FATTY ACIDS AND FAT CONTENTS OF WILD AND FARMED PIGEON MEAT

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ABSTRACT: The objective of this study was to investigate the fat content and fatty acids composition of wild and farmed pigeon meat of Pakistan. Folch method is used to extract the fat, and gas chromatography (GC-FID) was used to evaluate fatty acid composition. The wild pigeon's meat has lower fat contents (13.66 %) as compared to farmed bird (17.00 %) as found out by standard methods. The wild pigeon meat contains higher contents of unsaturated fat as compared to farmed (72.1 and 60.9%). The nutritious essential fatty acids ie., oleic acid (47.4 %) and linoleic acid (2.0 %) are also higher in wild bird meat as compared to farmed birds i.e., 42.4% and 1.0 % respectively. The current studies revealed that the granivorous wild pigeon have higher contents of animal fats when farmed under controlled environment.

Key words: Animal fats, Oleic acid, Palmitic acid, polyunsaturated fat, Birds Feed,

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INTRODUCTION

Meat is an important source of long chain fatty acids, high biological value proteins, high quality essential minerals ,several vitamins and trace elements (Dannenberger *et al.,* 2007). The prospering interest in safety, quality and satisfactory standard of meat was resulted due to having a engrossing desire for health conscious society to consume the lower fats. For satisfying the consumer's aspiration consuming low fat products, the quality of meat should be inspected (Nuernberg *et al.,* 2009). Animals as well as birds are hunted for meat. Birds are actually gained more importance due to exhibiting the lower and healthy fat content.

Pigeon meat exhibits essential amino acids, high protein, vitamins, essential minerals, low fat, less cholesterol content and high concentration of unsaturated fatty acids (Buculei *et al.,* 2010). It is considered beneficial for consumers who desired to take the specific type and quantity of fats due to many health problems especially cardiovascular diseases (Cooper and Horbañczuk 2002) (Pomianowski *et al.,* 2009) investigated the fatty acids composition of three pigeon species (Europigeon, Wrocławski, King) and observed resemblance in fatty acid profile of pigeon meat with meat types of poultry species. Monounsaturated fatty acids MUFA and polyunsaturated fatty acids (PUFA) and low concentration of saturated fatty acids (SFA) were reported in fatty acids profile of pigeon squabs (Ali *et al.,* 2021). The wild birds exhibit different fatty acid contents when compared to farmed one (Nuernberg *et al.,* 2009). The current studies are carried out to investigate the fats contents of wild pigeons and farmed pigeon.

MATERIALS AND METHODS

Samples collection: Seven samples of each wild and farmed pigeons having same age and weight are arranged by birds supplier of Tollinton Market Lahore.

Moisture content of meat: The weighed birds were slaughtered, meat was cleaned by unwanted contents. The minced meat was oven dried overnight at (100 ±1°C). The moisture contents were determined.

Extraction of meat fats: The meats samples of each bird (50± 2g) were subjected for fat extraction by polar solvent mixture; Chloroform-Methanol (2:1) (Folch *et al.,* 1957). The solvents were recovered by rotary thin film evaporator, the unwanted materials were separated by washings with Folch solution. The extracted fat was treated with anhydrous sodium sulfate for removal of water contents. The samples were oven dried prior to the determinations of fat contents.

Fat derivatives: The extracted fat of each sample (1 mg) was methylated for fatty acids analysis by standard method (AOCS) prior to chromatography. The BF_3-Methanol reagent of (Riedel-de HaënGmBH, Germany) was used for esterification. The methyl esters (FAME) were solvent extracted, each washed and water contents were removed by anhydrous sulfate.

GC-FID analysis: FAME of each bird sample was separated on GC-Shimadzer-14 Gas Chromatograph, having high resolution Column (30

meter×0.25mm×0.20µm, Zebron ZB-FAME,USA) and a flame ionization detector. The carrier gas was nitrogen. The column oven temperature was programmed initially at 100^0C for 2 minutes and then increase at a rate of 3°C/min till 10°C. The final temperature was held constant for 5 minutes. Injector and detector temperature were maintained at 240°C and 280°C respectively. Each FAME sample (0.1 µL) was injected in a split mode ratio (1:10). Fatty acids were identified by comparison of relative retention time of known standards (Supelco®, USA).

Statistical analysis: The mean values of fatty acids are determined with standard deviations (± SD).

RESULTS AND DISCUSSION

The fat contents of wild pigeons and farmed pigeons were determined as 13.66 and 17.59% on wet meat basis. Overall the pigeon meat has lower fat contents of meat fats as compared to cow, goat and camel meats (Pomianowski *et al.,* 2009). The pigeon meat fats contain lower contents of fats as compared to other ruminants ie., buffalo (21 %), lamb (23 %) (Dimov *et al.,* 2012, Gonzales-Barron *et al.,* 2021)

The palmitic acid saturated fatty acid was observed in wild pigeon meat (24.0 %) and farmed pigeon meat (29.6 %) as shown (Table 1). The remaining saturated fatty acids are in lower percentages in wild and farmed pigeon meats as shown under (Table 1). The saturated fatty acids; stearic acid (0.5% and 0.6%), capric acid (0.8% and 2.0%), lauric acid (1.1%, 3.1%), myristic acid (1.0 %, 3.3%) and arachidic acid (0.5 %) are identified in both wild and farmed pigeon meats respectively. The total saturated fatty acids of wild and farmed pigeon meat fats are meat fats of wild pigeon and farmed are 27.9% and 39.1%. The vegetable fats are considered healthier as compared to animal sources. The commercially important vegetable oils contains lower contents of saturated fatty acids (Rousseau, 2003) as soybean oil (15.5%), canola seed oil (6.8%), cottonseed oil (28.0%), Sunflower oil (12.6%). While, the cattle body fats or processed tallow contains higher contents of saturated fatty acids. Our previous findings reveals that the well-known breed of nilli ravi buffalo meat/body fats contains (32-34%) saturated fatty acids (Ali *et al.*, 2016). Therefore, the current work indicates that the pigeon's meat fats contains higher contents of saturated fats.

SFA should be considered while aiming to reduce the chance of hypercholesterolemia. The main fatty acids accountable for the cholesterol elevation are C14:0 and C16:0 acids (Valsta *et al*., 2005). Furthermore, Stearic acid C18:0 is a unique SFA because it does not increase blood cholesterol as much as other fatty acids do. Chain length, metabolic kinetics, ineffective absorption, and hepatic desaturation of stearic into oleic acid are potential causes of this discrepancy (Ruiz-Núñez *et al.,* 2016).

The industrially processed vegetable oils to hydrogenated fats are also commercially important due to food texture of domestic cooked food and fast food products. They have crispy taste, but *trans* fatty acids are produced during industrial processes. However, the *trans* fatty acids are not advised, or lower levels are permitted globally (Ali *et al*., 2007). According to current study, there are no *trans* fats in these birds meat. Therefore, the meat fats of these birds play a role in cooking.

Table 1. Fatty acids of wild pigeon and farm pigeon meat by Gas Chromatography.

FATTY ACIDS	WILD PIGEON [% ± SD]	FARMED PIGEON [% ± SD]
$C_{10:0}$	0.5 ±0.1	0.6 ±0.1
$C_{12:0}$	0.8 ±0.1	2.0 ±0.1
$C_{14:0}$	1.1±0.1	3.1 ±0.2
$C_{16:0}$	24.0 ±2.7	29.6 ±3.0
$C_{16:1}$	6.2 ±1.0	6.4 ±1.0
$C_{18:0}$	1.0 ±0.1	3.3 ±0.2
$C_{18:1}$	47.0 ±3.3	42.4 ±2.8
$C_{18:2}$	16.3 ±1.5	10.5 ±1.2
$C_{18:3}$	2.0 ±0.5	1.0 ±0.3
$C_{20:0}$	0.5 ±0.1	0.5 ±0.1
$C_{20:1}$	0.6 ±0.1	0.6±0.1

Values are mean ± SD

The monounsaturated oleic acid is the major fatty acid amongst all fatty acids of both, wild pigeon meat (47.0%) and farmed pigeon meat (42.4%) respectively (Table 1). Our results about monounsaturated fatty acids (MUFA) contents in wild pigeon fat are in partial agreement and comparable with previous literature (Ali et. al., 2021, Pomianowski *et al*., 2009) who observed oleic acid (37.50-50.65 %) and palmitoleic acid (7.56-8.47%) contents in pigeon meat. While a lower oleic acid (27.6%) and palmitoleic acid (3.8 %) was reported by (Ayden, 2005).The polyunsaturated fatty acids are also reported as lonoleic acid; 16.3% and 10.5%, linolenic acid; 2.0% and 1.0 % respectively. Oleic acid has the advantage of lowering blood cholesterol levels, and it has been projected to reduce the incidence of coronary heart disease by 20–40%, primarily through lowering LDL cholesterol (Steinberg *et al*., 2003).

The unsaturated fatty acids are sources of essential fatty acids also known as omega acids and are crucial for decreasing blood cholesterol (Ong and Goh, 2002). Moreover, essential fatty acids as precursor of prostaglandins had been found in accessory genital glands, seminal plasma and lung tissues of the human body (Gunstone, 1967). Therefore, these birds' meat have

healthy fats relative to ruminant's meat because they don't include trans fats, lower levels of saturated fats and are excellent source of crucial fatty acids.

Table 2. Saturated, mono and polyunsaturated fatty acids of wild pigeon meat and farmed pigeon meat by Gas Chromatography.

FATTY ACIDS	WILD PIGEON [%]	FARM PIGEON [%]
ΣTSFA	27.9	39.1
ΣMUFA	53.8	49.4
ΣPUFA	18.3	11.5
ΣUFA	72.1	60.9

TSFA→ Total saturated fatty acids, MUFA→ Mono unsaturated fatty acids,
PUFA → polyunsaturated fatty acids, UFA→ Unsaturated fatty acids

The milk fats contain PUFA (1-3%) (Talpur *et al.,* 2007) while the wild and farmed pigeon meats contain PUFA (18.3 and 11.5%), respectively. However, the observed variations are found out in meat fatty acids of wild and farmed pigeon as shown under (Table 2). The wild and farmed pigeon's meat contain TSFA (27.9 and 39.1%), MUFA (53.8, 49.4%), PUFA (18.3, 11.5%) and UFA (72.1, 60.9%).

A slightly lower value of linolenic acid (15.00%) was observed by (Ali *et al.,* 2021). In contrast, (Aydin, 2005) found a higher level (26.7%) of linoleic acid content in pigeon breast muscle while (Pomianowski *et al.,* 2009) reported 15.96% of linoleic acid. Linoleic acid has the capability to reduce the development of artheroschelerosis and lower the risk of cardiovascular disorders.

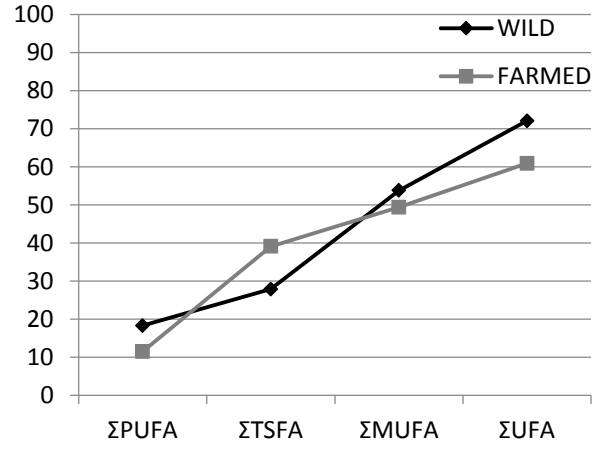

Figure 1. Comparison of different classes of pigeon meat fatty acids.

The comparison is summarized in Figure-1. The meat fats of wild pigeon are healthier as compared to farmed pigeon meat. The wild pigeon meats contain higher contents of unsaturated fatty acids, polyunsaturated fatty acids and monounsaturated fatty acids. The polyunsaturated fatty acids have great significance in dietary fats. Their fish meat is a major animal source of polyunsaturated fatty acids. The important aspect of the current findings is percentile variations of fatty acids in wild and pigeon meats fatty acids. The lower contents of total saturated fatty acids are present in wild pigeon meat. Higher concentrations of polyunsaturated fatty acids are also present as compared to farmed pigeon. The feed impact may be attributed to the findings as the wild birds are not restricted to the processed feed and are inhabitant to eat vegetable sources. The feed effects the meat and milk fats of ruminants as mentioned in our previous work (Abdullah *et al.,* 2019). The results reveal that the processed feed contains animal fats inspite of vegetable fats.

Conclusion: The composition of determined fatty acids of wild pigeon meats and farmed pigeon meats naturally makes its taste and characteristic texture after cooking. The wild and farmed pigeon meats contain healthy fats, as considerable contents of polyunsaturated fatty acids ΣPUFA (18.3, 11.5%) and monounsaturated fatty acids (ΣMUFA, 53.8, 49.4%) are identified. The oleic acid is the major fatty acid ($C_{18:1}$ 47.0, 42.4%) then palmitic acid ($C_{16:0}$ 24.0, 29.6 %), linoleic acid ($C_{18:2}$ 16.3, 10.5%) and palmitoleic acid ($C_{16:1}$ 6.2, 6.4%). The findings show that these regional pigeons are granivorous in nature. However, the controlled feed environment negatively impacts their meat fats composition as higher contents of animal fats are found out in farmed pigeon meats.

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