass fat deposition. These authors established that fat accretion is governed by the genetic constitution of the bird, and is closely influenced by the nutritional and management practices, in addition to the effect of environmental temperature, sex, and age. However, many scientists stated that most influencing agent is the dietary factors (energy, protein level, source and quality respectively, energy to protein ratio and feeding system. In this reviewed paper author compared dietary different sources, level and quality inclusion in broiler diets studied by many scientists and stated that dietary fat sources significantly increased broiler performance, serum and carcass lipids and altered fatty acids concentration and type in all levels and quality with exceptions for high level vegetable oils inclusion (6% and more) which significantly decreased broiler performance and all serum carcass traits.

I. INTRODUCTION

Advance genetic improvement and efficient broiler production lead to the most intensive worldwide broiler industry compare to other animal production sectors. The modern hybrid broiler chickens characterized by rapid growth, high feed utilization efficiency, tender meat production, grow, thrive and produce under different environmental conditions. have been achieved through advanced genetic improvement of the modern broiler chicken. High growth rate sequentially led to high body weight, overconsumption (two or three times greater than their maintenance requirements) of feed particularly dietary energy and rapid growth rate (when fed ad-libitum) associated with bird metabolic (Ascitis disease and sudden death syndrome), skeletal disorder and more fat deposition beside its undesirable effect on human health *(Robinson et al, 1992)* and *(Yu and Robinson, 1992),*

- *Factors affecting broiler performance and serum- carcass lipid:*

The exploitation of genetic potential in current commercial hybrids characterized with high performance require high energy diets, increasing demands for energy in growing chickens can be satisfied by the additional fat to the feeding mixtures. The use of fat either plant or animal origins in intensive poultry production diets has been well stablished *(Sadeghi and Tabeidian, 2005).* Oils high cost and their use in human food limits its uses on animal diets particularly when formulating least cost rations *(Willson &Bayer, 2000).* According to *Rose (2001).* Maximum used level of animal fat or vegetable oils is 6% in the diet more than this level makes it difficult to maintain pellet quality, or mechanical move the sticky feed. In a study of reviews stated that beef tallow is consumed more frequently than cocoa butter *(US Department of Agriculture, 1979).* Final body and heart weight was significantly affected by fat source, *(Haug, 2007) in contrast with Azman (2005)* who noted that final body weight was not affected by fat source. Many other scientists also emphasized that dietary fatty acids composition and chain length affect body fat accumulation, distribution and oxidation *(Hill et al, 1993). Villaverde et al (2005), Bavelaar and Beynen (2003), and Nitsan et al (1997)* observed that adding a vegetable oil rich in PUFA to the diet at the expense of animal fat (SFA) reduces the amount of abdominal fat in broiler carcass. *Zollitsch et al* (*1996)* stated that animal fat provokes significant high daily weight gain and daily feed intake, the feed conversion ratio, oleic acid content, accumulation of saturated fatty acid in thigh skins and abdominal fat pad compared to the vegetable oil source. However, vegetable oil is induced a significantly higher effect on thigh skins, breast muscle and abdominal fat pad fatty acids. *Tabeidian et al* (*2005).* Some authors *(Keren-Zvi, et al, 1990, Brue and Latshaw, 1985)* are reported recently that high level of vegetable oil supplementation depresses body fat, abdominal adipose tissue and cholesterol contents of broiler birds selected. Also, fat Levels in the diet improve the average daily body gain, and amount of feed per body gain. However, carcass lipids follow fat levels in diets. *Deaton et al* (*1981)* reported that body fat increases with the level of dietary tallow used. However, some studies have reported opposite results. *Zollitsch et al* (*1996)* observed that unsaturated vegetable oils produce, higher metabolizable energy value (ME) than animals' fats. carcass fat quality was affected by dietary fat inclusion in diets therefore dietary fatty acids are induced a little change in the broiler body fat *(Sciafe et al, 1994).* Thus, the abdominal fat is more sensitive to change in dietary fatty acid composition so its good indicter to the changes in broiler diet fats *(Yau et al, 1991). Rondelli et al (2004)* and *Sanz et al., (1999)* proved that abdominal fat fatty acids concentration significantly affected by dietary fat composition. *Wongsuthavas (2007) and. Rodriguez et al (2005)* stated less

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weight in birds fed diet containing high amount of vegetable oil. The differences in feed to gain ratio were significantly affected by the diet with the highest level of vegetable oil. However, the feeding of animal fat has a significant increasing influence on the composition of broiler adipose tissues. *Vermeersch and Vanschoubrock (1968) and Manila et al (1999)* proved that fatty acids profiles for the breast muscle and abdominal fat were altered by the dietary oil increased total fatty acids concentration in both type of tissues, while beef tallow decreased it, but increased saturated fatty acids concentration. *Shimomura et al. (1990)* reported a decreased body fat accumulation in animals fed oil than in those fed animal fat. *Pan et al. (1979) Vila` and Esteve-Garcia (1996)* found that plant oil produced less abdominal fat deposition in broilers than animal fat at different levels of fat inclusion. *Selvaraj and Purushothaman (2004)* reported that an isocaloric and isonitrogenous diet not affect weight gain and feed consumption, but the feed conversion ratio was improved when broilers were fed less level in the starter and finisher diets. *Seerley et al (1978)* reported that average daily gains, Feed: gain ratio was not different between fat sources, but fat level indicated an improvement in the feed: gain ratio with each increment of added fat and appeared to influence gross carcass composition; with more back carcass fat deposit on the carcass. *Cortinas et al (2004)* found that quantified Fatty Acids of thighs and breasts were not affected by dietary supplementation. *Najib and Yousef M. Al-Yousef (2011)* claimed that vegetable oil diets relatively produced high feed intake, lower body weight, higher feed conversion ratio and increased the omega3 fatty acid which makes this meat healthier to human. *El Yamany et al (2008)* the data revealed that no significant effect was recorded on both edible and offal parts percentage. *Qureshi (2004)* observed that the serum cholesterol significantly higher in chicks fed on animal fat as compared to those fed on vegetable oil diets. *Asti et al. (1989)* stated that animal fat induced the highest effect on broilers serum cholesterol concentration. *Malakian et al (2010)* reported that broiler performance, carcass traits, abdominal fat pad percentage, triglycerides, total serum protein concentration, and the cholesterol content were not affected by inclusion different levels of animal fat. Plasma (serum), total cholesterol was (190-210 mg/dl) while muscle (meat) total cholesterol was 96-107%. *Monfaredi (2011)* found no significant effect on carcass, thigh, breast, and liver weight. In other studies, broilers fed dietary animal fat had the highest carcass and serum cholesterol levels *(Blanch et al., 1995; Verma et al., 1995)* whereas, *Fan et al. (1995)* found that dietary fat sources not affected serum cholesterol concentration. *Aghdam Shahriar et al., (2007) and Hegsted et al (1993)* found that animal fat increases broiler serum cholesterol content, vegetable oil actively lowering serum cholesterol. *Crespo and E. Esteve-Garcia (2001)* and Maraschiello et al. (1998) noted that the level and type of fat had no effect on body weights and percentages of thigh to breast weight, and chemical composition of thigh and breast meat. The same authors stated that breast muscle cholesterol concentrations showed lower values than the thigh muscle, although fat source affect both thigh and breast cholesterol. *Crespo and E. Esteve-Garcia. 2001)* concluded that differences in tissue fatty acid profiles could be attributed to different roles of fatty acids in these tissues or to their different contents of phospholipids. *Newman et al (2002) and Ozdogan, and M. Aksit (2003)* observed that fat source significantly affects water contents of breast muscle. *Elmansy (2006)* and Ragab and *Osman A. M. R (unpublished)* revealed no significant difference among dietary treatments in chemical composition and different broiler carcass traits. *Zanini et al (2006)* stated that linear reduction in abdominal fat pad and relative liver weight when compared to soybean oil fed birds. *Karamouz et al (2009)* found that serum parameters were not affected by different dietary fat treatments. *Sanz et al (2000)* reported that abdominal fat pad deposition weight was significantly lower in birds fed the sunflower oil diet compare to those fed the beef tallow diet. *Neudonerffer. T.S. and C.H. Lea (1968)* mention that different dietary fat sources had no effect on the amount of lipid fractions (cholesterol), except triglycerides, which were varied considerably. *Peebles et al (1997)* reported no dietary effects on cholesterol was noted, and significantly lower triglycerides were found. *Navidshad (2010)* observed that triglycerides and cholesterol were positively correlated with each other. *Zakaria (2013)* reported that the different level of dietary fat significantly induced higher differences in heart percent, gizzard, while abdominal fat was significantly lower. Dietary fat levels significantly affect meat chemical analysis such as dry matter, fat and ash percent with the different levels of fat and forms of feed, whereas, no significant differences on blood parameters. *Omenka and Anyasor (2010)* stated that no significant difference were observed on the broiler internal organs mean weight studied, plasma-protein and muscle protein content. The total serum cholesterol and fat content were significantly lower. *Scaife et al (1994)* reported that feed intake and live weight were greatest, while abdominal fat pad, feed conversion ratio was poorest, liver lipid concentration was significantly reduced by dietary animal fat and lowest for diet vegetable oil whereas, abdominal fat pad fatty acid profile was most readily altered by dietary fatty acids. The author concluded that there was a strong correlation between dietary and tissue fatty acid composition for all fatty acids profile whilst liver fatty acid profile was least modified by dietary fatty acids. *Aydin (2007)* found that dietary fat treatments were not significantly affect abdominal fat, relative organ weights. *Fouladi et al (2008)* showed that vegetable oil low levels (2, and 4%) significantly increased carcass weight, breast, thigh, liver, spleen, decreased fat deposition, blood cholesterol and triglycerides. Also increased gizzard, and heart weigh but not significantly. *Hrdinka et al (1996)* showed that the abdominal and subcutaneous fat significantly differed compared to breast and thigh fat composition, and a significant change in the fatty acid patterns for all analyzed tissues especially adipose tissues. *Hargis et al (1993)* Enrichment of poultry meat and with the omega-3 fatty acids (marine oil or meal) might be an excellent alternative source. *Gallardo (2012)* detected an increase in oleic acid, decrease in linoleic acid, and slight increase in α-linolenic acid with a higher level of vegetable oil. *Smith et al (2003)* found that the fatty acid pattern of the fat from various sources were similar to the diet content. *Salamatdoustnobar et al (2010)* showed that vegetable oil fatty acids affected in ascending rate breast meat and significantly reached 40.09 - 44.81 percent and animal fat fatty acid significantly declined. *Valavan et al (unpublished)* reported that supplement of omega-3 fatty acids sources in broiler ration significantly

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increase on omega-3 fatty acids composition of broiler meat and significantly reduced palmitic and stearic acid concentrations also he stated that the total unsaturated fatty acids concentration in the breast and thigh meat of broilers showed an increase among all dietary fat source groups. *Ayerza (2007)* reported a Chia significantly increased the unsaturated fatty acids in the plasma contents compared to the control diet. *Safamehr et al (2012)* reported that Fish Oil elevated the blood palmitic acid, omega-3 polyunsaturated fatty acids, and caused a decline in the level of arachidonic acid. *Burlikowska et al (2010)* observed that dietary animal fat increased percentage of Saturated Fatty Acids to higher and decreased Poly Unsaturated Fatty Acids to the lower level in chickens. Also, they stated that dietary fat source not significantly affect total protein, and albumin content. *Aldaraji et al (2011)* indicated that supplementation diets with fish oil and flax oil significantly improved body, carcass, organ weights (heart, liver, gizzard, thigh, and breast) and dressing percentage while significantly decrease weights of wings, back and neck compared to sunflower and corn oil treatments. However, Fish oil surpasses other treatment groups with relation to all carcass parameters involved in this experiment. *Mohammed and Horniakova (2012)* reported that carcass yield, breast muscle percentage, leg muscle and total protein was not significantly higher in animal fat group. *Witt et al (2009* showed that the broilers fed a diet supplemented with high level of animal fat had a better dressing percentage, breast meat yield and breast weight compared to vegetable and fish oil treatments. *Guerreiro Neto et al (2011)* concluded that dietary fat sources do not influence the broiler performance, carcass traits, serum cholesterol, HDL and triglyceride levels. The diets containing poultry fat improves ether extract. *Potença et al (2008)* suggested that either animal fat or vegetable oil had no influence on broiler performance, abdominal fat deposition, or tibia density and strength. *Tekeli (2012)* showed that fat sources no statistical differences were observed between treatment groups on hot carcass, cold carcass weight, carcass yield, and abdominal fat weight. *Kralik et al (2003)* no statistically significant differences were observed either in the proportions of individual tissues and bone in the thighs with drumsticks nor in the proportions of these tissues and bone in carcass. *Bobadoye et al (2008)* observed that no significant effect of dietary energy sources on all the organs measured, breast muscles, the thigh, and the drumstick muscle weight. *Rezaei et al (2004)* reported that chicken fed diets with low fat level (3%) resulted in the highest breast meat and the lowest abdominal fat percentage.

II. RESULT AND DISCUSSION

The additional fat inclusion to the poultry diets in different sources with different levels is an orientation associated with high growth rate hybrids in recent poultry industry. In this reviewed paper found that the dietary fat source (vegetable oil or animal fat origin) at low level of inclusion (2, 4%) are significantly affect poultry performance, serum carcass lipids and traits in compare with control diet (no fat), in high level (6% and more) vegetable oil negatively affected performance and serum carcass and lipids adversely affect by high inclusion of animal fat. The result is agreed with Donaldson (1985) who stated that high level of vegetable oils is known to inhibit lipogenesis sequentially performance and lipids and similar to *Macleod (1991)* who illustrated that high fat deposition in broilers would partially be associated with high animal fat energy retention since the efficiency of energy utilization is high during fat synthesis which is opposite with expectation of *Zollitsch (1979)* who reported that unsaturated vegetable oil produced lower fecal energy losses and consequently, higher metabolizable energy which expected to deposit more carcass fat than saturated animal fat and similarly *Wiseman (2003)* demonstrated that for all ages tallow, which contains saturated fatty acids, is less digestible and therefore, less available to the animal. The same author also showed that the ability to digest dietary fat increases with increasing age, because young birds have lower lipase levels than older birds. *Sanz et al, (2000), Crespo and Esteve-Garcia, (2002); Newman et al., (2002); Villaverde et al, (2006)* stated that metabolic basis for diminishing effect of vegetable oil on body fat deposition is poorly understood.

III. CONCLUSION

Here we can conclude that the source of dietary fat induced a significant effect on broiler performance and serum carcass lipids in low levels (2, 4% of inclusion), but in high levels (6% and more) animal fat significantly increased broiler performance and serum carcass lipids whereas, vegetable oils diminishing broiler performance and serum carcass lipids

RECOMMENDATIONS

1. More research should be done to well understood of vegetable oil diminishing effect reasons.
2. Animal fat induced and deposit more saturated fats since vegetable oils retarding performance but deposit more unsaturated fat from the human health side of view to find out if the mixture of both (vegetable oil and animal fat) if it can solve the problem.
3. Enriching broiler diets with fish oil or meat as a source of omega-3 fatty acids (healthy fat) need to be well stablished with more researches in both levels and type.

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