# Knowledge, attitudes, and practices of avian influenza among backyard poultry breeders in Fayoum Governorate, Egypt

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**Background**
Avian influenza (H5N1) (AI) is becoming a serious public health threat in Egypt. The current study aimed to assess the existing knowledge, attitudes, and various practices regarding AI in household backyard poultry breeders residing in Fayoum Governorate, in rural Egypt.

**Material and methods**
Of the 149 cases confirmed to date in Egypt, 51 have been fatal. This study was implemented in El Gendy and Manshat Abdllah villages in Fayoum Governorate. The latter village is the one in which a case of AI was confirmed in February 2007. A group of 150 women aged 15 years and above were recruited. A structured Arabic questionnaire was used to collect data.

**Results**
All interviewed women ($N=150$) had heard about AI. TV\radio was the common source of information (83.3%). Nearly all interviewed women knew that AI is transmitted from birds to humans (99%). Most of the participants (>90%) correctly identified saliva, nasal secretions, feces, and contaminated vehicles as the modes of AI transmission. The knowledge regarding biosecurity measures (>70%) and measures of prevention (>90%) was generally good. More than 90% of the interviewed housewives agreed that AI is a serious disease that can be prevented, and that sanitary precautions during breeding and food preparation practices are effective measures for prevention of AI infection. Protective measures such as the use of gloves and masks, which minimize the risk of transmission of AI from poultry to humans, were seldom used by housewives in all their breeding, slaughtering, and cooking practices. However, washing hands either with water or with soap and water was reported by the vast majority of the respondents (>90%).

**Conclusion and recommendation**
There was a good level of knowledge and favorable attitude of the study participants regarding AI; however, practices appear to be inadequate to achieve full protection against AI. Comprehensive and multidisciplinary interventions should be widely used to enhance the complex behavior change process among the village residents.

**Keywords:**
avian influenza, backyard breeders, Egypt, H5N1, KAP

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## Introduction

Avian influenza (AI) is an infectious disease of birds caused by type-A strains of the influenza viruses [1]. The AI (A/H5N1) virus has the potential to cause devastating effects to poultry flocks and humans. Initially confined to Southeast Asia, the virus has migrated to the Middle East, Europe, former Soviet Union satellites, and Africa [2].

Of all influenza viruses that circulate in birds, the H5N1 virus is currently of greatest concern for human health for two main reasons. First, the H5N1 virus has caused by far the greatest number of human cases of very severe disease and the greatest number of deaths. A second implication for human health, of far greater concern, is the risk that the H5N1 virus, if given enough opportunities, will develop the characteristics it needs to start another influenza pandemic [1]. In recent years, highly pathogenic AI type-A viruses of the H5N1 subtype have crossed the species barrier and infected humans in many parts of the world [3].

Several epidemiologic studies have been published to evaluate the risk factors, including contact with poultry and poultry products and non-poultry-related contact such as from H5N1-contaminated water, for H5N1 infection in humans. Evidence from the published literature has illustrated that exposure to the H5N1 virus has occurred through contact with infected poultry blood or bodily fluids through food preparation practices,

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consuming uncooked poultry products, or through the care of poultry (either commercially or domestically) [4].

AI (H5N1) is becoming a serious public health threat in Egypt. It was confirmed in Egypt in February 2006. Since then, the virus has spread in 21 governorates, affecting hundreds of poultry farms. Of the 149 cases confirmed to date in Egypt, 51 have been fatal [3]. Almost all of the currently recorded human cases of AI H5N1 have reported close contact with diseased poultry [4,5].

Very little data exist that reveal the current level of awareness of AI and household behavior related to backyard poultry breeding in Egypt. In an attempt to gain a better understanding of this situation, the current study aimed to assess the existing knowledge, attitudes, and various practices undertaken by backyard household poultry breeders in rural Egypt. This will help in the provision of baseline diagnostic data for communication and health education strategies targeting these high-risk groups.

## Materials and methods

### Study design and setting

This cross-sectional study was implemented in El Gendy and Manshat Abdllah villages in Fayoum Governorate. Ezbat Elgendy was selected as one of the hotspots of AI in Fayoum governorate by Ministry of Health and Population surveillance professionals. The Manshat Abdallah village is the one in which a case of AI was confirmed in February 2007.

A group of 150 women aged 15 years and above were recruited for the current study. They represented all housewives in Elgendy village ($N = 95$). In Manshat Abdellah village, a representative sample of households was taken to cover geographic quadrant where a case of AI was diagnosed. The village is composed of 6 zones; the zone where the case appeared was chosen for the current study, this zone included 430 households. We selected all housewives in the street where the case resided, and every 10th house in the rest of the zone. All housewives responded except the mother of the case. A total sample of 55 women was interviewed.

A specially developed structured Arabic questionnaire based on relevant studies was constructed [6–8]. It was designed to assess the sociodemographic characteristics, knowledge (symptoms of the disease in birds and humans, types of birds affected, transmission and measures of prevention of disease in birds and humans, and sources of these information), attitude, and practices (breeding practices such as breeding places, mixing species, wandering practices, special precautions when coming in contact with birds and whether keeping children away from poultry places, and also slaughtering, cleaning, and cooking practices) of backyard poultry breeders and nonbreeders concerning AI. The questionnaire was pretested, and adjustments were conducted accordingly. The time needed for filling the questionnaire ranged between 20 and 30 min.

### Statistical analysis

The collected data were computerized and analyzed using the Statistical Package for Social Science (SPSS, Inc., Chicago, Illinois, USA) version 12. On data entry, all responses were verified for completeness and logical consistency, and translated to English to facilitate data manipulation.

Data were summarized using descriptive statistics such as percentage, arithmetic mean, and SD. At the stage of data analysis, a scoring system was used for both knowledge and attitude questions. The correct answer was given a score of 1 and the wrong answer (and do not know) was given a score of 0. The knowledge score was calculated for transmission questions covering 15 items, biosecurity measures covering seven items, and preventive measures covering 16 items. The total knowledge score was calculated by summation of the total items for transmission, biosecurity, preventive measures, and three items of source of infection (types of birds affected and role of domestic ducks in the epidemiology of AI). A total score of 41 was computed and used to compare between groups. A cut-off point was determined on the basis of the median value of the total knowledge score of at least 34. Housewives at or above the median value were classified as having good knowledge, whereas those having a total knowledge score less than the mean value were classified as having poor knowledge. Attitude score to AI and governmental legislation was calculated covering 11 items and was coded, with a value of 2 for 'agree responses,' 1 for 'don't know responses,' and 0 for 'disagree responses' (ranged from 0 to 22). Student *t*-test and analysis of variance were used to compare quantitative data, whereas the $\chi^2$-test was used for qualitative data. The crowdedness index was calculated by dividing the number of persons within the household by the number of rooms; a cut-off point of 2 was used ($\leq 2$ as a low-crowdedness index and $> 2$ as a high-crowdedness index) [9].

## Results

A group of 150 housewives, 63.3% from EL Gendy village and 36.7% from Manshat Abdllah village, were recruited for the current study. The mean age was $36.45 \pm 10.84$ years (ranging from 19 to 70 years). Nearly half of the respondents were illiterate (46%) and 92.7% were married (92.7%). Around half of the husbands (43.9%) were illiterate and were working as farmers (40.3%). The majority of households were poultry breeders (78.3%), with a mean crowdedness index of $1.64 \pm 0.52$ (Table 1).

### Knowledge of the study group about avian influenza

All interviewed housewives heard about AI. TV\radio was the common source of information (83.3%), followed by friends and relatives (56%) and social workers (31.3%). The majority of housewives (85.3%) were aware of the symptoms of AI in birds. From a total score of 7, the mean knowledge score of 128 housewives regarding the symptoms of AI in poultry was $1.77 \pm 0.85$, and it ranged from 0 to 4. Nearly half of the housewives (50.7%) were

**Table 1. Distribution of the interviewed housewives according to their total knowledge score by sociodemographic data and breeding habits**

| | No (%) | Mean of total knowledge score (SD) | Significance *P-value |
|---|---|---|---|
| Residence | – | – | – |
| El Gendy | 95 (63.3) | 34.13 (3.9) | 0.096 |
| Manshat Abdlla | 55 (36.7) | 34.6 (6.3) | – |
| Education | – | – | – |
| Illiterate | 69 (46.0) | 32.17 (4.8) | 0.00* |
| Read and write | 16 (10.7) | 32.87 (6.8) | – |
| Primary | 11 (7.3) | 33.72 (4.9) | – |
| Preparatory | 8 (5.3) | 37.37 (1.7) | – |
| Secondary | 40 (26.7) | 37.57 (2.1) | – |
| University | 6 (4.0) | 37.83 (1.5) | – |
| Crowdness index | – | – | – |
| $\leq 2$ | 125 (83.3) | 33.56 (6.7) | 0.224 |
| $>2$ | 25 (16.7) | 34.45 (4.5) | – |
| Husband's education | – | – | – |
| Illiterate | 41 (43.9) | 32.07 (5.3) | 0.00* |
| Read and write | 20 (14.4) | 34.15 (2.4) | – |
| Primary | 12 (8.6) | 32.41 (7.5) | – |
| Preparatory | 6 (4.3) | 33.16 (3.9) | – |
| Secondary | 47 (33.8) | 36.68 (3.3) | – |
| University | 12 (8.6) | 37.83 (1.1) | – |
| Husband's occupation | – | – | – |
| Farmer | 56 (40.3) | 34.07 (3.4) | 0.009* |
| Employed | 29 (20.9) | 37.03 (2.6) | – |
| Skilled worker | 14 (10.1) | 36.0 (2.6) | – |
| Worker | 13 (9.5) | 34.23 (3.8) | – |
| Arzoki (no regular work) | 25 (18) | 32.36 (8.0) | – |
| Retired | 2 (1.4) | 30.50 (2.6) | – |
| Breeding poultry | – | – | – |
| Yes | 118 (78.3) | 34.38 (3.9) | 0.014* |
| No | 32 (23.7) | 34.03 (7.6) | – |
| Fear of infection with AI | – | – | – |
| Yes | 109 (72.7) | 35.33 (3.4) | 0.00* |
| Sometimes | 30 (20.0) | 30.03 (4.4) | – |
| No | 11 (7.3) | 27.54 (10.7) | |

AI, avian influenza.
*$P$-value of student $t$-test for comparing between two subgroups, analysis of variance test for comparing between more than two subgroups.

aware of the symptoms of AI in humans. Among this knowledgeable group, fever and cough were the most commonly reported symptoms in humans (94.8 and 63.2%, respectively), whereas complications such as pneumonia, respiratory distress, and conjunctivitis were reported only by 6.6% of this group. From a total score 5, the mean knowledge score of 76 housewives regarding the symptoms of AI in humans was $1.88 \pm 0.79$ and it ranged from 0 to 4.

Fifty-eight percent of the interviewed housewives correctly identified that all types of birds are affected by AI. Less than half (40%) of the study group identified that ducks are affected late by AI, and only 26% of these women knew that ducks may show no symptoms despite harboring AI infection. Nearly all the interviewed housewives knew that AI is transmitted from birds to humans (99%). The majority ($>90\%$) correctly identified saliva, nasal secretions, feces, and contaminated vehicles as modes of AI transmission to humans (Table 2).

The knowledge of the study group regarding biosecurity measures was generally good ($>70\%$ of the study group correctly identified biosecurity measures). From a total score of 7, the mean knowledge score regarding biosecurity measures was $6.17 \pm 1.09$, and it ranged from 2 to 7 (Table 3). Similarly, the knowledge of the housewives with regard to the measures of prevention was high ($>90$), except for one measure: avoiding the use of bird excreta as manure, to which less than half of the interviewed housewives (42%) reported the correct answer. From a total score of 16, the mean knowledge score for prevention measures of AI infection was $14.97 \pm 1.79$, and it ranged from 4 to 16.

We also examined the total mean knowledge scores in relation to the different socio-demographic subgroups. The mean knowledge scores differed between housewives according to the husbands' occupation and the level of education of both the housewives and their husbands ($P<0.01$). Also, the total mean knowledge score was significantly higher in poultry breeders compared with nonbreeders ($P<0.05$) and in those who believed that they were at high risk of contracting AI ($P<0.01$) (Table 1).

### Attitude of the study group toward avian influenza

Our results revealed that over 90% of the interviewed housewives agreed that AI is a serious disease that can be prevented, and that following sanitary precautions during breeding and food preparation practices is an effective way of protection from infection with AI. Despite the perception of more than 70% of the participants that AI is a serious problem in Egypt, a large proportion believed that the government is taking sufficient measures to control the disease and that the government efforts are for their own protection (67.3 and 86%, respectively) (Table 4).

**Table 2. Distribution of the interviewed housewives by their knowledge regarding avian influenza transmission**

| AI transmission | Yes no. (%) | No no. (%) | Do not know no. (%) |
|---|---|---|---|
| From wild birds to domestic birds | 123 (82.0) | 0 (0) | 27 (18.0) |
| From birds to humans | 149 (99.3) | 0 (0) | 1 (0.7) |
| Exposure to birds during breeding practices and in live birds markets | 134 (89.3) | 6 (4.0) | 10 (6.7) |
| Eating properly cooked eggs and poultry[a] | 3 (2.0) | 139 (92.7) | 8 (5.3) |
| Eating improperly cooked eggs and poultry | 100 (66.7) | 6 (4.0) | 44 (29.3) |
| Water contaminated with avian influenza viruses | 85 (56.7) | 7 (4.7) | 58 (38.6) |
| Touching cages of infected birds | 140 (93.3) | 1 (0.7) | 9 (6.0) |
| Vehicles, equipment, and surfaces contaminated with secreta or excreta of infected birds | 142 (94.6) | 1 (0.7) | 7 (4.7) |
| Saliva and nasal secretion of infected birds | 148 (98.7) | 0 (0) | 2 (1.3) |
| Feces and excreta of affected birds | 146 (97.3) | 1 (0.7) | 3 (2.0) |
| Feathers of infected birds | 118 (78.7) | 22 (14.7) | 10 (6.7) |

AI, avian influenza.
[a]No is the correct answer.

**Table 3. Distribution of the interviewed housewives by their knowledge regarding biosecurity measures**

| Biosecurity measures | Yes[a] no. (%) | No no. (%) | Do not know no. (%) |
|---|---|---|---|
| Thoroughly and routinely cleaning equipment, vehicles, cages and disinfecting them | 148 (98.7) | 2 (1.3) | 0 (0) |
| Preventing the exposure of bird food and water to wild birds | 142 (94.7) | 2 (1.3) | 6 (4.0) |
| Keeping new birds separate from the rest of the flock for at least 2 weeks | 139 (92.7) | 5 (3.3) | 6 (4.0) |
| Separating the poultry from living places | 113 (75.3) | 28 (19.3) | 8 (5.3) |
| Separation between different types of birds | 108 (72.0) | 23 (15.3) | 19 (12.7) |
| Vaccination of poultry when advised by local authorities | 144 (96.0) | 2 (1.3) | 4 (2.7) |
| Getting rid of all birds in the flock if any case appears | 125 (83.3) | 7 (4.7) | 18 (12) |

[a]Yes is the correct answer.

**Table 4. Distribution of the interviewed housewives by their attitude toward avian influenza and government legislation**

| Attitudes | Agree[a] no. (%) | Do not agree no. (%) | Do not know no. (%) |
|---|---|---|---|
| Avian flu is a serious disease | 141 (94.0) | 4 (2.7) | 5 (3.3) |
| Avian flu is a preventable disease | 146 (97.3) | 2 (1.3) | 2 (1.3) |
| Dealing correctly with live birds is an effective way to protect from exposure to avian flu | 144 (96.0) | 3 (2.0) | 3 (2.0) |
| Dealing correctly with birds during food preparation is an effective way to protect from exposure to avian flu | 143 (95.3) | 3 (2.0) | 4 (2.7) |
| Avian Flu is a serious problem in Egypt | 110 (73.3) | 9 (6.0) | 31 (20.7) |
| The avian flu problem is increasing | 60 (40.0) | 49 (32.7) | 41 (27.3) |
| Egypt is capable of eliminating AI | 87 (58.0) | 25 (16.7) | 38 (25.3) |
| Confidence in the information told by officials about AI | 123 (82.0) | 17 (11.3) | 10 (6.7) |
| Some of the affected AI human patients died. | 131 (87.3) | 15 (10.0) | 4 (2.7) |
| Efforts made by the government are sufficient to control AI | 101 (67.3) | 34 (22.7) | 15 (10.0) |
| Efforts made by the government are for protecting you and your family from AI | 129 (86.0) | 11 (7.3) | 10 (6.7) |

AI, avian influenza.
[a]Agreeing with the above statements is considered a positive attitude.

From a total score of 22, the mean attitude score toward AI and government legislations was $18.62 \pm 2.70$, and it ranged from 10 to 22.The total attitude score was significantly related to the level of education of the housewives ($P<0.05$) and their total knowledge score. The mean attitude score was significantly higher among housewives with good knowledge (total knowledge score $\geq 35$) compared with housewives with poor knowledge (total knowledge score $<35$) (19.1 vs. 18, $P$-value $<0.05$). Furthermore, the mean attitude score was significantly higher among housewives who feared to be affected by AI than those who did not (18.9 vs. 14.5, $P$-value $<0.01$) (data not shown).

### Breeding, slaughtering, and cooking practices by the study group

The breeding, slaughtering, and cooking practices were explored in the study group (Table 5). We found that the majority (78.3%) of the group were poultry breeders and were slaughtering their poultry at home (84.7%). The common place of breeding poultry was on the roof of the house inside a cage (50.8%), and only 7% of poultry breeders did that in a separate place (Table 5).

Our results revealed that protective measures such as the use of gloves and masks, which minimize the risk of transmission of AI from poultry to humans, were seldom used by housewives in all their breeding, slaughtering, and cooking practices. For example, a small percent of poultry breeders wore gloves while caring for poultry or cleaning their places (5.1%), and almost none was continuously wearing face masks. However, washing hands either with water or with soap and water was reported by the vast majority of the respondents ($>90\%$) in their poultry breeding, slaughtering, and cooking practices. With regard to the methods of getting rid of

**Table 5. Practices of the interviewed housewives regarding poultry breeding, slaughtering, and cooking practices**

| Practices | No. (%) |
|---|---|
| Breeding poultry (yes) | 118 (78.7) |
| Vaccinating poultry (*n*=118) (yes) | 102 (87.0) |
| Place of breeding (*n*=118) | – |
| On the roof of the house | 69 (58.4) |
| Inside the house | 16 (13.6) |
| Outside the house | 33 (28.0) |
| Mixing different kinds in the same place (*n*=118) (yes) | 72 (61.0) |
| Whether birds were kept in a closed place or roam freely (*n*=118) | – |
| Always in a closed place | 23 (19.5) |
| Always roam freely | 18 (15.2) |
| Sometimes in a closed place (part of the day) | 77 (65.3) |
| The person responsible for caring for these birds (*n*=118) | – |
| The woman herself | 65 (55.0) |
| Any person in the family | 53 (45.0) |
| The person responsible for collecting eggs (*n*=118) | – |
| The woman herself | 54 (45.8) |
| Any person in the family | 64 (54.2) |
| Cleaning poultry places regularly (*n*=118) (yes) | 117 (99.2) |
| Methods of getting rid of excreta after cleaning (*n*=118) | – |
| Used as a manure | 52 (44.4) |
| Thrown in the ponds and canals/streets/garbage | 45 (38.1) |
| Burnt | 20 (11.1) |
| Using protective clothing while cleaning or feeding poultry (e.g. gloves/masks) (*n*=118) (yes) | 6 (5.1) |
| Washing your hands with soap and water after feeding birds or cleaning yard (*n*=118) (yes) | 116 (98.3) |
| Letting children play beside poultry (*n*=118) (yes) | 41 (34.7) |
| Letting children help in breeding practices and collecting eggs (*n*=118) (yes) | 5 (4.2) |
| Slaughtering birds at home (*n*=150) (yes) | 127 (84.7) |
| Wearing gloves or plastic bags or face masks while slaughtering (*n*=127) (yes) | 2 (1.6) |
| Washing hands after slaughtering and cleaning (*n*=127) (yes) | 126 (99.2) |
| Methods of washing (*n*=127) | – |
| With water only | 6 (4.7) |
| With soap and water | 120 (94.5) |
| With disinfectant | 1 (0.8) |
| Using the same knife for slaughtering and other cooking purposes (*n*=127) | – |
| yes (after washing it with soap and water) | 111 (87.4) |
| No | 15 (11.8) |
| Methods of getting rid of feathers and other remnants (*n*=127) | – |
| Thrown in the street/canals/garbage | 107 (89.3) |
| Buried or burnt | 20 (15.7) |
| Wearing gloves before dealing with birds and eggs for cooking (*n*=150) (yes) | 3 (2.0) |
| Washing hands with soap and water after dealing with birds and eggs for cooking (*n*=150) (yes) | 149 (99.3) |
| Washing poultry meat before cooking (*n*=150) (yes) | 150 (100) |
| Methods of washing poultry meat (*n*=150) | – |
| Wash with water and salt/flour | 139 (92.7) |
| Wash with water | 11 (7.3) |
| Washing eggs before cooking and boiling (*n*=150) (yes) | 84 (55.3) |
| Eating improperly cooked eggs (*n*=150) (no) | 143 (95.3) |
| Eating improperly cooked meat (*n*=150) (no) | 149 (99.3) |
| Using the same the utensils and surfaces for cooking poultry meat and for cooking vegetables and other food (*n*=150) (no) | 150 (100) |
| Methods of washing utensils and surfaces (*n*=150) | – |
| Water | 1 (0.7) |
| Soap and water | 149 (99.3) |

bird excreta after cleaning, nearly half of the respondents used it as manure (44.4%), and it was burnt by only 11.1% (Table 5).

We also found a significant association between the level of knowledge and sound practices. For example, the mean total knowledge scores were significantly higher in housewives who always kept their poultry in a closed place compared with those who allowed poultry to roam freely ($P<0.01$) (Table 6).

**Table 6. Distribution of the interviewed housewives according to their total knowledge scores by the different practices**

| Practices | Mean knowledge scores (SD) | *P*-value (student *t*-test/ANOVA) |
|---|---|---|
| Keeping birds in a closed place (*n*=118) | – | – |
| Always roam freely | 31.61 (4.1) | 0.001* |
| Sometimes in a closed place | 34.51 (3.8) | – |
| Always in a closed place | 36.08 (3) | – |
| Using special clothes or shoes while cleaning or feeding poultry (*n*=118) | – | – |
| Yes | 37.95 (3.9) | 0.047* |
| No | 33.12 (1.9) | – |
| Methods of getting rid of bird excreta after cleaning (*n*=117)[a] | – | – |
| Used as a manure | 33.75 (3.28) | 0.003* |
| Thrown in the ponds and canals | 33.07 (4.9) | – |
| Thrown in the streets | 33.83 (5.77) | – |
| Thrown in the garbage | 36.30 (3.02) | – |
| Burnt | 37.07 (2.32) | – |
| Eating improperly cooked eggs (*n*=150) | – | – |
| Yes | 29.14 (10.4) | 0.002* |
| No | 34.54 (4.4) | |

ANOVA, analysis of variance.
[a]One person was missing.
*Significant at $P<0.05$.

### Perceived roles played by different parties in the management of an avian influenza outbreak

Finally, we explored the study group's perception of the roles played by different parties in controlling AI. Vaccination of poultry emerged as the most commonly recommended measure to be adopted by individuals (46.7%), farm owners (47.3%), and the government to control AI (46.0%). Care when in contact with birds, especially diseased birds (26.0%), was the second recommended measure at the individual level, whereas compensating the affected poultry breeders (12.0) was the second recommended measure at the governmental level (Table 7).

## Discussion

This study aimed to provide information on AI-related knowledge, attitudes, and practices of backyard poultry breeders and nonbreeders in two villages in Fayoum governorate. We found that all housewives were aware of AI. The main sources of information were television (83.3%) and social workers who were trained in providing information on AI following the Ministry of Health and Population projects (31.2%). These findings were consistent with findings from many studies [6,7,10]. For example, a national survey on AI-related knowledge, attitude and practice (KAP) conducted by El-Zanaty *et al.* (2007) found that approximately nine in 10 respondents reported exposure to AI messages through any source, with the highest exposure through TV [8]. Similarly, El-Ghourory [11] found that the TV was the most

**Table 7. Distribution of the interviewed housewives by their perception of the expected role of individuals and officials in the prevention and control of avian influenza**

| Control measures | No. (%) |
|---|---|
| The role of individuals in controlling AI[a] | – |
| Cessation of backyard poultry breeding | 36 (24) |
| Vaccination of poultry | 70 (46.7) |
| Preventing exposure of the poultry to wild birds | 14 (9.3) |
| Proper cooking of eggs and poultry | 6 (4) |
| Reporting diseased poultry or dead poultry to local authorities | 20 (13.3) |
| Care when in contact with birds, especially diseased | 39 (26) |
| Don't know | 14 (9.3) |
| The role of organized farm owners in controlling AI[a] | – |
| Avoid importing poultry | 3 (2) |
| Vaccination of poultry | 71 (47.3) |
| Culling diseased poultry in a safe way | 7 (4.7) |
| Reporting diseased poultry or dead poultry to local authorities | 29 (19.3) |
| Getting rid of poultry excreta in a safe way | 10 (6.7) |
| Do not know | 55 (36.7) |
| The role of poultry traders in controlling AI[a] | – |
| Avoid selling live birds | 2 (1.3) |
| Buying and selling vaccinated birds only | 28 (18.7) |
| Reporting diseased poultry or dead poultry to local authorities | 2 (1.3) |
| Getting rid of poultry excreta in a safe way | 6 (4) |
| Avoid selling diseased birds | 89 (59.3) |
| Don't know | 31 (19.6) |
| The role of the government in controlling AI[a] | – |
| Providing alternative to poultry meat | 10 (6.7) |
| Compensation of the affected poultry breeders | 18 (12) |
| Providing enough vaccines | 69 (46) |
| Regular observation of the poultry markets | 11 (7.3) |
| Providing a secure landfill for burying dead and culled birds | 1 (0.7) |
| Increase awareness campaigns about AI | 11 (7.3) |
| Do not know | 41 (27.3) |

AI, avian influenza.
[a]Multiple answers were permitted.

common source of information about AI among medical students, Cairo University, in Egypt . This highlights the important role that the mass media plays in shaping people's awareness and level of knowledge, particularly in emergency situations such as AI outbreaks. In contrast, the role played by social change agents should not be overlooked, particularly in changing the practices, given their success in other domains such as in reproductive health in Egypt.

In the current study and in concordance with El-Zanaty *et al.* (2007), 85% of the interviewed housewives knew the symptoms of AI in poultry. The most commonly mentioned symptoms were ruffled feathers and swollen cyanotic combs. However, this was not the case with the human infection with AI. Almost half of the respondents were only aware of the overall symptoms of AI in humans. Fever was the most commonly reported symptom. The discrepancy in the percentages of study participants who knew the symptoms of AI in birds and in humans may be due to the large number of affected bird cases they saw or heard about, compared with the few human cases that occurred [8].

Recent studies have shown that domestic ducks have acquired an important role in the epidemiology of AI as they can excrete large quantities of lethal virus without showing the warning signs of visible illness [12]. In our study, the knowledge of housewives about the role of domestic ducks in the epidemiology of AI was poor; only 26% of the respondents knew that domestic ducks shed the AI viruses in large quantities without showing any symptoms. This confirms what was reported by El-Zanaty *et al.* [8] , and mandates the formulation of standardized health education messages that warn ducks breeders and provide healthy guidelines on best breeding practices.

Generally, the interviewed housewives were aware of the transmission methods of AI infection, such as exposure to infected poultry, cages, feathers, saliva and nasal secretion, and feces. Despite the fact that the majority of the interviewed housewives (97%) knew that feces is a source of infection (Table 2), nearly half of the backyard poultry breeders (44.4%) reported storing poultry excreta to be used as a manure (Table 5). In concordance with the these findings, a study conducted in Vietnam among a group of small holder poultry raising farmers found that almost all the households studied reported saving poultry excreta for fertilizers, feeding fish, and selling; nearly half of them did not know that poultry waste could be an infection source [13].

The mean total knowledge scores were significantly related to the level of women's education. This was in agreement with several studies that have assessed the educational level and its impact on KAP regarding AI [6] and other health topics [14–17]. Also, the total knowledge score was significantly higher among the backyard poultry breeders than among nonbreeders ($P<0.05$). This may be due to the fact that breeders are more familiar with the different disease scenarios because of their contact with birds, in addition to the role played by the local social workers affiliated to primary healthcare, who were targeting poultry breeders with home visits to give health education on the sources of infection and preventive measures.

A significant difference was found in the total knowledge score according to the risk perception of AI infection, that is participants who were afraid of contracting AI infection had more knowledge about AI-related sources of infection, methods of transmission, and preventive measures. This was consistent with the research conducted by Abbate *et al.* [6], in which they found that poultry workers who believed to be at a high risk of contracting AI during work were more knowledgeable about the protective measures for exposure to AI. This might be attributed to the fear of AI, which motivates knowledge acquisition to avoid infection, or conversely, better knowledge might increase risk perception.

Generally, housewives had a good knowledge regarding many aspects of AI, including transmission, biosecurity measures, and preventive measures; nevertheless, they seldom adopt protective measures such as use of masks and gloves during their breeding, slaughtering, and cooking practices. For example, the number of housewives who used gloves or plastic bags (6%) or face masks (1.2%) when coming in contact with their poultry was very low; however, the majority of the home breeders

(98.3%) washed their hands with water and soap after handling these birds, which seemed to be a feasible measure for them to adopt (Table 5). This underscores the utmost importance of addressing economic barriers when planning for behavior change [7,18].

Examining the prevalence of AI human cases in Egypt showed that children represent a large percent (68%); this might be attributable to faulty breeding habits that allow birds to wander freely in the environment, giving children a chance to play with them. Moreover, some families involve their children in breeding poultry. In the current study and in concordance with El-Zanaty *et al.* [8], we found that a small percent of participants involved their children in caring for birds and collecting eggs (4.5%); however, a larger percent allowed children to play with the poultry (35%) (Table 5). These faulty practices put children at a heightened risk and must be the target of any future awareness campaigns of AI [7].

The majority of the housewives slaughtered poultry at home (84.7%), and the majority of them threw poultry remnants after slaughtering in the canals or streets (89.3%) (Table 5). These practices are very hazardous and could be attributed to a lack or inaccessible sanitary slaughtering services, hence permitting the wide spread of the virus in the environment and facilitating its transmission to humans [4].

We also found a significant difference in the total knowledge score between housewives who adopted healthy behaviors, such as always keeping their poultry in a closed place ($P = 0.001$) and using special garment and shoes while cleaning or feeding poultry (0.04), and those who did not (Table 6). Abbate *et al.* [6] recorded that those who did not know prevention precautions had a six-fold greater risk for inconsistent adherence to preventive guidelines compared with those who could identify them. Hence, improving the knowledge of AI transmission and preventive measures is an important factor in and a step toward achieving a healthy behavior change.

## Conclusion and recommendation

In conclusion, there was a good knowledge and attitude of the study participants regarding AI; however, practices appeared to be inadequate to achieve full protection against AI. Furthermore, mass media and personal communication were two important channels of communication on AI; they should be properly utilized to ensure their effectiveness in dispersing information and sound knowledge. Finally, it is noteworthy to mention that high awareness does not necessarily lead to behavior change. Behavior change is a complex process that should involve comprehensive and multidisciplinary intervention, which combines risk perception, communication, and feasible and practical recommendations, including economic considerations.

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### Conflicts of interest

There are no conflicts of interest.

## References

1 WHO. Avian Influenza ('bird flu'). Fact sheet, 2006. Available at: *http://www.who.int/mediacentre/factsheets/avian_influenza/en*. [Accessed on 12 November 2011].

2 Thomas JK, Noppenberger J. Avian influenza: a review. Am J Health Syst Pharm 2007; 64:149–165.

3 WHO. Avian influenza – situation in Egypt – update 53, 2011. Available at: *http://www.who.int/csr/don/2011_06_16/en/index.html*. [Accessed on 12 November 2011].

4 Samaha H. Highly pathogenic avian influenza in Egypt. Integrated national plan for avian and human influenza, 2007. Available at: *www.fao.org/avianflu/en/conferences/june2007/documents/Day_1/3-1*. [Accessed on 12 November 2011].

5 ECDC. Avian Influenza – country update – human disease and related poultry outbreaks, 2007. Available at: *http://ecdc.europa.eu/Health_topics/Avian_Influenza/Country_humans.html#EGYPT [serial on the Internet]* [Accessed on 12 November 2011].

6 Abbate R, Di Giuseppe G, Marinelli P, Angelillo IF. Knowledge, attitudes, and practices of avian influenza, poultry workers, Italy. Emerg Infect Dis 2006; 12:1762–1765.

7 UNICEF. Study of knowledge, attitudes, practices and behaviors to inform the avian influenza prevention and containment communication strategy in georgia. Prepared by the Curatio International Foundation with the support of UNICEF 2006.

8 El-Zanaty F, El-Ghazaly N. Avian Influenza survey: Knowledge, attitudes and practices of the Egyptian public. UNICEF Egypt, 2007. Available at: *http://www.unicef.org/egypt/FinalNewsletter.pdf*. [Accessed on 12 November 2011].

9 Labib NA, Said M. *Practical training course in community medicine for medical student fourth year*. Cairo University. 2007; p. 51.

10 Elorduy Bilbao O, Rey Martinez MR, Martin Martin R, Rego Fernandez C. Understanding of avian flu and change in habits because of it. Aten Primaria 2007; 39:325.

11 El-Ghourory L. Awareness of medical students about avian flu. Med J Cairo Univ 2007; 75**(Supp II):** 1–5.

12 WHO. Laboratory study of H5N1 viruses in domestic ducks: main findings, 2004. Available at: *http://www.who.int/csr/disease/avian_influenza/labstudy_2004_10_29/en/print.html*.

13 CARE International in Vietnam, Quality of Life Promotion (LIFE) Centre. Knowledge, Attitudes, Practices Study of Small Holder Poultry Raising Farmers in Response to Avian Influenza, 2005. Available at: *http://www.comminit.com/global/node/219322*. [Accessed on 12 November 2011].

14 Okobia MN, Bunker CH, Okonofua FE, Osime U. Knowledge, attitude and practice of Nigerian women towards breast cancer: a cross-sectional study. World J Surg Oncol 2006; 4:11.

15 Sharma AK, Bhasin S, Chaturvedi S. Predictors of knowledge about malaria in India. J Vector Borne Dis 2007; 44:189–197.

16 Ismail NA, Ahmed HA. Knowledge, attitudes and practices related to avian influenza among a rural community in Egypt. J Egypt Public Health Assoc 2010; 85:73–96.

17 Al-Shehri AS, Abdel-Fattah M, Hifnawy T. Knowledge and concern about avian influenza among secondary school students in Taif, Saudi Arabia. East Mediterr Health J 2006; 12**(Suppl 2):** S178–S188.

18 Takeuchi MT. Avian influenza risk communication, Thailand. Emerg Infect Dis 2006; 12:1172–1173.