Production parameters and profitability of the Egyptian Household Poultry sector: A survey

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Abstract

Poultry production experienced tremendous change in Egypt in the last three decades. Small-scale family poultry production otherwise called household poultry was part of this transformation but to date no concise description has been made of the Egyptian household poultry. In this report, poultry production at the household level in Egypt was described using a survey and reviews. Inputs and outputs of this production system were evaluated and the profitability of the household poultry was estimated. Household poultry contribute immensely to food security in Egypt; provide certain income and social security. A mean flock size of 73 (mixed flock) was determined and this will yield a net annual profit of 2287.67LE (US$397.34) per annum with some forms of household biosecurity. The important household poultry diseases are principally viral and bacterial and certain other diseases. While the Egyptian household poultry are similar to others in Africa in terms of multi species stocks, women-driven project, labour and marketing structures, it differs in input systems, hatchery method, disease management, and other indices. Suggestions for improvement of this sector of the poultry industry were offered.

Keywords: Egypt; household poultry; management; production parameters; biosecurity; diseases.

Introduction

The poultry industry in Egypt experienced huge transformation in the last 3 decades primarily in response to the increasing human population and the corresponding demand for more food resources and land, but also due to increasing availability of improved production technologies (Hosny, 2006). Egyptian poultry production systems engage about 1.4 million individuals (≥6% of the total Egyptian workforce and ≥15% of the agricultural workforce; CAPMAS, 2006) and between 5 and 7 million households are involved in the household poultry production (HHPP). The industry is broadly categorised into Sectors 1, 2, 3 and 4 as outlined by the Food and Agricultural Organization of the United Nations (FAO, 2006). In the Egyptian poultry industry, Sector 1 will include the integrated industrial producing companies characterized by high level of biosecurity, highly automated feeding, watering and environmental control systems while Sector 2 are the large commercial farms including some of the breeder farms that produce broilers, layers and day-old birds with moderate to high biosecurity and capacity of >15000 birds per farm. The small scale commercial farms are structurally similar to the Sector 2 but with a smaller production capacity and lower level of biosecurity and are referred to as Sector 3. The household production systems, commercial (Exotic or Baladi) or traditional are the Sector 4 (Hosny, 2006; MALR, 2007; Geerlings et al., 2007; Fasina et al., 2011).

The household poultry have market shares of approximately 53% and up to 40% in the meat and egg production sectors in the 90s (Hosny, 2006). The production system sometimes widely referred to as “rooftop” originated from the fact that the majority of the household poultry production in Egypt are done on the topmost floor, or in certain instances in uncompleted flats (or parts thereof) within the multi-storey buildings. A sizeable portion of household poultry is also raised within the yards of many households, while a few may be raised in agricultural lands or on the street (Geerlings *et al*., 2007).

The most important factor for the Egyptian human population in keeping poultry appears to be the need to meet the household food security but up to 45% of annual household incomes, may be provided by HHPP (Geerlings *et al*., 2007). Other benefits of HHPP in addition to food security may include forms of investment, social statuses regular

incomes and employment (Croppenstedt, 2006; Geerlings *et al.*, 2007; Yakout *et al*., 2009).

The HHPP sector in Egypt is typical in that it is an almost intensive system with an apparent contrast to the zero- or low-input backyard setting elsewhere in resource-poor countries (Akinola and Essien, 2011), and are comprised of indigenous (Baladi) birds (chicken, ducks, geese and turkeys) as described by Geerlings *et al*., (2007). It is similar to the smallholder family poultry production (SFP) model previously described by Sonaiya (2005).

It should be emphasized that the HHPP system has undergone tremendous transformation into a near absolute intensive system mainly because of the challenge faced due to the scarcity of arable and grazing lands since Egyptians live in densely populated towns and villages along the Nile valleys and delta which is less than 5% of the total surface area of the country, and the remaining 95% of the land will hardly support livestock keeping

To date, available literatures vary widely in the available datasets on HHPP in Egypt. While the Ministry of Agriculture and Land Reclamation (MoALR), gave an average of 33.24 birds per household (MALR, 2007), others have reported varying figures ranging from 51.7 (Geerlings *et al*., 2007); 20.7 and 5.4 (Governorates Information Units as cited by Geerlings *et al*., 2007); 10 to 20, and up to a few hundred (Hosny, 2006); and 90 (Yakout *et al*, 2009). Since the systems for input provision has gained acceptance among the household poultry farmers and are deeply entrenched in Egypt, a comprehensively qualitative and quantitative assessments of their merits will be needed and centralized data for economic feasibility will need to be undertaken. This empirically-based background information will also become very useful in other technical, operational and financial assessments as well as in the quantification of introduction of major changes affecting the poultry industry in Egypt. This paper reviews the important production parameters, assess profitability and outline the key inputs, limitations and innovations in the household poultry production system in Egypt based on literature and key findings. Key contributions and observations, including areas of improvement that may be useful in other resource-poor settings are discussed.

Survey

A questionnaire survey (see appendix 1) was conducted amongst household poultry farmers in Menoufia, Qalyubia and Gharbia Governorates, north of Egypt. These governorates are some of the largest producers of broilers and layer birds in Egypt with a combined human population of >11.5 million and a total of approximately 3 million households, and an average family size of > 4. Many of such households raise poultry (CAPMAS, 2006; Hosny, 2006; Geerlings *et al*., 2007; MALR, 2007) and they play major role in the overall national poultry production. This was supported with an opinion surveys of key informants and experts (n=10) using Delphi survey technique (Linstone & Turrof, 2002; Ferri et al., 2006) and literatures search.

Districts were selected using abstract transects and villages including households were randomly selected within each district. A validated and pre-tested questionnaire was used to collate key poultry production parameters in the household poultry in Egypt. Between 5 and 22 interviews were conducted in each village and efforts were made to purposively sample producers within each category of flock sizes (<20; 21-40; 41-60; 61-80; >80) in every village. A total of 191 households interviews in 15 villages were conducted in the 3 governorates but 188 interviews were included in the analysis.To ensure the reliability of data collected from the farmers, physical observations/counting of the flocks and photographic documentations were done. These were correlated with the interview responses. Where minimal disparities were noticed, observed data were used.

Though we are aware that pigeons are also widely kept in the households, we did not include them in this survey because they occupy a different stratum of the household poultry ecosystem (roof-adapted), cannot be easily counted because of their movement dynamics and are not restricted by intensive system of management.

All dataset on flock parameters, composition, performance indicators, inputs and outputs, including prices were evaluated using descriptive statistics at 95% confidence levels. The mean scores produced from the statistics were used to assess profitability of the household poultry production using cost and returns analytic tool (Alemdar *et al*., 2010).

Results

Flock parameters and population structures

The total populations of 6439 chickens, 2475 ducks, 211 geese and 48 turkeys were studied from 188 households. In the standing population of households within Menoufia, Gharbia and Qalyubia, 50% of the households will have chicks, 33% will have growing chickens, 96% will have laying hen, spent hen will be almost non-existent, 96% will have mating cock, and 54% will have fattened chickens (data from survey, not shown).

Furthermore, 22% will have duckling, none will have growing ducks, 87% will have layer duck, only 4% will have spent duck, 87% will have drake and 70% will have fattened ducks. In addition, only about 67% of the households will rear other species in addition to these two. The structure of these other species are likely to be that about 54% of the household will have layer geese, 54% will have ganders, 25% will have fattened geese and less that 8% will have turkeys. These structures supervene for the regular season but will change slightly during the festive and post festive periods (data not shown).

Of the 188 households, 109 (57.98%) raised chickens and ducks only; 50 (26.60%) raised mixed species of chickens, ducks, geese with or without turkeys; 25 (13.30%) raised only chickens; 2 (1.06%) raised only ducks and 2 (1.06%) raised only ducks and geese with or without turkeys (data not shown). None of the households considered in this survey did raise geese or turkey only.

The mean number of birds per household is approximately 73 birds during the regular season (Table 1), though this figure varied widely based on financial statuses of the different families (widows and extremely poor families tend to keep less than 10 birds). However, mean flock size of 57.1 and 58.8 were respectively obtained for the pre-festive and post-festive seasons. No statistically significant difference exist between the three seasonal mean flock sizes ($p = 0.575102$, $\chi^2 = 5.71159$; Tables 1 & 2), It was observed that more fattened birds were kept prior to major festivities and more younger birds and growing ones were kept after festivals (Table 3).

Table 1. Observed Flock Parameters and structures in the Egyptian Household Poultry (n = 188)

FLOCK PARAMETERS & STRUCTURES	Mean flock size ±SD at 95% CI,	Range
Flock size	**73**±12.53**,**	Min = 32*, Median = 65, Max =160
Chicken	**40±**17.64,	Min = 8, Median = 44, Max = 69
Ducks	**25±**13.26,	Min = 3, Median = 27, Max = 47
Geese (±1-2 turkeys)**	**8±**6.69	Min = 2, Median = 5, Max = 23
Others	0**	
Flock composition – numbers	**Number/mean of 73 birds/flock**	
Chicks- (3 to 9 weeks of age)	**12**	Min = 6, Median = 20, Max = 50
Pullets (9 weeks until laying)	**10**	Min = 6, Median = 18, Max = 30
Hens-Layers	**7**	Min = 6, Median = 13, Max = 30
Hens-end of lay***	**0**	
Cock-For reproduction	**1**	Min = 1, Median = 1, Max = 4
Cockerels-For consumption and sale	**10**	Min =1, Median = 17, Max = 40
Ducklings (up to 9 weeks of age)	**9**	Min = 8, Median = 15, Max = 21
Ducks-9 weeks until laying	**0**	
Ducks-Layers	**4**	Min = 1, Median = 3.5, Max = 22
Ducks-End of lay***	**0**	
Ducks-Drake	**2**	Min = 1, Median = 2, Max = 6
Ducks-Fattened	**11**	Min = 6, Median = 20, Max = 30
Geese-Immature (0-9 weeks)****	**0**	
Geese-Layers	**2**	Min = 1, Median = 3, Max = 4
Geese-Gander	**1**	Min = 1, Median = 1, Max = 2
Geese-Fattened	**5**	Min = 2, Median = 10, Max = 20

*A flock size of 5 was observed but was not included in the analysis because it is not a typical flock size. In this case, all of the birds in the flock were donated to the poor widow as a form of social security/assistance to earn some incomes.
**±1-2 turkeys may exist in few households. Its presence will affect geese number.
*** Removed as soon as are available (rapid dynamics).
**** Goslings are produced 2x a year. They are removed 4-7days after

Table 2. Flock Performance indicators of the Egyptian Household Poultry based on farmers responses (n = 188)

PERFORMANCE INDICATORS	Values	Range	Standard deviation
Mortality (Chicks/ducklings 0 - 9 weeks of age)	14.19%/year[1]	Min = 0, Median = 16.5, Max = 46	7.16
Mortality (9 weeks and over)	6.52%/year	Min = 0, Median = 0, Max = 33	6.85
Egg production-Hens	64%	Min = 50, Median = 63, Max = 87	10.22
Egg production-Ducks	13 eggs/clutch[2]	Min = 10, Median = 12.75, Max = 15	2.01
Egg production-Geese	10 eggs/clutch	Min = 7, Median = 9.5, Max = 15	2.30
Hatchability-Ducks eggs	78%[3]	Min = 60, Median = 80, Max = 90	9.17
Hatchability-Geese eggs	75%[4]	Min = 63, Median = 75, Max = 86	6.76
Turn over			
Hens-End of lay	0.89 (1/year)	Min = 0.5, Median = 1, Max = 1	0.20
Hen (layer and cock inclusive)	0.89 (1/year)	Min = 0.5, Median = 1, Max = 1	0.20
Chicken 3 weeks of age	3.4 (3/year)	Min = 2, Median = 3, Max = 6	0.88
Fattened chicken (cock)	3.58 (4/year)	Min = 2, Median = 4, Max = 6	0.90
Ducks-End of lay	0.5 (1/2/year)	Min = 0.33, Median = 0.5, Max = 1	0.12
Ducks	0.5 (1/2/year)	Min = 0.33, Median = 0.5, Max = 1	0.12
Ducks-Day Old	3.87 (4/year)	Min = 3, Median = 4, Max = 5	0.68
Ducks-Fattened	3.46 (3/year)	Min = 2, Median = 3, Max = 6	0.99
Geese-Goose and Gander	0.38 (1/3/year)	Min = 0.25, Median = 0.33, Max = 1	0.26
Geese-Day Old	2 (2/year)		
Geese-Fattened	2 (2/year)		

[1] Value of 75% death in the chicks was taken as outlier and was not included in the analysis. The farm with this value had HPAI H5N1.

[2] These values are for the Baladi ducks. It was observed that the Muscovy ducks produced an average of 25 eggs per clutch.

[3] 3.74 clutch is obtainable per annum, SD = 0.71 (3.39-4.08), Min = 3, Median = 3.5, Max = 5. Total offspring per annum observed is 36.72, SD = 9.65 (31.92-41.52), Min = 21, Median = 38.5, Max = 54

[4] 2.39 clutch is obtainable per annum, SD = 0.46 (2.11-2.67), Min = 2, Median = 2, Max = 3. Total offspring per annum is be 17.69, SD = 5.59 (14.32-21.07), Min = 10, Median = 18, Max = 30

Table 3. Comparison of observed mean flock size during the regular, pre-festive and post-festive periods in Egypt (n = 111)

Periods	Count	Mean flock size±SD	Minimum, median and maximum
Regular	24	73.0±12.53	Min=32, Median=65, Max=160
Pre-festive	42	57.1±19.69	Min=35, Median=51.5, Max=105
Post festive	45	58.8±19.04	Min=36, Median=53, Max=119

P-value = 0.58. No statistical significance exists between the periods studied.

Using the means obtained for each category, the approximate percentages of household birds are chickens 55% (40/73), ducks (including Baladi, Muscovy, mule and Peking) 34% (25/73) and geese ± turkey 11% (8/73; Table 1). For the means obtained for the chickens' category, the approximate percentages of chicks, growing chickens, layers, cocks and fattened chickens in a standing population will respectively be 31% (12/40), 24% (10/40), 18% (7/40), 3% (1/40) and 24% (10/40). Spent hen was almost non-existent in the poultry population because the dynamics of the spent bird within the flock is very rapid (removal for household consumption almost immediately a bird is spent).

Using the means obtained for the ducks' category, the approximate percentages of ducklings, growing ducks, layer ducks, spent ducks, drakes and fattened ducks in a standing population will be 34% (8-9/25), 0-2% (0-1/25), 15% (3-4/25), 2-3% (1/25), 4% (2/25) and 43% (10-11/25) respectively. Growing ducks are rarely encountered because of either of the following reasons: the period of the survey was at the end of the period when several households may keep minimum numbers of ducks due to heat stress associated with summer months (approximately May-October) or because of the practice of selling-off of Baladi day-old-ducks and buying of 3-6-week old Peking ducks for fattening.

Similarly, for the means obtained for the category in the other species, geese population was approximately 96% of the total population of other species raised (7-8/8) while turkey was only about 4% (0-1/8). Among the geese category, no young goose was encountered possibly because this period was the end of heat stress when rarely no goose egg was laid and incubated. However, layer geese were approx 20% (1-2/8) while gander and fattened geese were 6% (1/8) and 68-73% (5-6/8) respectively, while turkeys may range from 0-6%.

Table 4. Inputs and Outputs in the Household Poultry, Egypt based on Market survey (n = 56)

INPUTS/OUTPUTS AND PRICES		Standard deviation	
Commercial feed (retail price)	**3LE/kg**, Min = 2.5, Median = 3, Max = 3.5	0.24	
Grain purchased (retail price)/produced	**2LE/kg**, Min = 1.5, Median = 2, Max = 2.75	0.32	
Chicken at 3 weeks of age	**5.4LE**, Min = 3.5, Median = 5.5, Max = 7.5	1.36	Price of day old chicks varies widely due to seasonal demand, festivities and availability. The same applies for day old ducks
Chicken at 6 weeks of age	**8.26LE**, Min = 5.3, Median = 7.5, Max = 14	8.26	Price of day old chicks varies widely due to seasonal demand, festivities and availability. The same applies for day old ducks
Beddings	**20LE/Annum**		These may include straws, wood shavings, top soil, ratsh and husks. The bedding are only procured for brooding young birds mainly but may also be applied in the pen of older birds. A bag costs between 3-7LE and are obtained on an average of 4 times a year.
Veterinary services	**13LE/Quarter** = 52LE/Annum, Quarterly Min = 5, Median = 10, Max = 25	6.12	
Vaccination (HPAI)	Free		
Vaccination (Others)	NA		Most birds are vaccinated against Newcastle and Gumboro from the nursery before they are sold to household producers
Eggs	**0.75LE**, Min = 0.5, Median = 0.75, Max = 0.75	0.09	Prices of eggs tend to increase significantly during holidays and special seasons. Such Egyptian holidays and festivities were summed to be on average of 93 days per annum.
Baladi day-old-ducks (DOD)	**9/ 2week-old**, Min = 6.5, Median = 9.25, Max = 12.5	2.32	1-week old Baladi duck sells for approximately 6.17LE; three-week old Baladi duck sells for approximately 18LE, Peking ducklings sell averagely less than the Baladi ducklings.
Fattened chicken (cock)	**24.24LE**, Min = 20, Median = 24.7, Max = 27.3	2.03	1kg sells for around 18.65LE. A Baladi chicken weigh approximately 1.3kg
Fattened baladi duck	**44.42LE**, Min = 27.5, Median = 48.4, Max = 57.2	10.12	1kg sells for around 19.30-20LE. A Baladi duck weigh approximately 2.3kg
End of lay hens	**16.75LE**, Min = 10, Median = 17.5, Max = 25	4.71	Spent hen are sold as whole or eaten at home and not weighed. Spent Peking or Muscovy may sell for around 15.50LE
End of lay duck	**20.44LE**, Min = 15, Median = 18, Max = 32.5	5.93	Spent duck are sold as whole or eaten at home and not weighed. Spent goose sells for approximately 52LE.
Geese-Day Old (Gosling)	**27.50LE**		Gosling are sold between 4-7days of age
Geese-Fattened	**70.00LE**		Geese will sell for an average of 65LE while gander will sell for an average of 75LE
Value of labor			
Value of labour	**~2hours**, Min = 1 hour, Median = 2hours, Max = 3hours	0.54	An average value of 2.1LE per hour obtains for farm worker in Egypt. This equals 126LE per month but was not accounted for in the analysis.

Flock performance indicators

The mean mortality was 14.19% in young birds and 6.52% in adults. Mean hen-day egg production in chicken was 64% while 13 and 10 eggs per clutch were laid on average in the ducks and geese, respectively. Hatchability of duck and goose eggs was 78% and 75%, respectively (Table 2).

The turnover for chicken was once per annum while it was once every two years for ducks and once every three years for the geese. However, age-biased turnovers were observed in the different species (Table 2). The inputs and their prevailing prices are summarized in Table 4. As shown in this table, feed, veterinary services, vaccination (HPAI H5N1, Newcastle and Gumboro), labour and stock (birds) are the main inputs but commercial feed and grain supplements, remained by far the most important input item.

Table 5. List of important poultry diseases in the Egyptian household poultry based on Expert's opinion ranking (n = 10).

Rank	Disease	Expert Matrix Score ±Standard deviation
1	HPAI H5N1	1.3±0.67
2	Newcastle	2.4±0.42
3	Infectious bronchitis	5.5±0.55
4	Gumboro (IBD)	6.7±1.03
5	Coccidiosis	6.7±3.40
6	Fowl pox	7.2±2.27
7	Fowl cholera	8.8±1.39
8	Clostridial	9.6±1.89
9	Endoparasitosis	12.5±2.00
10	Mycoplasmosis	13.1±1.89
11	*E. coli* infection	16.3±2.52
12	Tumour/Marek's	17.5±2.08
13	Infectious laryngotracheitis	17.5±3.51
14	Salmonella	22.2±1.89
15	Ectoparasitosis	24.3±0.76
16	Coryza	40.0±0.58
17	Nutritional deficiency	50.0±0.76

The lower the score, the more important the disease is in the Egyptian household poultry.

Important Diseases

The experts and farmers are of the opinion that highly pathogenic avian influenza H5N1 (HPAI H5N1) is the most important diseases in household poultry in Egypt. The

perception of importance in this regards is defined in terms of level of economic losses/fatality and based on which disease major decisions on HHPP will be taken. This disease is followed by Newcastle disease, infectious bronchitis, infectious bursal disease (Gumboro), coccidiosis (sometimes with clostridial infection), helminthiasis and other poultry diseases in that order (Table 5).

Profitability

Using the cost and return analysis, and based on the key parameters observed and the assumptions taken, it was observed that the household poultry production in Egypt is a profitable business. Over the period of one year, the household poultry project that involve a total of 73 mixed flock birds yielded a return of approximately 2389.67LE[*] (~US$415.00) or 2287.67LE (~US$397.34), discounting for the current level of biosecurity as observed in the poultry flocks (Fasina *et al*., 2011)

However, it should be stated that profitability in the present circumstances is more of values since most of the poultry produced were meant for household consumption. It is also important to emphasize that though the value of labour was estimated to be 126.00LE/month (US$21.88) or 1512LE/annum (US$262.61), it was not included in the analysis since no household poultry producer was willing to pay for such services. Furthermore, labour cost will significantly reduce profitability of the project by a margin of 63.27% (1512LE/2389.67LE), and this is not feasible for household poultry production.

Discussion of the results

In this study, the household poultry in Egypt is quantified in terms of parameters and its profitability estimated using survey data from the present field and questionnaire-based study. Critical inputs/outputs balance were evaluated and by far, feed (including concentrates and grains) remain to be the most important input in household poultry production in Egypt. While feed is critically important for household poultry in other

[*] At the time this analysis was carried out 1 USD = 5.7575 Egyptian pound (LE)

reports elsewhere, the percentages it constitute to the total input may not be as high as we have in this report (Sonaiya and Swan, 2004; Akinola and Essien, 2011). According to our estimation, feed took approximately 87% of the total costs of production (Tables 4 and 3), a situation that is similar to what obtains in the commercial sector (Ravindran and Blair, 1993). This approximate percentage, however, differs within individual households since no uniform standard of feeding was established. It is impracticable and economically not feasible to feed HHP with 100% commercial feed and remuneration for labour is equally not financially viable at the current level of productivity and prevailing market prices.

Though the mean flock size achieved in this analysis was 73, we are aware that district-based mean flock size differ significantly in view of key inter-districts and inter-governorates differences in flock structures and compositions based on certain prevailing circumstances. From our observations, flock compositions depend partially on the availability of supply of day-old-birds and supplement feeds. In areas where there were major hatcheries, chickens tend to play a more prominent roles compared to areas distant from such hatcheries. The mean flock size described in this report falls within the wide range of 10-20, up to a few hundred as described by Hosny, (2006). It was higher than that previously described (~52) by Geerlings, *et al.*, (2007) but slightly lower than that (90) described by Yakout, *et al*., (2009). The compositions of chickens, ducks and other birds (geese and turkeys) were similar to those reported by other workers (48-52%-chickens, 22-25%-ducks; Geerlings *et al*., 2007)

Though, the flock structures and composition varied based on seasons, no significant difference was observed (Table 2). This is probably associated with the dynamics of replacement and restocking of young and fattened birds all the year round. It is important to state that many of the household producers avoided raising waterfowl (ducks and geese) in the summer months (~May-September) due mainly to the extreme heat condition that result in high mortalities (up to 50%) in the young birds. The survey we carried out just before a major festivity revealed that an increasing numbers of fattened birds were reserved for such occasion and immediately post festivity, the increase shifted to the younger and growing birds (data not shown). These seasonal variations have also

been studied by Yakout *et al*., (2009) who reported that the winter months have the highest population of birds.

The method of household poultry production herein described is truly innovative in view of the optimization of limited land resources at the disposal of producers and improvement in the management system of Sector 4 poultry. This method also have improved health component since it excludes these birds from certain soil/land related poultry diseases (e.g internal parasites) and it represents a key contribution to the twin goals of hunger reduction and poverty alleviation amongst the rural communities. However, raising birds inside the accommodation where humans reside comes with the risks of human infections with poultry diseases (especially those with zoonotic potentials) mainly due to high degree on intensification and the close associations between man and these birds (Fasina *et al*., 2007; Fiebig *et al*., 2009; Hogerwerf *et al*., 2010).

The production parameters are good to excellent for household poultry production. The mean mortality of 14.19% is comparable to those obtained in controlled studies in Ethiopia (14%) (Demeke, 2007) but are far less than 30% (Hosny, 2006) and 60% reported for field cases of scavenging and rural poultry (Maphosa *et al*., 2004). We concluded that the intensification of household poultry in Egypt was responsible for this observed reduced mortality.

The hatchability of approximately 78% and 75% obtained respectively in ducks and goose were good for profitability in poultry business (Sonaiya and Swan, 2004). On average, 37 ducklings and 18 goslings are expected from each layer duck and goose per annum, respectively. It will be desirable to improve on the percentage egg production in chickens where values as low as ~33% were observed in certain instances. Fortunately, farmers who reported that they use vegetables and other household food leftovers had sustained higher percentage hen-day (data not shown). Such usage of vegetables and household food leftovers should be employed on a wider scale in the Egyptian household poultry. This practice if adopted will also optimally recycle leftover materials.

While we are aware that the profitability of the project as described in this analysis may be subjected to a variety of risks and uncertainties, we confirmed that such variations in the profitability of household poultry projects are compensated for by increasing price of key outputs (eggs and poultry meat) especially during important occasions and holidays.

Such holidays have been summed up to be about 93 days per annum (Geerlings *et al*., 2007). Since it is highly unlikely that the price of feed will remain high throughout the year as we used in this model, this will positively influence the profitability of the project.

It should be stressed that the huge proportions of the meat and eggs arising from the household poultry project analyzed herein (73 number mixed flock) are utilized within the household in meeting food security needs. However, the poorer families tend to sell these products and buy lesser qualitative food items and meet other household needs. In addition to meeting these needs and generating incomes, the birds and their products played key roles in the forms of investment, social security and benevolence (especially to widows, women with new births and newly wedded).

As previously emphasized in other report, avian influenza and Newcastle diseases are very important family poultry diseases (Branckaert, 2007). Our findings affirm these assertions. The emergence of HPAI H5N1 in Africa has become of particular concern to farmers and operators in the industry. This disease is of major concern in view of its fatalistic potentials and huge economic losses associated with it (Sonaiya, 2007; Akunzule *et al*., 2009; Sipahi *et al*., 2011).

Household poultry is important in Egypt, and will remain so for the foreseeable future. Advocacy for improved biosecurity within the sector is needed to reduce the chances of human infections by zoonotic diseases of poultry origin because of the intimate co-habitation (Fasina *et al*., 2007; Hogerwerf *et al*., 2010). The data provided in this report could be put into good use and serve as baseline information for future quantitative studies involving the Egyptian household poultry sector, while serving other purposes in policy formulations by the government concerning household poultry.

Conclusions

The Egyptian family poultry sector is profitable and compares favourably with what obtains elsewhere and can be used to improve livelihood of rural women and their family (Bagnol, 2009).

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Appendix 1

QUESTIONNAIRES FOR THE HOUSEHOLD POULTRY OPERATION

Governorate: _____ District:_____ Village:_____
Number (code) for the Household group: _____ Tel. of contact: _____
Name of the principal respondent: _____
Number of persons in the group: _____
Interviewer: _____ Date: _____

---

1) Total number of chicken observed:_____

   i. Chicks (3-9 weeks)_____
   ii. Pullets (10-18 weeks)_____
   iii. Hen (layer)_____
   iv. Hen (spent)_____
   v. Cock (for reproduction)_____
   vi. Cock (fattening)_____

Bird	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec

2) Total number of ducks observed: _____

   i. Duckling (3-9 weeks)___
   ii. Grower ducks(9-lay)___
   iii. Duck (layer)_____
   iv. Duck (spent)_____
   v. Drake_____
   vi. Duck (fattening)_____

Bird	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec

3) Total number of other species ( ) observed:_____

i. _____ iv. _____

ii. _____ v. _____

iii. _____ vi. _____

Bird	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec

4) What is the average mortality (Ck) between time of purchase and 9weeks?____

5) What is the average mortality (Ck) between after 9weeks to end of production?__

6) What is the average mortality (Dk) between time of purchase and 9weeks?____

7) What is the average mortality (Dk) between after 9weeks to end of production?__

8) How many chicken eggs do you collect per day?_____

9) How many duck eggs are laid on average per clutch?_____

10) How many times does your duck lay and hatch per year? _____

11) How many ducklings are hatched per one hatch?_____

12) How many (other species)_____ eggs are laid on average per clutch?_____

13) How many times does your (other Spp) _____ lay and hatch per year?

14) How many (other spp)_____ are hatched per one hatch?_____

15) Averagely, how often do you replace your old hen?_____

16) Averagely, how often do you buy 3-6weeks old chicken to replace old ones?____

17) How often /year do you sell off fattened chickens?_____

18) How often do you sell off spent hen?_____

19) How often do you replace old ducks?_____

20) How often do you buy ducklings or replacement ducks?_____

21) How often do you sell off fattened ducks?_____

22) How often do you replace other species (mention)?_____

23) How often do you buy replacement (other species)?_____

24) How often do you sell off fattened _____ (other spp)?_____

25) What quantity of commercial feed is given to your birds?_____

26) How much on average is a kilogramme of commercial feed?_____

27) What quantity of grains is given to your bird?_____

28) How much on average is the grain per kilogramme?_____

29) What other things do you feed to your birds?_____

_____.

30) How much is a 3-week-old growing chicken?_____

31) How much is a 6-week-old chicken?_____

32) How much is duckling sold for?_____

33) At what age do you sell your duckling?_____

34) Do you use straw/bedding in your poultry? _____

35) If yes, how much does it cost?_____

36) Do you pay for veterinary service?____. How much per month on average?_____

37) What vaccination do you give your birds?_____

38) How much do you pay for vaccination?_____

39) How much on average do you sell one egg?_____

40) How much on average do you sell your day-old baladi duck?_____

41) How much on average do you sell your fattened chicken/cock?_____

42) How much on average do you sell your fattened baladi duck?_____

43) How much on average do you sell your spent hen?_____

44) How much on average do you sell your spent duck?_____

45) How much do you sell other species?_____

46) How much do you sell any other products from the farm?_____

47) How much time do you spend in the poultry daily?_____

48) What quantity of feed do you give to:

i. Chicks (3-9 weeks)_____
ii. Pullets (10-18 weeks)_____
iii. Hen (layer)_____
iv. Hen (spent)_____
v. Cock (for reproduction)_____
vi. Cock (fattening)_____
vii. Duckling _____
viii. Duck (grower)_____
ix. Duck (layer)_____
x. Duck (spent)_____
xi. Duck (fattened)_____
xii. Drake _____
xiii. Goose
xiv. Adult geese

x

49) How much grains do you give to:

i. Chicks (3-9 weeks)_____
ii. Pullets (10-18 weeks)_____
iii. Hen (layer)_____
iv. Hen (spent)_____
v. Cock (for reproduction)_____
vi. Cock (fattening)_____
vii. Duckling _____
viii. Duck (grower)_____
ix. Duck (layer)_____
x. Duck (spent)_____
xi. Duck (fattened)_____
xii. Drake _____

50) Do you pay for transport to the market to sell chicken, ducks or eggs?____, How much?_____

51) Do you pay for cost to process your chicken/duck?___. How much?_____

52) Do you pay for repairs, maintenance and shoe replacement?____ If yes, how much?_____

53) How much does the building for your birds cost?_____

54) Do you raise the young bird separately?_____, How much do you use to house them?_____

55) After last HPAI outbreak how many days did you take before restocking?_____

56) Which of the biosecurity measures tabulated below is practiced or present in the farm? Tick all observed measures. If **"no"**, which one are you willing to adopt?

s/no.	**STRUCTURAL BIOSECURITY**	**Yes**	**No**	**Practicability**	**Willingness to adopt the measure**	**Associated costs per annum (LE)**
1	Restricted access					
2	Fence around premises					
3	Gate at entrance					
4	Composting litter before removal					
5	Wire mesh window					
6	Foot pans for disinfection before the house					

	OPERATIONAL BIOSECURITY					
7	Record keeping					
8	Food and water control					
9	Terminal (Post cycle) cleaning					
10	Routine(regular) cleaning					
11	Safe disposal of faeces and dead birds (is animal and insect proof)					
12	Quarantine new purchased birds for at least 10 days					
s/no.	**Measure**	**Yes**	**No**	**Practicability**	**Willingness to adopt the measure**	**Associated costs per annum (LE)**
13	Regular cleaning and disinfection of					

	feeders and drinkers					
14	Sufficient feeding and watering space available for all birds					
15	Sufficient space for each bird (No overcrowding)					
16	Remove manure and litter routinely.					
17	Usage of Disinfectant after cleaning					
18	Lock for each house					
19	Assess Health status of birds coming in					
20	Do not mix different ages					
21	Do not mix different species					
22	All-in all-out production					
23	Hand sanitizer, gloves and washing					
24	Going from young to older birds					
25	Change clothing when going in/out					
26	Separate sick birds					
27	Consult with a veterinarian in case of sick birds					
28	Change rubber boots/slippers					
29	Wash/disinfect equipment and tools					
30	Do not borrow equipment from neighbors					
31	Downtime $\geq$ 2 weeks					
32	Pest control (rodents & insects)					
33	Prompt sick/ dead bird disposal from the farm					
34	Removing litter after each flock					
35	Change solution in foot pans regularly					
36	Auditing: incentives, education, adherence (encourage assistants to adhere to biosecurity)					

Thank you for your time and patience.

APPENDIX 2.

Appendix 1. Profitability analysis of the household poultry for a 73 number mixed flocks of chicken, ducks and geese				
INPUTS/COSTS INCURRED				
Feed costs			**Total feed/annum**	**total cost/annum**
Commercial feed	**Mean Feed/Bird/Day**	Assuming the standard of 50g for 1-9 week-old, 96g for 10-18 week-old and 120g for >18 weeks		
Chicken-Immatures (3 to 9 weeks of age)	42g	(42g x 12 chicks x 365 days/ 1000) x 3LE	183.96kg	551.88LE
Pullets (9 weeks until laying)	21g	(21g x 10 chickens x 365 days/ 1000) x 3LE	76.65kg	229.95LE
Hens-Layers	21g	(21g x 7 chickens x 365 days/ 1000) x 3LE	53.66kg	160.97LE
Hens-Spent	21g	(21g x 0 chickens x 365 days/ 1000) x 3LE	0kg	0
Cock-For reproduction	21g	(21g x 1 chickens x 365 days/ 1000) x 3LE	7.67kg	23.00LE
Cockerels-For consumption and sale	21g	(21g x 10 chickens x 365 days/ 1000) x 3LE	76.65kg	229.95LE
Ducks-Immature (up to 9 weeks of age)	41g	(41g x 8 ducklings x 365 days/ 1000) x 3LE	119.72kg	359.16LE
Ducks-9 weeks until laying	19g	(19g x 0 ducks x 365 days/1000) x 3LE	0kg	0
Ducks-Layers	19g	(19g x 4 ducks x 365 days/1000) x 3LE	27.74kg	83.22LE
Ducks-Spent	19g	(19g x 0 ducks x 365 days/1000) x 3LE	0kg	0
Ducks-Drake	19g	(19g x 2 drakes x 365 days/1000) x 3LE	13.87kg	41.61LE
Ducks-Fattening	19g	(19g x 11 ducks x 365 days/1000) x 3LE	76.29kg	228.86LE
Geese-goose and gander	20g	(20g x 3 geese x 365 days/1000) x 3LE	21.90kg	65.70LE
Geese-Day Old	50g	(50g x 18 gooslings x 14 days/1000) x 3LE	12.60kg	37.80LE
Geese-Fattened	20g	(20g x 5 fattened goose x 365 days/1000) x 3LE	36.50kg	109.50LE
Grain purchased/used	**Grain/bird/day**			
Chicken-Immatures (3 to 9 weeks of age)	0	(0g x 12 chicks x 365 days/ 1000) x 2LE	0kg	0
Pullets (9 weeks until laying)	39g	(39g x 10 chickens x 365 days/ 1000) x 2LE	142.35kg	284.70LE
Hens-Layers	52g	(52g x 7 chickens x 365 days/ 1000) x 2LE	132.86kg	265.72LE
Hens-Spent	52g	(52g x 0 chickens x 365 days/ 1000) x 2LE	0kg	0
Cock-For reproduction	52g	(52g x 1 chickens x 365 days/ 1000) x 2LE	18.98kg	37.96LE
Cockerels-For consumption and sale	52g	(52g x 10 chickens x 365 days/ 1000) x 2LE	189.80kg	379.60LE
Ducks-Immature (up to 9 weeks of age)	0	(0g x 8 duckling x 365 days/1000) x 2LE	0kg	0
Ducks-9 weeks until laying	41g	(41g x 0 ducks x 365 days/1000) x 2LE	0kg	0
Ducks-Layers	54g	(54g x 4 ducks x 365 days/1000) x 2LE	78.84kg	157.68LE
Ducks-Spent	54g	(54g x 0 ducks x 365 days/1000) x 2LE	0kg	0

Ducks-Drake	54g	(54g x 2 drakes x 365 days/1000) x 2LE	39.42kg	78.84LE
Ducks-Fattening	54g	(54g x 11 ducks x 365 days/1000) x 2LE	216.81kg	433.62LE
Geese-Goose and gander	53g	(53g x 3 geese x 365 days/1000) x 2LE	59.13kg	118.26LE
Geese-Day Old	0	(0g x 18 gooslings x 14 days/1000) x 2LE	0kg	0
Geese-Fattened	53g	(53g x 5 fattened goose x 365 days/1000) x 2LE	96.73kg	193.46LE
Others (Barseem/Old bread/Seriss/Leftovers)	43g	43g x (73-20 young ones) x 365/1000 x No cost	831.84kg	0
		Total feed costs per annum		**4,071.44LE**
Other variable costs	**Costs**			
Bedding	20LE/annum			20.00LE
Marketing	10LE/annum			10.00LE
Overhead (registration, legal, accounting)	0			
Power & fuel (gas, oil, propane, etc.)	0			
Processing costs (off farm costs)	0			
Repairs & maintenance (Shoes, pest control, sanitation, netting)	60LE/annum			60.00LE
Birds-Chicken 3 weeks	222.32LE/annum	3.58X x 11.5chicken(discount for 15% mortality) x 5.4LE		222.32LE
Gosling (for fattening)	0	Home produced		0
Birds-Ducks	0	Home produced		0
Utilities (electric, telephone, etc.)	0			
Utilities (disposal)	0			
Veterinarian	52LE/annum			52.00LE
Medicine	0			
Vaccines (HPAI)	0			
Vaccines (Others)	0			
Interest (on operating costs)	0			
Fixed costs				
Permanent buildings (depreciation). Value of building is 1000 EP. Depreciation is over 10 years	1000LE/10years= 100/year=8.3/mnth			100.00LE
Insurance	0			
Cages (depreciation). Depreciation is 5years.	100LE/5years=20/year =1.67/mnth			20.00LE
Equipment (depreciation) (4feeder and 4	60LE/3year=20/year			20.00LE

drinker)	=1.67/mnth			
Egg trays	0			
Processing buildings (depreciation and tax)	0			
Processing equipment (depreciation and tax)	0			
		Total variable and fixed costs		**4,575.76LE**
Labour costs (excluding extra Biosecurity measures)				
Paid production labor cost	0			
Paid processing labor cost	0			
Paid marketing labor cost	0			
Unpaid production labor value	0			
Unpaid processing labor value	0			
Unpaid marketing labor value	0			
Costs of extra Biosecurity measures				
Equipment/materials/tools for implementation	72±30LE	Upper range of 102LE was used for calculation		**102.00LE**
Unpaid biosecurity labor value	0			
TOTAL INPUTS PLUS BIOSECURITY				**4677.76LE**
OUTPUTS/RECEIPTS				
Sales - Home consumption - Gifts				
Value of chicken eggs produced	1216.82LE	63.5% x 7ck x 365 days x 0.75LE		
Value of slaughter chicken produced	867.79LE	10ck x 24.24LE x 3.58X		
Value of spent hens produced	134.00LE	8ck x 16.75LE x 1X		
Value of DOD produced	1,321.92LE	36.72 offspring x 4dk x 9LE		
Value of slaughter ducks produced	1,690.63LE	3.455X x 11dk x 44.42LE		
Value of spent ducks produced	61.32LE	0.5X x 6 dk x 20.44LE		
Value of Day old geese produced	972.95LE	17.69 offspring x 2geese x 27.50LE		
Value of slaughter geese produced	700LE	10 geese x 70LE		
Income from feather sales	0			
Income from manure sales	0			
Income from miscellaneous sales	0			
Any other income	0			

Total Output	**6, 965.43LE**	**Total Output= 6,965.43LE**		
Profit = Total outputs less Total costs		6,965.43-4575.76 = **2,389.67LE**		**2,389.67LE**
Profit with biosecurity = Total outputs less (Total costs + Biosec).		6,965.43-4575.76-102.00 = **2,287.67LE**		**2,287.67LE**

Assuming that the standard average quantity of feed of 50g will be for 1-9 week-old, 96g for 10-18 week-old and 120g for >18 weeks.
Note that the prevailing exchange rate is 5.7575LE = US$1.00.

1. Total costs of feed, grains and other feed items consumed by each group of birds per annum were calculated thus: **Fbd*Bn*Cd*P/u**. Where **Fbd** is Feed/bird/day; **Bn** is Number of birds; **Cd** is Number of days in the cycle; P/u is Price per unit.
2. 3-week-old chicken inputs were calculated thus: **Cn*Bn(discounting for chicks mortality)*P/u**. Where **Cn** is the Number of cycle per annum; **Bn**(discounting for chicks mortality) is the Number of birds (discounting for 14.19% chicks mortality); P/u is the price per unit.
3. Cost of biosecurity was calculated thus: $\sum B_{1\text{-}n}$. Where B_1 is Biosecurity item 1, B_2 is biosecuroty item 2 and B_n is Biosecurity item nth.
4. Total Inputs (Ti) = ∑Tfc.Ovc.Fc.Lc. Where Tfc is Total feed costs; Ovc is other variable costs; Fc is fixed costs and Lc is labour and other costs. The total inputs may include or exclude Biosecurity costs (Bioc) based on the model in use.
5. Value of chicken eggs produced = % production*Ln*Cd*P/u. where Ln is number of active laying birds.
6. Value of slaughtered chickens, spent hens, ducks, spent ducks, and geese = Bn*Cn*P/u
7. Value of Day-old-ducks and day-old-gosling produced = No*Ln*P/u (No is number of offspring; It is calculated based on the average number of eggs per clutch, number of clutch per annum and mean percentage hatchability).
8. Total Output (To) = ∑Vce.Vc.Vsh.Vdod.Vsd.Vd.Vdog.Vg. Where Vce is the value of chicken eggs; Vc is the value of slaughtered chickens; Vsh is the value of spent hen; Vdod is the value of day-old-ducks; Vd is the value of ducks; Vsd is the value of spent ducks; Vdog is the value of day-old gosling and Vg is the value of geese.
9. Annual Profit margin = To – Ti(±Bioc).