UNIVERSITI PUTRA MALAYSIA

GROWTH PERFORMANCES, CARCASS YIELD AND MEAT QUALITY OF FREE RANGE VILLAGE CHICKENS FED ON DIET CONTAINING DEHYDRATED PROCESSED FOOD WASTE

HOSSEIN SHANAGHI

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By

HOSSEIN SHANAGHI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirement for the Degree of Master of Science

May 2015

DEDICATIONS

Dedicated to my mother and my father for their endless and boundless love, support, encouragement, and most of all for their ever continuous do'a for my life.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the Degree of Master of Science

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May 2015

Chairman : Prof. Dahlan Ismail, PhD
Faculty : Agriculture

The study was conducted to evaluate effects of feeding diets containing dehydrated processed food wastes (DPFW) on growth performances (feed intake, body weight gain, feed conversion ratio), meat quality and carcass yield of free range village chickens for 10 weeks. The food waste was collected from 20 different restaurants of Universiti Putra Malaysia during 3 months. The first step of processing food waste was reducing the fat content of food waste by soaking it in hot water at >90 °C - < 100 °C for 10 minutes. Then it was dehydrated under the sun (3 days) (average 30 °C), mixed and the representative samples were analyzed for dry matter (DM) 89.3%, crude protein (CP) 16%, ether extract (EE) 7.1%, crude fiber (CF) 3.7%, crude ash 7.4%, NaCl 3.07%, Ca 1.56%, phosphorous 0.87% and ME 3700 kcal/kg. The formulated diet was based on chemical composition of DPFW. The experimental design used was completely randomized design involving four different rations. The rations contained processed dehydrated food waste at the rate of 0 (T1), 20 (T2), 40 (T3) and 60% (T4). 180 grower female village chickens at four weeks of age with average initial body weight 300±10g (mean ± SD) were randomly distributed to four treatments with three replicates (15 birds per replicate) for grower and finisher rearing periods (grower 5-9 weeks and finisher 10-14 weeks). The four treatment rations formulated were approximately iso-caloric and iso-nutrigenous with 3000 kcal/kg ME and 20% CP for grower period and 3100 kcal/kg ME and 18% CP for finisher period, respectively. As the data suggested, the differences in growth performances of village chickens among treatments may be related with the composition and/or the levels of DPFW intake. Accordingly, the results showed that the highest feed intakes in grower (634 g) and finisher phases (2722.1) were observed in the control group, while the lowest was in treatment 4 (586.3 g for grower and 2542.6 g for finisher phases) ($P<0.05$). No significant difference was found between the control group (634 g and 2722.1g) and treatment 2 (630.7g and 2707g) in grower and finisher phase ($P>0.05$). Linearly declines in body weight gain were recorded in diets containing more than 20% of DPFW during both grower and finisher rearing phases. Higher amounts of DPFW in the diets (more than 20%) reduced the intake of nutrients and metabolic energy. Consequently, birds grew significantly less compared with those in the control group. The average FCR showed no significant ($P>0.05$) differences among birds fed on just commercial feedstuff in the control group (3.52) and treatment 2 (3.55) containing 20% processed food waste during whole rearing period. Feed conversion ratio was poor and significantly in treatment 3 (3.65) and treatment 4 (3.69) ($P<0.05$). DPFW inclusion showed no significant differneces ($P>0.05$) on the carcass weight, dressing percentage, relative weights of the heart, liver and intestine when T2 (20% DPFW) was compared to the control group. However, by increasing the amount of DPFW on the diets (40% and 60%) significant differences were observed in all items in T3 and T4 compared to the control group ($P<0.05$).

In addition, a significant interaction between DPFW and feed intake (P<0.05) resulted in a higher reduction in carcass yield of birds consuming more than 20% DPFW when compared with birds without access to DPFW. pH value of T4 did not show a significant difference from T3 (P>0.05), while it showed a significant difference between T2 and the control group (P<0.05). This trend was similar to L value and a value, whereas no significant differences observed in b value among treatments (P>0.05). Shear value was slightly higher in control group (p<0.05) compared with other treatments. However, no significant differences were recorded in all treatments (P>0.05). Although cooking loss in T4 was slightly higher than other treatments, there were no significant differences among all treatments (P>0.05). Fat content and ash were the lowest in the control group while moisture was the highest (71.14 %). T4 significantly had the highest fat content and it decreased linearly to the control group (P<0.05). Crude protein was slightly higher in the control group compared with other treatments, however, no significant differences were found (P>0.05). The present study showed that the feeding diet containing DPFW resulted in significantly lower drip loss and higher pH in free-range village chickens meat. This may be attributed to the lower glycogen content of the muscles and decreased lactic acid (LD) production. The predominant fatty acids in meat for all treatments were saturated fatty acids; palmitic acid (16:1), strearic acid (18:0), the mono-unsaturated fatty acid palmitic acid (16:1) and oleic acid (18:1n-9), and the polyunsaturated fatty acids (PUFA); linoleic acid (18:2n-6) and arachidonic acid (20:4n-6). The total saturated fatty acid (SFA) was the highest in T4 (40.28%), followed by T3 (36.78%), T2 (33.68%) and T1 (30.16). In contrast, the total polyunsaturated fatty acid (PUFA) was the lowest in T4 (26.82%), followed linearly by T3 (30.0%), T2 (32.91%) and T1 (36.05%). Furthermore, the ratio of PUFA/SFA in treatment 4 (60% DPFW) was the lowest, representing (0.66%) and it increased respectively from T3 (0.81%), and T2 (0.97%) to T1 (1.19%). The highest total n-6 were found in T1 (34), while the lowest belonged to T4 (24.35%). However, the highest total n-3 belonged to T4 (2.47%), whereas the lowest one belonged to the control group (2.05%). Consequently, the inclusion of more than 20% DPFW, had a major influence on the fatty acid composition of chicken meat, leading to a significant decrease in most PUFA, increase saturated fatty acid (SFA) content of chicken meat and n-6/n-3 ratio. In general, the village chicken fed on a diet containing DPFW contained fat with a greater proportion of SFA than the control group. According to a sensory evaluation result, there were no significant differences in tenderness, juiciness, color or flavor of village chicken meat among all treatments (P>0.05). However, the descriptive panel found some significant differences (P<0.05) in texture and overall acceptability (P<0.05). As the result of sensory evaluation shown, overall liking in texture of chicken meat in the control group was the highest (6.8) while in T4 was the lowest (6.26). As panelists preferred, chicken meat from T4 (60% DPFW) had the highest liking rate of 6.6 (P<0.05) while the last one was control group (0% DPFW) with the rate of 6.06 (like slightly) (P<0.05). Furthermore there was no significant difference between T3 (40% DPFW) (6.4) and T2 (20% DPFW) (6.26) (P>0.05). The data presented, suggests that diets containing dehydrated processed food wastes had positive effects on tenderness, juiciness and flavor of meat, even though there were no significant differences among all treatments (P>0.05). According to the results, it seems that diets containing up to 20% dehydrated processed food waste could be used in grower and finisher rearing phases without any negative effects on growth performances, carcass yield and meat quality of free range village chickens.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagi memenuhi keperluan untuk ijazah Master Sains

PERSEMBAHAN PERTUMBUHAN, BANGKAI HASIL DAN DAGING KUALITI RANGE PERCUMA AYAM VILLAGE FED ON DIET YANG MENGANDUNGI KERING SISA MAKANAN DIPROSES

Oleh

HOSSEIN SHANAGHI

Mei 2015

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Kesan kemasukan sisa makanan proses yang terhidrat (DPFW) ke dalam diet ayam kampung terhadap prestasi pertumbuhan (pengambilan makanan, berat badan badan, nisbah penukaran makanan), kualiti daging, sifat bangkai, asid lemak dan panel rasa disiasat dengan menggunakan 180 ayam kampung (baka Arab). Sisa makanan telah dikumpulkan dari 20 restoran yang berlainan di sekitar Universiti Putra Malaysia. Dalam usaha untuk menyediakan dan memproses sisa makanan, lemak sisa makanan dikurangkan kepada 7.1% dengan merendam dalam air panas bersuhu > 90 ° C - < 100 ° C selama 10 minit, langkah seterusnya ialah menjemur di bawah matahari (48 jam), langkah seterusnya ialah pengisaran dan menganalisis nilai-nilai pemakanannya. DPFW mengandungi 89.3% bahan kering, 16% protein mentah, 7.1% lemak mentah, 3.7% serat mentah, 7.4% abu mentah, 3.07% NaCl, 1.56% Ca, 0.87% fosforus, 4053 kcal/kg GE. Ayam kampung ini secara rawak telah dibahagikan kepada empat tahap kemasukan DPFW (0, 20 dan 40 dan 60%) rawatan untuk membesar dan tempoh tamat (membesar: 5-9 minggu dan tamat: 10-14 minggu). Setiap rawatan mempunyai 45 ayam dengan tiga replikasi (15 burung bagi setiap replika). Data yang dicadangkan ialah; perbezaan di antara pertumbuhan di dalam setiap rawatan mungkin berkaitan dengan komposisi dan / atau tahap pengambilan DPFW. Ini menunjukkan bahawa dengan meningkatkan lebih 20% kemasukan DPFW, pengambilan makanan akan menurun secara linear, ini menunjukkan bahawa prestasi utama burung bergantung kepada pengambilan DPFW dan ia mungkin juga disebabkan oleh catuan yang kurang baik daripada DPFW (lebih daripada 20%) berbanding dengan bahan makanan konvensional . Penurunan berat badan secara linear direkodkan dengan penambahan lebih 20% DPFW dalam catuan ayam kampung dalam kedua-dua penanam dan penamat fasa penternakan. FCR meningkat (P <0.05) dengan kemasukan DPFW yang semakin meningkat (lebih daripada 20%) dalam tempoh penanam. Jumlah yang lebih tinggi dalam diet DPFW (lebih daripada 20%) telah mengurangkan pengambilan nutrien dan tenaga metabolisma dan, akibatnya, pembesaran burung akan berkurang dengan ketara, oleh itu membelanjakan sebahagian tinggi daripada tenaga pemakanan dan nutrien dalam penyelenggaraan. Purata FCR menunjukkan tiada perbezaan signifikan (P> 0.05) antara burung yang diberi makan dalam kumpulan kawalan dan rawatan 2 ditambah dengan 20% sisa makanan yang diproses dalam tempoh penternakan keseluruhan. Nisbah penukaran makanan itu sangat teruk dan meningkat dengan ketara apabila sisa makanan yang diproses telah ditambah sehingga 60% dalam rawatan 4 (3.69) (P <0.05). FCR yang paling sedikit dimiliki oleh kumpulan kawalan. Hanya peningkatan FCR dicatatkan dalam rawatan 2 (20% DPFW); 3.55 berbanding kumpulan kawalan; 3.53 dengan tiada perbezaan yang signifikan (P> 0.05). Data menunjukkan bahawa nisbah penukaran makanan hanya dipengaruhi dengan meningkatkan DPFW apabila dikenakan lebih daripada 20% (P> 0.05). Keputusan menunjukkan bahawa pengambilan makanan tertinggi di

pembesaran dan penamat fasa diperhatikan dalam kumpulan kawalan dengan 634 g dan 2722.1 g masing-masing, manakala yang terendah adalah dalam rawatan 4, iaitu 586.3 g untuk pembesaran dan 2542.6 g untuk fasa penamat (P <0.05) . Tiada perbezaan yang signifikan telah dijelaskan antara kumpulan kawalan (634 g dan 2722.1g) dan rawatan 2 (630.7g dan 2707g) dalam penanam dan pengemas (P> 0.05). Kemasukan DPFW tidak menunjukkan kesan yang signifikan (P> 0.05) pada berat bangkai, peratusan berpakaian, berat relatif jantung, hati, usus apabila rawatan 2 ditambah dengan 20% DPFW berbanding dengan kumpulan kawalan. Bagaimanapun, dengan peningkatan jumlah DPFW (40% dan 60%) perbezaan ketara diperhatikan dalam T3 dan T4 berbanding dengan kawalan kumpulan (P <0.05), yang disertai dengan penurunan linear dalam semua perkara. Sebagai tambahan, interaksi yang signifikan antara DPFW dan pengambilan makanan (P <0.05) menyebabkan penurunan yang tinggi pada hasil bangkai burung yang memakan lebih daripada 20% DPFW berbanding burung tanpa akses kepada DPFW, yang tertakluk kepada peningkatan penambahan DPFW Hasilnya, kemasukan lebih daripada 20% DPFW mempunyai kesan negatif ke atas hasil bangkai (P <0.05). Nilai pH T4 tidak mempunyai perbezaan yang signifikan dengan T3 (P> 0.05), sementara ia mempunyai perbezaan yang signifikan dengan T2 dan kumpulan kawalan (P <0.05). Trend ini adalah sama dengan nilai L dan nilai a, manakala tiada perbezaan yang ketara diperhatikan dalam b nilai antara rawatan (P> 0.05). Nilai ricih adalah lebih tinggi sedikit dalam kumpulan kawalan (p <0.05) berbanding dengan rawatan lain, di mana tidak ada perbezaan ketara telah dicatatkan di antara mereka (P> 0.05). Walaupun kehilangan memasak dalam T4 adalah lebih tinggi sedikit daripada rawatan lain, tidak ada perbezaan yang signifikan di antara semua rawatan (P> 0.05). Kandungan lemak dan abu adalah yang paling rendah dalam kumpulan kawalan manakala kelembapan adalah yang paling tinggi (71.14%). Rawatan 4 ketara mempunyai lemak yang paling tinggi dan ia menurun secara linear kepada kumpulan kawalan (P <0.05). Protein mentah adalah lebih tinggi sedikit dalam kumpulan kawalan berbanding dengan rawatan lain, bagaimanapun tiada perbezaan yang signifikan dijumpai (P> 0.05). Kelembapan dan abu tidak mempunyai perbezaan yang signifikan di antara rawatan yang ditambah dengan sisa makanan diproses (P> 0.05). Kajian ini menunjukkan bahawa memakan DPFW menyebabkan kehilangan titisan dan pH yang lebih tinggi. Ini boleh menyumbang kepada kekurangan kandungan glikogen yang rendah dalam otot, juga dalam pengeluaran asid laktik (LD). Perbandingan antara rawatan diet dalam kumpulan kawalan dan diet DPFW lain menunjukkan bahawa menggantikan diet burung dengan produk DPFW pada tahap 20% tidak mempengaruhi pengeluaran daging. Walau bagaimanapun, diperhatikan bahawa penurunan dalam pengeluaran daging dengan tahap peningkatan produk DPFW, menunjukkan tahap penggunaan produk DPFW yang tinggi telah mempengaruhi secara negatif pengeluaran daging ini. Asid lemak utama dalam daging untuk semua rawatan ialah asid lemak tepu; asid palmitik (16: 1), asid strearic (18:0), asid palmitik mono-tak tepu asid lemak (16: 1) dan asid oleik (18: 1n-9), dan asid lemak poli tak tepu (PUFA); asid linoleik (18: 2n-6) dan asid arakidonik (20: 4n-6). Jumlah asid lemak tepu (SFA) adalah yang tertinggi di T4 (40.28%), diikuti oleh T3 (36.78%), T2 (33.68%) dan T1 (30.16). Sebaliknya jumlah politaktepu asid lemak PUFA adalah yang paling rendah di T4 (26.82%), diikuti secara linear oleh T3 (30.0%), T2 (32.91%) dan T1 (36.05%). Tambahan pula, nisbah PUFA / SFA dalam rawatan 4 ditambah dengan 60% DPFW adalah yang paling rendah (0.66%) dan ia meningkat masing-masing dari T3 (0.81%), T2 (0.97%) kepada T1 (1.19%). Jumlah n-6 paling tinggi dijumpai dalam rawatan 1 mewakili 34, manakala yang terendah adalah milik kepada rawatan 4 ditambah dengan 60% DPFW (24.35%). Walau bagaimanapun, jumlah n-3 yang tertinggi milik rawatan 4 (2.47%), manakala yang paling kurang adalah dalam kawalan kumpulan (2.05%). Oleh yang demikian, kemasukan lebih daripada 20% DPFW, mempunyai pengaruh yang besar kepada komposisi FA daging ayam, yang membawa kepada penurunan yang ketara dalam kandungan kebanyakan PUFA, peningkatan asid lemak tepu (SFA) daging ayam dan n-6 / n-3 nisbah. Secara umum, diet makanan ayam kampung yang ditambah dengan DPFW mengandungi lemak dengan kadar SFA yang lebih besar daripada kumpulan kawalan. Seorang panel perasa berkata, pengalaman memakan daging ayam kampung tidak menyebabkan tanggapan yang berbeza terhadap kelembutan, kelembapan, warna dan rasa di antara rawatan yang berbeza beza ini (P> 0.05). Mereka menyukai rasa, warna, juiciness dan kelembutan daging ayam kampung. Walau bagaimanapun panel yang deskriptif mendapati beberapa perbezaan yang signifikan (P <0.05) dalam tekstur dan penerimaan keseluruhan (P <0.05). Menurut ahli panel, tekstur daging dalam kumpulan kawalan tanpa DPFW mempunyai kadar tertinggi (6.8) manakala rawatan 4 yang ditambah dengan 60% DPFW adalah yang paling rendah (6.26). Terdapat perbezaan yang signifikan hanya antara T3 (6) dan T1 (6.8) (P <0.05). Secara amnya, ahli panel lebih cenderung memilih, daging ayam dari T4 (60% DPFW) mempunyai kadar tertinggi kesukaan sebanyak 6.6 (Kadar ini adalah lebih daripada sedikit dan hampir kepada sederhana) (P <0.05) manakala yang terakhir adalah kumpulan kawalan (0% DPFW) dengan kedudukan 6.06 (sedikit) (P <0.05). Tambahan pula tidak ada perbezaan yang signifikan antara T3 (40% DPFW) (6.4) dan T2 (20% DPFW) (6.26) (P> 0.05). Pada data yang dibentangkan, mencadangkan bahawa penambahan DPFW dalam diet burung berbanding dengan kumpulan kawalan, mempunyai kesan positif dalam kelembutan daging, kelembapan dan rasa. Walau bagaimanapun, tidak terdapat perbezaan yang signifikan di antara semua rawatan (P> 0.05). Menurut hasil, ia kelihatan bahawa sisa makanan proses terhidrat boleh menjadi pengganti sebanyak 20% daripada makanan yang dirumuskan dalam penanam dan fasa penamat ayam kampung tanpa apa- apa kedan negatif.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of scinece. The members of the Supervisory Committee were as follows:

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Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF ABBREVIATIONS

a*	Redness (CIELAB color dimension)
AOAC	Official methods of analysis
b*	Yellowness (CIELAB color dimension)
BWG	Body weight gain
CAST	Council for Agricultural Science and Technology
CFS	Commercial feedstuff
CRD	Complete Randomized Design
DHA	Docosahexaenoic fatty acid; 22:6n-3
DKW	Dehydrated kitchen waste
DLF	Dehydrated leftover foodwaste
DM	Dry matter
DPA	Docosapentaenoic acid; 22:5n-3
DPFW	Dehydrated processed food waste
EPA	Eicosapentaenoic fatty acid; 20:5n-3
FA	Fatty acids
FAME	Fatty acid methyl esters
FAO	Food and Agriculture Organization
FCR	Feed Conversion Ratio
GE	Gross Energy
IAEA	International Atomic Energy Agency
ISO	International Organization for Standardization
L*	lightness (CIELAB color dimension)
LA	Linoleic acid; 18:2 n-6
LC	n-3 PUFA Long-chain n-3 polyunsaturated fatty acids
LD	lactic acid
M%	% Moister

ME	Metabolisable energy
MUFA	Monounsaturated fatty acids
n-3	Sum of 18:3n-3, 20:3n-3, 20:5n-3, 22:5n-3 and 22:6n-3
n-6	Sum of 18:2n-6, 18:3n-6, 20:2n-6, 20:3n-6, 20:4n-6;22: 2n-6 and 22:4n-6n-6/n-3
n-6/n-3	n-6/n-3 ratio = sum of 18:2n-6, 18:3n-6, 20:2n-6, 20:3n-6, 20:4n-6; 22:2n-6 and 22:4n-6/ sum of 18:3n-3, 20:3n-3, 20:5n-3, 22:5n-3 and 22:6n-3
NLRI	National Livestock Research Institute
NRC	National Research Council
P/S	PUFA/SFA ratio = sum 18:2n-6, 18:3n-6, 18:3n-3, 20:2n-6, 20: 3n-6, 20:4n-6, 20:3n-3, 20:5n-3, 22:2n-6, 22:4n-6, 22:5n-3 and 22:6n-3 / sum of 14:0,15:0,16:0, 17:0,18:0 and 20:0.
pH	Potential of hydrogen
ppm	Parts per million
PUFA	Polyunsaturated fatty acids
R	Replicate
SEM	Standard error of mean
SFA	Saturated fatty acids
SFRB	Scavenging feed resource base
T	Treatment
USDA-APHIS	United States Department of Agricultu re

CHAPTER I

INTRODUCTION

Dramatic increase in human population recently, the need for high quality versatile foodstuffs mainly protein, raising levels of income (food preference) and elevated living standards have created a tremendous demand for animal products (FAO, 2006). Accordingly, the big expansion in animal protein demand recently, has been largely met by the rapid worldwide evolution in livestock production, especially poultry. As a result, there has been a dramatic growth in the global poultry meat production (FAO, 2002).

Global consumption of poultry products, especially poultry meat, has consistently increased over the years, and this trend is expected to continue. It is due to the primary characteristics of chicken meat, as an economical and available protein source, which can be cooked quickly, easy to digest and low in calories and a good foodstuff for a weight-control regime. In addition, it is recognized as a source of both saturated and unsaturated fatty acids, but has a higher proportion of unsaturated fatty acids and less cholesterol than other foods of animal origin (Rymer and Givens, 2005). Moreover, chicken meat fibers are tender and have a mild flavour that goes well with other foods (Dransfield, 1997).

Accordingly, the industrial rearing system has been developed to meet a commercial market demand, which is a fast production system. It is described by large numbers of birds being reared, predominantly in confinement for meat production (FAO, 2004). Meanwhile, although fast growth rate has been effective in decreasing the number of days to achieve market weight of chickens (Sulistiyanto *et al*., 1999), there have also been related serious problems caused by this production system. Eventually, this has led to attract attentions to alternative rearing system and chicken breed that is deprived from those serious issues. Due to the problems caused by the industrialized rearing system, growing awareness of human health, chicken welfare, nutritional concerns and chicken diseases, especially markets for free-range system and type of chickens (village chickens) that are suitable for this system have been considered (Bartussek, 1999).

Village chickens (Indigenous) are crossbreed between red jungle fowl and mixed exotic domestic breed, that has been brought by European, mainly British (Duguma, 2006). The indigenous chickens generally have slower growth rate than their commercial breeds when raised under similar commercial conditions. The feeding routine of this type of chickens is usually twice a day, with a variety of leftover feed. Active muscle movement and organic nature of village chickens diet produces delicious and highly nutritious meat (Wattanachant, 2008) with low fat and cholesterol, but high in protein content (Watanachant *et al*., 2004). In addition, it is excellent source of water-soluble vitamins and minerals, such as iron and zinc (Boccia *et al*., 2005).

Interest in free-range production system is increasing throughout the world, in response to concerns about food safety, human health and animal welfare (Hermansen, 2003). The primary characteristics of this production system are: a defined standard, greater attention to animal welfare (stocking density, perches, free-range areas), no use of growth promoters and animal offal. As Fanatico et al. (2006) stated, free range system usually involve birds having access to an outside area during part of the growing period. Outdoor access permits birds to forage and explore diverse environments, increasing their choice of food sources, encouraging activity and improving their growth performances (Spradbrow, 1997). European Union Commission (EUC, 2000) stipulates standard stocking densities for traditional free-range production standards, which is limited to at least 2 m^2 per chicken at outdoor area.

Throughout free range rearing system, animal welfare is increasingly viewed as a factor affecting the quality of animal products while being an important tool of marketing strategy (Lund & Algers, 2003). Free-range system provides a suitable housing with stable environment in which birds feel comfortable during day and night. They are protected against potential predators, and provided with security (Dawkins et al., 2003). In this system birds can express their natural behaviours with the freedom of movement and show typical signs of calmness and comfort, such as dust and solar bathing, stretching wings, beak cleaning and preening (Glatz & Ru, 2002). In addition, out-door access provides a large area per bird and decreases animal density, therefore contributing to reduce stress (Mopate and Lony, 1999). Accordingly, when it comes to chicken meat production, there is a perception by consumers that if birds are kept under free range conditions, they are healthier, produce better quality products, low in calories and saturated fats, high in protein and vitamins with better taste (Bogdanov, 1997).

Free-range village chickens also have a great potential to consume weeds, seeds and pests, which could be an effective strategy to control the resistance of farm parasites. This also could reduce the chemical contamination of farm products, which are being used severely by farmer (Nel, 1996). Thus, this system could be considered as a clean green cost-effective weed, pest and disease control program to improve farming productivity (Gray & Hovi, 2001).

This innovative system does not demand heavy manual labour and it can be maintained with low land, labour and capital costs. It is usually assigned to households (women and children), who normally have fewer off-farm employment opportunities (Alam, 1997). Gueye (2000) reported that free-range village chicken production represents an important system for providing additional income to resource-poor small-scale farmers. They are basis of high quality protein for the family, provide a small income and play a part in the cultural life of the society (Cumming, 1992). To support the previous reports, Dolberg, (2003) stated that this system involves excess family labour and surplus on-farm feed to generate household income and high quality protein food. It can also play a significant role in poverty alleviation and meet the multiple social, economic and cultural needs of farmers (Dolberg and Peterson, 2000)

However, despite of all benefits, which the free-range system offers, production and productivity remain well below potential. The low productivity is caused by poor nutrition, which comes as a consequence of a lack of supplementary feed (Fakhrul Islam & Jabbar, 2003).

The main nutritive source base, receive by free range chickens is scavenging, and it consists of anything edible found within the surrounding environment. The productivity of scavenging chickens is determined by the capacity of the scavenging feed resource base, which will fluctuate throughout the year dependent on the season (rain – or dry season) (Ponte *et al.,* 2008). Population of scavenging chickens is affected by a lack of available feed resources, due to the fact that the feed consumed is under the nutritional needs of the chickens (Sonaiya, 2004). Therefore, birds face quantitative and qualitative food shortage particularly in poor agricultural or household residues environment. To overcome this problem some farmers give commercial feedstuff to free range chickens in order to lead them to meet their nutritional requirements and produce highest output. However, the common commercial feedstuffs are not economically worthy for farmers to provide for chickens (Dolberg, 2001).

Thus, in order to allow indigenous chickens to contribute effectively to food security improvement, it is necessary to increase their productivity by decreasing use of commercial feedstuff through using diet that contains reasonable, available and nutritive local feed resource (Sonaiya & Swan, 2004). To achieve this goal researchers have examined different feed sources such as food waste. Official publications and bulletins from USDA-APHIS confirm that using food waste as feeds for livestock has the great nutritional and economical potentials to assist prodicers increase the livestock production (USDA-APHIS 1995). To support this report, Westendorf (2000) stated that food waste as an available and nutritive resource could be used as a possible economical alternative source to supplement nutrient intake for animals. Food waste is a precious supply, which can be reutilized as a new valuable feedstuff through animal production. In addition, Westendorf et al. (1998), in earlier study stated that recycling and reusing leftover food into animal feed is vital because it can contribute to not only declining import of feed ingredients but also reducing environmental pollution.

Food waste utilized by animals is usually collected from hospitals, restaurants, hotels and prisons (Westendorf *et al.*, 1996), which is often high in fat and moisture content, while nutrient content is usually adequate, however highly variable. Variability in the dry matter (DM), crude protein (CP), fat (EE), grass energy (GE), and crude fiber (CF) content of food waste can limit its incorporation as a feed additive into livestock and companion animal feeds. Because of its variability, food waste must be processed to create a uniform product with consistent fractional composition (Farhat et al., 1998)

In addition, care must be taken when feeding kitchen waste, could be a cause of diseases for the animals. The issue of animal health is always a concern when discussing the use of food waste as an animal feed. When food waste is fed wet it has only a very brief shelf life, and there is always the risk of animal diseases (USDA-APHIS, 1990). Epidemics of diseases have been associated with the feeding of unprocessed wet food waste (NLRI, 1999). Furthermore, the high moisture content (more than 40%) in food waste could reduce dry matter and nutrient intake, thereby reducing animal performances.

Considering fat content of food waste, which is high according to results of previous studies, researchers have not indicated the role of fat in keeping quality of food waste. Therefore, it is important to design a new method to reduce fat content of food waste, which should be practical by small-scale farmers in order to increase keeping quality of food waste. Therefore, new method of processing food waste must focus on maintaining the nutritive quality of food waste while reducing its high fat and moisture content (Lipstein, 1984).

Thus, using processed dehydrated food waste (DPFW) as a feed for village chickens may decrease the use of commercial feedstuff, which may allow small-scale farmers to contribute effectively in chicken meat production. However, there are only a few reports in the literature, which evaluated the feeding value of food waste as a feed for free-range village chickens.

1.1 General Objective of Study

The main objective of this study is to evaluate the impact of a diet containing DPFW on growth performances, carcass yield and meat quality of free range chickens.

1.2 Specific Objectives of Study

The specific objectives of present study are to:

1- Determine the economical and practical method of processing and dehydrating food waste.

2- Determine a dehydration method, which is practical with limited equipments and suitable for small-scale farmers (dehydration of food waste under the sun).

3- Determine a soaking time, in order to decrease the fat content of food waste to an acceptable degree, while maintaining the nutritive values of food waste.

4- Determine nutritive values of DPFW, in order to use it on the formulated diet of village chickens.

5- Evaluate the effects of different dietary inclusions of DPFW on growth performances, carcass yield and meat quality of free-range village chickens.

1.3 Hypothesis

Food waste has nutritive values and it is suitable to use as a feed for poultry. Using a diet containing food waste (alternative feedstuff) to feed free-range village chickens not only reduces the use of commercial feedstuff, also will improve growth performances and meat quality of chickens.

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