

UNITED NATIONS FOOD and AGRICULTURE ORGANIZATION (FAO)
Sudan

Knowledge about Avian Influenza and Practice
among
People Involved with Poultry Production

in
River Nile, Khartoum, Gezira, White Nile and Central Equatoria States

A KAP Survey Report

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Part I
Main Report

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1. Introduction:

On March 12, 2003, the World Health Organization (WHO) issued a historic global alert for severe acute respiratory syndrome (SARS), a deadly new infectious disease with the potential for rapid spread from person to person and via international air travel. WHO and its partners, including the Centers for Disease Control and Prevention (CDC), promptly initiated a rapid, intense, and coordinated investigative and control effort that led within 2 weeks to the identification of the etiologic agent, SARS-associated coronavirus (SARS-CoV), and to a series of decisive and effective containment efforts. By the time SARS-CoV transmission was brought to an end in July 2003, more than 8,000 cases and 780 deaths had been reported to WHO¹.

The emergence of SARS provided a dramatic illustration of the potential for new diseases that can suddenly appear and spread, leading to widespread adverse health and economic and social consequences. Although Sudan and Africa in general were not exposed to the outbreak on a large scale and the world effective measures of surveillance and infection control taken to contain and control the outbreak, the high risk of occurrence (e.g. through migratory wild birds), the impossibility of predicting SARS-CoV appearance and the speed by which the virus can spread, require a high degree of preparedness and an ability to swiftly respond to control a SARS outbreak. To achieve that a strong information and updated base is required, particularly with regard to human practice and behaviour, particularly of people who are more vulnerable than others, e.g. those in direct contacts with birds. The information those people command is one determinant factor in how they can contribute positively or negatively in preventing or containing the virus spread.

Since the first outbreak of HPAI in Sudan in April 2006, FAO has played a very significant role in coordination of Avian Influenza prevention and control efforts in animals with many stakeholders. One important aspect has been the collaboration of FAO with UNICEF and other government partners on AI communication as part of awareness raising and protection efforts. Accurate, timely, and consistent communication is vital for the prevention, containment and response of avian flu pandemic. Giving people the right information will reduce the risks of Avian Influenza (AI) infection, prevent unnecessary panic and mitigate its economic and social impacts. Strong communication strategies and tools play a crucial role in addressing the four intervention priorities on AI intervention; (a) creating public awareness, (b) avoiding panic, (c) reducing animal to animal transmission, and (d) preventing animal to human transmission. In FAO view, the Highly Pathogenic Avian Influenza (HPAI) in the Sudan is not expected to diminish significantly in the short term and the AI epidemic will continue to pose a critical threat to the livestock in the country and a significant risk to public health. For this reason FAO-Sudan has launched this study to conduct a rapid knowledge, attitude and practice (KAP) survey among commercial and backyard poultry producers in AI affected and non affected states in Sudan, to provide a better understanding of the most effective messages and communication channels to use in helping protect the poultry and humans from AI².

¹ Source: WHO "Public Health Guidance for Community-Level Preparedness and Response to Severe Acute Respiratory Syndrome (SARS)", Version 2

² FAO, TOR

1.1 Background to the Study:

This report is a result of a field survey conducted during the period of June-July 2007, covering five states: four of them affected by the disease in 2006, namely Khartoum, Gezira, River Nile and Central Equatoria and one non-affected state as a control which is White Nile. The main objective of the survey was to provide a baseline data identifying gaps in knowledge, attitudes and practices in relation to Avian Influenza (AI) among commercial and backyard poultry producers and keepers and those in contact with poultry and poultry products in order to enhance prompt and effective responses to the threat of AI among poultry producers and the public at large with a view to designing and implementing a comprehensive AI Communication Strategy that would enhance containment of AI in case of outbreaks.

1.2 Survey Objectives:

The specific objectives, as outlined in the TOR, include the following:

1. assessing the current level of knowledge, attitudes and practices on Avian Influenza including causes, detecting signs and symptoms, prevention and control measures;
2. assessing fears and risks and level of vulnerability associated with AI pandemic among farmers;
3. assessing prevailing misconceptions/beliefs around and awareness of about current efforts to prevent and control AI in the Sudan;
4. assessing if there are any differences in knowledge by category of poultry keeping, gender or locality;
5. assessing knowledge and information gaps as perceived by stakeholders;
6. assessing coverage, effectiveness and preference of current sources and channels of information and knowledge about AI among the different groups, including mass media, official channels, interpersonal communication, etc;
7. assess acceptability/approval of AI prevention and control activities and their perception of effectiveness and willingness to participate/be involved in AI prevention and control activities;
8. assessing level and nature of farmers expectations regarding AI prevention and control measures and intervention programmes; and
9. providing an in-depth analysis on prevailing gaps in AI prevention and recommendations for the development of a comprehensive communication strategy and action plan.

1.3 Methods Used:

The methods used in collecting data include:

1.3.1 Literature Review:

Scarcity of written literature on the subject at the national level restricted the literature reviewed to (a) technical reports, documents and websites information on AI and SARS mainly by WHO and FAO that focuses on the description of AI signs and means of transmission, SARS CoV disease definition and status and developments at the international level (mostly in Asia), approaches and key measures for SARS preparedness and response, SARS surveillance, command, control and containment measures and (b) background and contextual information on the surveyed states, which are believed to influence the state of knowledge and type of practice, was collected from academic literature, UN, World Bank, INGO reports, consultancy reports and official documents.

1.3.2 Questionnaire

This is the main method used as the tool to generate information on the social and economic conditions of the surveyed population and to assess the level of knowledge form of attitude, practice and behavior of respondents vis-à-vis AI spread. Report analysis heavily depended on the results of the questionnaire. The targeted respondents include poultry farms' owners and workers, backyard keepers and poultry distributors (transport and marketing)

A relatively long and largely closed-questions questionnaire was designed basically to cover for the gap in secondary data and generate statistical information. The questionnaire include six sets of questions on respondents personal and socio-economic information and relationship with poultry production, general knowledge about Avian Influenza, signs and means of transmission, handling infected birds, dealing with infected persons, a section specific to backyard producers, a section specific to farm workers and a section on effective methods of disseminating information about AI. (See Annex ??)

1.3.2.1 Sample Size and Distribution:

The sample size was predetermined at 575 cases and divided between the five states that were classified as large (Khartoum), medium (Gezira) and small for the rest. Because the sample in central Equatoria was for Juba only the size was reduced to 50 instead of the 75 planned for the small states. The classification was not based on state population size but on our estimates of the population engaged with poultry production and marketing. The actual coverage, after exclusion of incomplete and/or defective sheets amounted to 84% of the planned sample (See Table 0.1). Within the state, the sample was stratified into urban, rural, farms and markets. Selection within each strata, and due to time and budget constraints and absence of any sampling frame that can lead selection, of respondents was purely accidental and random but meant to cover the four groups of respondents, with an intended bias towards the poultry farm workers and backyard producers.

It is worth noting that several of the sites classified as urban, are actually poultry farms that are not in an agricultural area and rural in most states refers to suburban areas. Also in central equatorial state all the sample was within Juba town. The composition of the sample was as follow: poultry farms worker 45%, backyard producers 23.1%, farm owners 14.3% and distributors and others 17.7%. While commercial production dominate Khartoum and Gezira states, backyard production is more significant in all surveyed states except Khartoum. Also the largest category of the sample population in Juba was those engaged in marketing backyard poultry on permanent or temporary basis (Table 0.2)

Table 0.1: Sample Size and Structure

State	Sample				Total	Planned Sample	Coverage %	No of data collectors
	<i>Farm Owners</i>	<i>Farm workers</i>	<i>Backyard producers</i>	<i>Others</i>				
Khartoum	40	99	23	20	182	200	91	12
Gezira	10	53	25	34	122	175	70	6
White Nile	11	28	21	5	65	75	86.7	4
Central Equatoria	3	1	13	33	50	50	100.0	3
Nahr el Nil	5	36	22	2	65	75	86.7	3
Total No	69	217	104	94	484	575	84.2	28
Total %	14.3	44.8	21.5	19.4	100.0			

Table 0.2: Sample Distribution by Sites

States	Sample size		Sample Categories %				No. of Sites
	No	%	Urban	Rural	Farm	Market	
Khartoum	182	37.6	21.4	10.4	64.8	2.2	38
Gezira	122	25.2	52.4	19.7	23.8	4.1	29
White Nile	65	13.4	52.4	7.7	33.8	6.2	5
River Nile	65	13.4	49.2	18.5	32.3	-	18
Central Equatoria	50	10.3	64.0	20.0	16.0	16.0	12
Total	484	100					102

1.3.2.2 Data Collectors Orientation and Training:

A total of 28 data collectors were selected, 12 of them from the Federal ministries of Health and Animal Wealth and State Ministries of Agriculture (Animal Wealth) in Khartoum, Gezira, Central Equatoria, White Nile and representatives from the Ministry of Health and Agriculture from Nahr el Nil State and 10 private practitioners from Khartoum in addition to 5 practitioners who were recruited from the states in the process of the field work.

A 2-day orientation workshop was organized in Khartoum for the 23 data collectors. In the workshop, participants were given some background information on SARS and Avian Influenza and the situation in Sudan and briefed on the survey objectives, plans and methods. The questionnaire was discussed in details to clarify it and unify the understanding between the data collectors. The questionnaire pretest was done in Khartoum, also as part of the practical training of the participants, before the team was divided between the various states.

For logistical and resource reasons, the data collection in each state was limited to a specified zone around the state capitals and which includes farms, urban and suburban and/or surrounding rural areas. For example the in Khartoum the three towns and Sharq el Nil locality were covered, in Gezira Medani-Barkat zone, Nahr el Nil Atbara-Ed Damer zone, White Nile Kosti-Rabak-Gezira Aba and Juba town in Central Equatoria State.

1.3.2.3 Structured Interviews:

This method was used for farm owners and the interview check list included questions on personal information, history of the relationship with the poultry sector, information about the farm activities and farm workers, relationship with health authorities, marketing and marketing channels and the daily work routine. A total of 67 farm owners were interviewed, all in Khartoum and Gezira States. Most of them, however, were also included as respondents to the general KAP questionnaire.

1.3.2.4 Observation:

Observation was used in relation to the conditions of farms with regard to spacing, distance of workers living lodges, water sources, garbage disposal areas and the general hygiene conditions.

1.3.2.5 Group Discussion:

Some group discussions were tried with farm workers in Khartoum but they proved to be un-conducive, especially in the presence of farm owners and they were also unhelpful with regard to knowledge and behavioral questions and so it was discarded.

The main observations that came out of the field work were (a) the scarcity of secondary data in all the states other than Khartoum, (b) the smaller than anticipated number of the backyard poultry producers compared to commercial production, probably because of limiting the

sample area to the urban and sub-urban areas and (c) the very limited commercial production in Central Equatoria state.

1.4 A Note on Avian Influenza¹

Avian influenza (AI) is the general term for a form of viral disease that affects birds, caused by influenza A viruses. Of the 16 main subtypes of influenza A viruses, only strains within the H5 and H7 subtypes cause highly pathogenic avian influenza, which is highly contagious and rapidly fatal in susceptible avian species. Highly pathogenic avian influenza (HPAI) causes severe disease in chickens and up to 100 percent mortality; low pathogenic avian influenza (LPAI) causes mild disease and little or no mortality. H5N1 is the technical term for a particularly lethal sub-type of avian influenza, and just one of tens of sub-types of the disease. H5N1 can be transmitted to humans, although this is very difficult unless they come into close contact with infected birds. However, H5N1 is much less dangerous for humans than ordinary influenza (between the end of 2004 and the end of November 2006, less than 160 people have died as a result of the disease, compared to the 250,000-500,000 people who die each year from ordinary influenza)

- Migratory waterfowl (wild ducks) are the natural reservoir of all influenza A viruses. Chickens and turkeys are particularly susceptible to epidemics; direct or indirect contact of domestic flocks with wild waterfowl has been implicated as a frequent cause. Live bird markets have also played an important role in the spread of epidemics. Birds that survive infection may excrete virus for up to 10 days, orally and in faeces, thus facilitating further spread.
- Unlike chickens, some domestic ducks are known to be resistant to the viruses and can be asymptomatic carriers of the viruses, thus acting as a “silent reservoir” that perpetuates transmission. Evidence suggest that some species of migratory birds are directly spreading the H5N1 virus.
- Avian influenza viruses normally infect only birds and, less commonly, pigs but some subtypes of the viruses (H5, H7, and H9) have infected humans, causing mild respiratory symptoms or conjunctivitis, with the exception of H5N1 which has caused severe disease with high fatality rates.
- Studies show that H5N1 has become more pathogenic for mammals and caused fatal disease in naturally infected large felines (tigers and leopards) and domestic cats - species not previously considered susceptible to disease caused by any influenza A virus.

¹ Sources:

- WHO/FAO International Food Safety Authorities Network (INFOSAN), Highly pathogenic H5N1 avian influenza outbreaks in poultry and in humans: Food safety implications, INFOSAN Information Note No. 7/2005, 4 November 2005, www.who.int/foodsafety
- European Commission, Introducing Community measures for the control of avian influenza, Journal of the European Union, L 167, 22.6.1992, p.1 (Council Directive 92/40/EEC of May 1992, amended 2004)
- Olsen S.J., et al. (2005) Poultry-handling practices during avian influenza outbreak, Thailand. *Emerging Infectious Diseases*, Vol. 11, No. 10
- Swayne D., Beck J. (2005) Experimental study to determine if low-pathogenicity and high-pathogenicity avian influenza viruses can be present in chicken breast and thigh meat following intranasal virus inoculation. *Avian Diseases* 49:81-85
- Swayne D., Beck J. (2004) Heat inactivation of avian influenza and Newcastle disease viruses in egg products. *Avian Pathology* 33(5), 512-518

- Several mutations in the virus have been detected during 2005, but the significance of these mutations in terms of virulence and transmissibility in humans is not fully understood.
- Avian influenza virus are found only in the respiratory and gastrointestinal tracts of infected birds but H5N1 strain, spread to virtually all parts of an infected bird. Eggs can contain H5N1 virus both on the outside (shell) and the inside (whites and yolk)
- The virus can survive in faeces for 6 days at 37°C and for 35 days at low temperature (4°C)
- Food preservation processes such as freezing and refrigeration do not substantially reduce the concentration or viability of these viruses in contaminated meat. Generally speaking however, the virus dies more quickly in higher temperatures and the drier the droppings are. Temperature of 70°C in all parts of any food item will inactivate the H5N1 virus.
- There is no vaccine to protect people against H5N1
- The virus may persist on clothing, footwear and in hair

2. State of Knowledge about Avian Influenza and Practices:

2.1 Population Characteristics

As shown in Table 1.1 below, while in the River Nile and Central Equatoria States, most of those involved in the poultry production are from within the state, the vast majority in the other (central) states are from Western and Central Sudan. The factors of distance and limited opportunities for migrants in the north and south seem to behind that phenomenon. In all states most of the population surveyed (77%) are young (18-45 years), and about 8% of the total sample population are under 18 years and their number is particularly high in the River Nile State reaching about 19% of the population (Table 1.2).

Table 1.1 Percentage Distribution of Population by State and Home Region

Home Region	Khartoum	Gezira	White Nile	River Nile	Central Equatoria
Northern Sudan	9.3	3.8	9.2	72.3	14.0
Southern Sudan	5.5	3.1	4.6	9.2	66.0
Central Sudan	38.5	42.8	63.2	7.7	10.0
Western Sudan	43.4	36.7	21.5	4.6	2.0
Eastern Sudan	0.6	6.2	1.5	6.2	0.0
Abroad	2.7	7.5	0.0	0.0	8.0
Total	100.0	100.0	100.0	100.0	100.0

Table 1.2 Percentage Distribution of Population by State and Age Group

Age Group	Khartoum	Gezira	White Nile	River Nile	Central Equatoria	ALL
< 18 years	8.8	2.5	9.2	18.5	4.0	8.1
18-45	79.7	76.2	73.8	63.1	86.0	76.4
46-60	11.5	17.2	17.0	13.8	6.0	13.4
> 60 years	0.0	4.1	0.0	4.6	4.0	2.1
Total	100.0	100.0	100.0	100.0	100.0	100.0

The population is almost evenly distributed his education attainment between illiterate, Khartoum, basic secondary and university levels with small percentage (2.3%) of post graduates. The noticeable deviations are the high ratio of illiterate population in the River Nile state and university gradates in Juba (Central Equatoria) (Table 1.3).

Table 1.3: Percentage Distribution of Population by State and Education Attainment

Education Status	Khartoum	Gezira	White Nile	River Nile	Central Equatoria	All
Illiterate	11.0	15.6	18.5	30.8	8.0	15.5
Khalwa	23.6	14.8	16.9	6.2	6.0	16.3
Primary/basic	26.4	32.8	15.4	36.9	20.0	27.3
Secondary	21.4	15.6	13.8	18.5	20.0	18.4
University	17.0	16.4	35.4	4.6	40.0	20.0
Post university	0.6	4.8	0.0	3.0	6.0	2.5
Total %	100.0	99.2	100.0	100.0	100.0	100.0

About 40% of the surveyed population are married, 56% single, 2.3% divorcees and 1.7% widows (Table 1.4). All of those who are currently or have previously been married have children, 55% of them (23.2% of total) are supporting 4 or more dependents (Table 1.5)

Table 1.4: Percentage Distribution of Population by State and Marital Status

	Khartoum	Gezira	White Nile	River Nile	Central Equatoria
Single	63.2	53.1	54.2	46.2	48.0
Married	34.1	41.6	38.9	49.2	48.0
Divorced	1.1	3.1	5.0	4.6	0.0
Widow	1.6	2.2	1.9	0.0	4.0
Total	100.0	100.0	100.0	100.0	100.0

Table 1.5: Percentage Distribution of Population by State and No of Dependents

No of dependents	Khartoum	Gezira	White Nile	River Nile	Central Equatoria	All
None	61.0	54.4	53.8	47.7	58.0	56.3
1-3	15.0	22.5	24.6	21.5	26.0	20.2
4-6	20.7	17.2	17.0	29.2	16.0	20.0
7 or more	3.3	5.9	4.6	1.6	0.0	3.6
Total	100.0	100.0	100.0	100.0	100.0	100.0

2.1.1 Relationship with Poultry Production:

Over half the surveyed population are manual workers in the poultry sector, the rest are combining poultry work with other engagements including professional and clerical work, schooling (students) and home activities for housewives (Table 1.6).

Table 1.6 Percentage Distribution of Population by State and Type of Work

	Khartoum	Gezira	White Nile	River Nile	Central Equatoria	ALL
Professional	17.0	23.0	43.1	8.3	32.0	22.5
Clerical	3.0	3.0	3.1	2.0	14.0	3.7
Skill manual	61.5	50.0	36.9	58.5	20.0	50.6
Informal	1.5	7.0	6.2	2.0	10.0	4.3
Unemployed/housewife	3.8	7.4	3.0	13.8	8.0	6.6
Student	2.2	2.2	4.6	4.6	4.0	3.9
Others	11.0	7.4	3.1	10.8	12.0	8.7
Total	100.0	100.0	100.0	100.0	100.0	100

Regarding the history of involvement with poultry production, the over half the sample population (50.6%) have got engaged with poultry production within the last three years, compared to 29% with over five years of engagement. This in a way indicates that the AI outbreak two years ago did not impact negatively on or halted the increasing trend of engagement in poultry production as a quick-return investment. The combination of poultry work with other jobs or sources of income may indicate or can be attributed to the awareness about the high risks attached to it (sudden loss), the low level of inputs invested and the limited work demand.

2.1.2 Income sources and income levels:

Poultry and poultry products represent the mains source of income for over 53% of the surveyed population and a secondary source of income for about 10% of them. Other sources of income include professional work (10%), agriculture (8.3%), trade (4%) and manual and informal sector jobs (5.6%). Poultry also represent one source of income for many housewives and some students who are involved in backyard poultry production. As a secondary income source, 46% of those involved depend on poultry to supplement their incomes.

Regarding levels of income, as shown in Table 1.7 below, over 42% of the surveyed population earn monthly incomes of over 250 SDG (US \$ 125) which is almost double the internationally defined poverty line (2 dollars a day) and slightly under the national per capita income of US\$ 810 (World Bank, 2006). However, as most of the earning population are supporting families or dependents, it is most likely that many families are under the poverty line, although these figures do not take into account the non-cash income and direct food supply that might be enjoyed by the family nor the incomes of other household members.

About 2% of the sample population is earning more than SDG 1,000 a month, compared to about 32% earning SDG 250 or less. This latter category includes most of the backyard producers with no others jobs and the farm workers with no supplementary incomes¹

Table 1.7: Percentage Distribution of Population by Source and Level of Income

Monthly Income Level (SDG)	Population by Income Sources (%)								Total (%)
	Poultry & Poultry products	Agriculture	Trade	Professional/ clerical work	Manual/informal	Remittances/donations	Others	Unspecified/missing source	
< 100	3.9	2.3	1.2	1.5	1.2	0.4	1.2	1.5	13.2
100-250	28.0	2.3	1.2	1.2	2.1	-	8.5	0.8	44.1
251-500	13.4	1.7	1.0	2.7	1.5	-	2.3	0.8	23.4
501-1,000	3.7	0.4	-	3.3	0.4	-	0.4	1.5	9.7
1,001-3,000	1.7	1.2	0.6	0.6	0.4	-	0.2	0.4	5.8
> 3,000	0.2	0.4	-	0.2	-	-	0.4	0.2	1.4
Unspecified/missing value	2.3								2.3
Total	53.2	8.3	4.0	9.9	5.6	0.4	12.8	5.2	100
Secondary income sources	9.7	4.8	0.8	1.7	1.7	0.1	2.1	-	21.1

Except for Juba, poultry and poultry products represent the first source of income in all surveyed States. In Juba, poultry comes fourth after professional work, trade and other activities (i.e. fishing and livestock raising). Ironically and contrary to common belief, agriculture is the second source in all northern states other than Gezira, where poultry constitute the main source of income for 58% of the surveyed population, followed by clerical and professional work and last comes agriculture. This may indicate that farm owners are mostly urban-based investors who are not from within the agricultural sector.

2.2 Knowledge, Attitude and Practice:

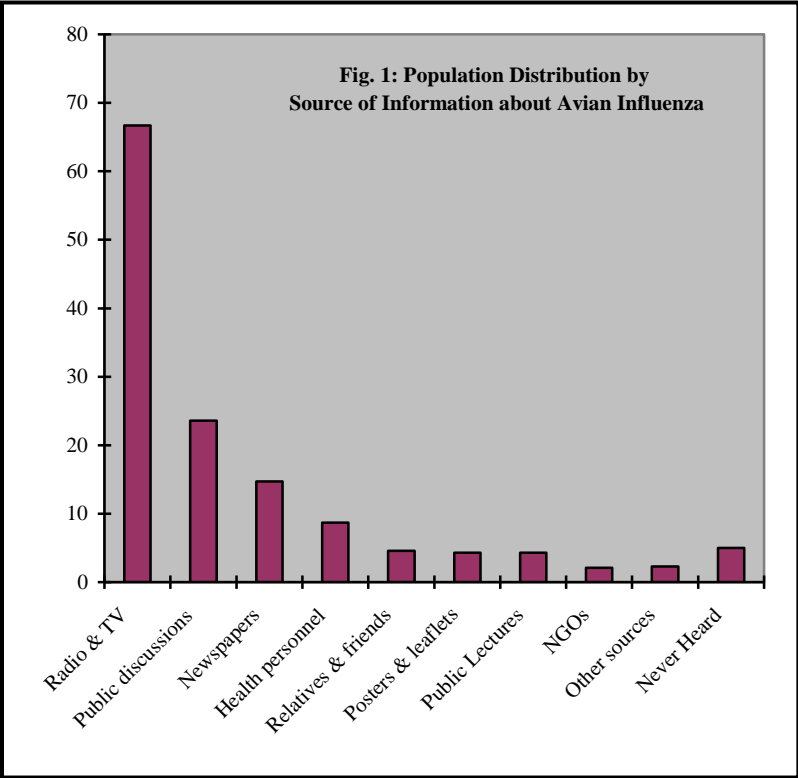
For any individual knowledge is the product of personal practical experience, including that of inherited and/or copied behaviour or practices, access to information and the ability to comprehend and organize that information. Attitudes are formed by acquired means most important of which is the volume and quality of information about the issue in question and by internal mechanisms built through inherited and practical experience, culture and belief, personal mode at the point in time when the information is received and on the basis of assessing the source of the information and/or the means of its communication or method of transmission, among other things. Behaviour and practice are then governed by the adequacy

¹ 26.4% of respondents confirmed having 2 or more income earner in their families

of information received, the persuasiveness of any message contained and the ability and freedom of the individual to take decisions and/or action. Therefore the effectiveness of any message aimed at changing or influencing practice or human behaviour has to take into account the above and be designed on the basis of the state and reality of the target recipient.

2.2.1 General Knowledge about AI and SARS

Only 6.2% of the surveyed population claimed not to have heard of AI and SARS before, most of them in Gezira and Khartoum (4.3%). The majority of those who heard about the disease received the information from more than one source. The main sources were the public media (Radio TV and newspapers) which together was the source of information to 81% of the population, general public discussion and chatting (28%), and specialized sources (health personnel, leaflets, public lectures) combined together was the source for only 19.3% of the population. The percentage of those who heard the news from radio and TV is much higher in Central Equatoria and White Nile States than in Khartoum and Gezira, while newspapers were highest in the White Nile and Gezira States. (Fig. 1)



Generally, while the media can only provide the information as news, that rarely include any scientific or specific message, public discussions and chats may spread distorted information that may cause more harm than good. Both were the main sources for most of the surveyed population. Sources that are expected to provide accurate information and technical advice were very limited in outreach and were largely restricted to Gezira and Khartoum States.

Over 78% of respondents reported hearing about SARS first time during the last tow years, and only 3.7% over 5 years ago and only 37% over 3 years ago. About 36% of respondents claimed to have asked a specialist about the disease, two thirds of them in Khartoum and Gezira States.

To test the type of the general information received, respondents were asked three basic questions on the number of people infected with SARS virus in Sudan, the states where AI cases were reported and the level of danger of SARS virus. The responses are summarized in the table below (1.8)

Table 1.8: Respondents General Information about SARS

Information	Accurate	Don't know	Missing
No of people infected in Sudan	14.9	42.8	1.5
State with highest AI incidence reported	63.4	19.6	1.2
How dangerous is AI virus	52.5	7.9	1.2
Average	43.6	23.4	1.3

Note: Model answers were (1) < 10 persons, (2) Khartoum, (3) 3. very dangerous

<p>Facts upon which knowledge assessment was made:</p> <ul style="list-style-type: none">• AI outbreak occurred in four Sudanese states• Suspected human infection was in Khartoum State• Disease Signs of bird Infection:<ul style="list-style-type: none">- <i>Bluish discoloration of comb , wattle and shanks</i>- <i>Loss of balance (including inability to walk)</i>- <i>Ruffled feathers</i>- <i>Difficulty in breathing</i>- <i>Loss of appetite</i>- <i>Depression and droopiness</i>- <i>Bluish colouring of wattles and comb</i>- <i>Edema and swelling of head, eyelids, comb, wattles, hocks</i>- <i>Watery diarrhoea</i>- <i>Pin-point haemorrhages (mostly visible on feet and shanks)</i>- <i>Bloody or watery discharge from nose or beak</i>- <i>Sudden fall in egg production</i>- <i>Eggs with soft or deformed shells</i>- <i>Rise in mortality rates</i>• For humans, the signs include<ul style="list-style-type: none"><i>Acute respiratory illness with fever and cough</i><i>Shortness of breath or breathing difficulties</i><i>Exposure within previous 7 days</i>• Nature of the disease (H5N1)<ul style="list-style-type: none"><i>It is dangerous</i><i>It is contagious through direct contact with infected person or animal</i><i>It is airborne in close proximity (one metre)</i><i>It can be transmitted by pigs and cats</i>• Transmission among birds can occur through contaminated tools and equipment used in production process or poultry transport vehicles• Vaccination can reduce mortality but may hide the symptoms of the disease

It is clear that the level of accuracy on the more specific information is very low and the high accuracy seems to be based on guesses and presumption, which also confirm the suggestion that the level of knowledge is merely *news* rather than *information*. The more specific knowledge about the disease was accessed through four sets of questions: general information about the disease occurrence, disease characteristics and signs, means of transmission among birds and information on human infection (signs and transmission). The responses which reflect the respondents' level of knowledge, their attitudes and practice are summarized in table (1.9)

Table 1.9: Respondents Knowledge about Avian Influenza and Best Practice

1.9.a General Information

Statement	River Nile		Khartoum		Gezira		White Nile		Central Equatoria		All States	
	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know
AI is a disease that infects only chicken	40.0	6.2	46.7	8.2	50.8	11.5	50.8	4.6	56.0	2.0	48.3	7.6
AI is a widely spread in Africa	12.3	29.2	20.9	19.2	14.8	23.0	26.2	16.9	20.0	20.0	18.8	21.3
Continuous hygiene and cleaning are important safety measures	4.6	6.2	6.0	7.7	4.9	9.8	7.7	16.9	8.0	12.0	5.0	8.5
Poultry infection occurred in most states of Sudan	18.5	21.5	33.0	17.0	28.7	31.1	46.2	12.3	26.0	24.0	30.8	21.3
Human infection occurred in some states of Sudan	27.7	26.2	14.8	34.1	13.1	33.6	38.5	19.5	22.0	32.0	20.0	30.6
<i>Use of respirator & gloves are effective preventive means</i>	80.0	15.4	76.4	8.8	73.0	17.2	73.8	9.2	82.0	12.0	76.2	12.2
Pigs can be infected by Avian Influenza	27.7	49.2	38.5	37.4	21.3	49.2	40.0	20.0	34.0	46.0	32.4	40.5
<i>Average</i>	30.1	22.0	62.6	9.5	29.5	25.1	40.5	14.6	36.9	21.1	34.7	20.3

Table 1.9b: Knowledge about the Disease

Statement	River Nile		Khartoum		Gezira		White Nile		Central Equatoria		All States	
	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know
Vaccination is an effective measure to control the disease	75.4	12.3	65.4	11.0	62.3	21.3	67.7	9.2	46.0	18.0	66.1	14.3
The disease infects the nervous system of birds	21.5	49.2	34.6	29.7	29.5	39.3	38.5	33.8	22.0	28.0	30.8	35.1
Avian influenza infects the respiratory system	67.7	26.2	69.2	19.2	57.4	30.3	75.4	13.9	64.0	20.0	66.3	22.3
One of the disease signs is the shedding of feathers	18.5	46.2	23.6	40.7	21.3	41.0	40.0	21.5	18.0	34.0	24.0	38.2
One of the signs of the disease is the swelling of bird feet	9.2	53.8	24.2	37.9	18.0	44.3	32.3	32.3	18.0	40.0	21.1	41.1
One of the disease signs is continuous screaming	15.4	50.8	38.5	31.9	22.1	44.3	36.9	23.1	30.0	38.0	30.2	37.0
One of disease signs is respiratory distress	56.9	40.0	62.1	18.1	52.5	33.6	72.3	12.3	60.0	32.0	60.1	25.6
One of disease signs is that produced eggs are covered with blood	23.1	49.2	28.6	36.8	28.7	44.3	29.2	27.7	20.0	46.0	27.1	40.1
One of disease signs is bleeding from the nose	27.7	58.5	31.9	25.3	29.5	42.6	44.6	18.5	38.0	46.0	33.1	35.3
The virus could be eliminated by boiling meet over 70 degree C	58.5	13.8	78.6	6.6	61.5	18.0	70.0	16.9	64.0	20.0	69.0	13.2
The vaccination protect poultry against disease and death	4.6	6.2	25.9	11.5	8.2	17.2	12.3	9.2	6.0	16.0	14.7	12.4
The virus can survive on the surface of and inside the eggs	46.2	27.7	39.0	36.8	34.4	35.5	40.0	32.3	42.0	44.0	39.3	35.6
Vaccination protects against infection	12.3	6.2	12.1	15.9	8.2	19.7	10.8	6.2	6.6	12.0	10.3	11.4
Vaccination reduces the effect of disease and mask clinical signs	73.8	15.4	48.4	26.4	43.4	34.4	46.2	29.2	44.0	32.0	49.8	27.9
Virus in eggs can be killed at sixty degree C	61.5	13.8	46.3	12.1	45.1	29.5	63.1	18.5	44.0	34.0	56.8	19.8
The bird can transmit the virus without showing any clinical signs	60.0	27.7	54.4	22.5	36.1	35.2	58.5	15.4	70.0	18.0	52.7	25.0
<i>Average</i>	52.1	31.1	38.1	27.6	34.9	38.0	46.1	20.9	32.3	29.8	40.7	27.1

Table 1.9c: Knowledge about Means of Transmission and Human Infection

Statement	River Nile		Khartoum		Gezira		White Nile		Central Equatoria		All States	
	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know
The disease could be transmitted to humans by cats	36.3	29.2	52.7	15.4	31.1	27.0	46.2	21.5	38.0	20.0	42.8	21.5
The disease could be transmitted by shoes	61.5	10.8	76.4	7.7	56.6	15.6	46.6	9.2	34.0	24.0	63.4	12.0
The disease can be transmitted between different birds flocks	73.8	13.8	81.3	5.5	71.3	17.2	76.9	7.7	76.0	10.0	76.7	10.3
The disease can be transmitted by broken eggs	70.8	112.3	73.1	7.7	55.7	22.1	61.5	12.3	52.0	28.0	64.7	14.7
The disease can be transmitted by cars used for poultry transport	66.2	16.9	79.1	6.0	62.3	23.0	56.9	16.9	58.0	18.0	68.0	14.5
The virus can be transmitted from raw to cooked meat	56.9	13.8	52.2	15.9	48.4	31.1	52.3	16.9	54.0	18.0	52.1	19.8
The disease can be transmitted by touching infected birds	78.5	9.2	61.5	11.5	58.2	17.2	66.2	4.6	87.0	8.0	65.3	11.4
Virus is transmitted by eating infected bird meat	75.4	7.7	51.1	4.9	55.7	14.8	58.5	4.6	82.0	8.0	59.7	8.1
The disease is transmitted by air	76.9	9.2	78.6	4.9	63.1	18.9	63.1	7.7	52.0	22.0	69.6	11.2
The disease is transmitted by insects and mosquitoes	26.2	20.0	32.4	12.6	37.7	23.0	41.5	6.2	56.0	18.0	36.6	15.9
AI is transmitted by drinking from open water sources in infected area	67.7	18.5	56.6	13.2	55.7	22.1	50.8	13.8	41.0	22.0	55.4	17.1
AI can be transmitted through animals' milk in infected poultry farms	32.3	21.5	45.1	13.7	26.2	30.3	26.2	12.3	2.0	22.0	33.7	19.6
AI can be transmitted by work tools in infected area (Feeder, Mob etc)	72.3	12.3	74.2	4.4	62.3	13.1	78.5	4.6	46.0	24.0	68.6	9.7
<i>Average</i>	61.2	22.7	33.6	19.1	52.6	21.2	55.8	10.6	50.6	18.6	58.2	11.6

Table 1.9d: Knowledge about Signs of Human AI Infection

Statement	River Nile		Khartoum		Gezira		White Nile		Central Equatoria		All States	
	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know	Correct	Don't Know
The disease is transmitted from birds to human	84.6	10.8	81.9	7.1	66.4	19.7	75.4	15.4	86.0	6.0	77.9	11.8
The disease can be transmitted from human to human	56.9	18.5	62.1	11.5	50.0	18.9	44.6	24.6	54.0	18.0	55.2	16.7
The disease can be transmitted through hand shaking	30.8	36.9	28.0	18.1	18.9	24.6	35.4	10.8	26.0	18.0	26.9	21.3
The disease can be transmitted by using infected person mobile	41.5	36.9	45.1	16.5	50.0	29.5	50.8	13.8	42.0	20.0	46.3	22.5
One of the sign is in human is conjunctivitis	7.7	58.5	17.0	53.8	18.9	51.6	21.5	21.5	14.0	48.0	16.5	49.0
One of the signs is the patient inability to walk	12.3	52.3	18.1	40.7	18.9	50.8	20.0	18.5	16.0	34.0	17.6	41.1
One of the signs is respiratory distress	55.4	35.4	58.2	25.3	49.2	39.3	66.2	21.5	56.0	34.0	56.4	30.6
One of the signs is muscle aching	6.2	49.2	13.2	38.5	10.7	50.8	13.8	33.8	14.0	42.0	11.8	42.8
One of the signs is arthritis and bone pains	6.2	53.8	19.6	36.8	11.5	52.5	13.8	33.8	14.0	40.0	13.6	43.0
<i>Average</i>	33.5	39.1	42.6	23.9	63.3	37.5	54.2	21.5	35.8	28.9	35.8	31.0

From the table, it is clear that in general the level of information is low and the accuracy of information is highest on the means of transmission among birds (58.2% on average for all states). The lowest average is ironically on the signs of the disease among humans (35.8% average) and the very general information about the disease (34.7%). Since the general information depends mainly on the media news (Radio and TV) and public discussion and chatting, this indicates the level of distortion that can occur in the absence of appropriate messages and the specialized people to deliver it. The overall average of accuracy level for the four categories of infections is 42.4%. When the average of those who admitted ignorance about the issues in question (22.5%) is subtracted, it means that over one third of the population carries information and convictions that is either deformed or faulty, but it forms the basis for their daily practice and/or behavior. This is particularly serious in relation to human infection, since 33% of the population falls within that category.

Regarding the situation within the surveyed states, there is no clear pattern or consistency in relation to the level of information about the four categories of questions. For example, in the general news-based information Khartoum recorded the highest accurate responses (62.6%) while accurate answers in the Gezira State were the lowest and don't knows were highest, despite the economic, social and cultural similarities and the geographical proximity of the two states. The River Nile State, on the other hand, recorded the highest accurate answers on the questions about the AI infection description and signs, but at the same time recorded the lowest level of accuracy on signs of human infection and the highest don't knows in two of the four categories of information. Likewise, the Gezira State, which recorded the highest accurate answers about signs of human infection, also registered the highest don't knows in two of the four categories of information. (Table 1.9)

It is therefore, very difficult to point to or isolate the factors that generated the variations in information volume and quality between the different states, nor the contradiction, sometimes, within the one state. In general, however, what can be deduced from the above picture is that

1. **Very few of the respondents received the information they have from specialists or reliable specialized sources** and fewer still are those who had access to written material, all of them veterinary doctors.
2. The information disseminated through the **media** (mainly Radio & TV) seems to **have been more effective in rural areas** where, it seems, people allocate more time to listen to radio and for watch TV.
3. No significant variations were depicted between educated and non educated persons (except for veterinary doctors) with regard to knowledge or practice vis-à-vis Avian Influenza. This in one way indicates that, the problem seems to be in the flow of information or access to it more than, for example, whether people can read or not, i.e. with regard to AI, **education does not prevent ignorance**.
4. **Knowledge does not necessarily mean good or rational practice or behavior**. For example, the pursuit of profit may tempt from owners to distribute suspected or infected poultry or poultry products or to reduce expenditure on preventive measures such as special uniform, vaccination, etc.. Farm workers, on the other hand, may have the knowledge but are unable to translate that knowledge into practice, for example, because the owner is not willing to provide the necessary inputs or does not allow specific practices. This, in turn, points to the economic factor that has to be taken into account as a determinant factor not only in the practice of stakeholders, but also in their reception of and interaction with any awareness messages.

2.2.2 Practice:

About 16% of the sample population claimed to have had an experience with sick birds while about 84% never had that experience. Of those, only 14.3% (2.3% of total population) claimed to have called a specialist. Other reactions to the incidents varied from just isolating the bird from the rest of the flock within the premises (16.7%), to burning it within the premises (25%), to the extreme of totally leaving the farm where the incident occurred (44.4%). That reactions may suggest the low level and scary nature of information people have or the inability of those in direct contact with birds to take prompt decisions, which explains the high ratio of those who fled the area.

About 24% of those who were exposed to the experience of a sick bird, claimed to have been told by specialists while the remaining 76% used their own judgment or were told by other non-specialized people. Most of those who went through the experience used a combination of signs or indicators to decide about the type of disease, including inability to move or limited movement of the bird (76%), the swelling of the shanks (37.5%) and 8.3% claimed to have used continuous screaming as the sign of sickness.

2.2.3 Responses to Human Infection

Only 1.2% of the surveyed population alleged that they have seen a (H5N1) SARS-infected person. Yet only 29% of the population admitted their lack of information or knowledge about the signs of human infection. The signs perceived by people as indicators of H5N1 are shown in table 1.10 below.

Table 1.10: % Distribution of Population by Perceived Signs of SARS Infection

Signs	Single sign	In a combination of signs
Continuous fever for a long time	4.7	38.8
Loss of weight	1.7	18.0
Diarrhea within no known cause	0.2	7.6
Loss of appetite	0.4	19.8
Inability to walk	2.1	21.9
Breathing difficulties	16.7	32.0
A combination of 2 or more of the above	41.7	-
Others	3.9	8.1
Don't know	29.1	29.1
Total	1000	100

Although breathing difficulties was the highest single sign used and the second highest in the combined category of signs, most of the others indicators mentioned seem to be related to HIV/AIDS signs. While this raises the worry about the confusion and damage that may occur, on the positive side it indicates that an effective campaign like that of HIV/AIDS will bring results. Most important, however, is that it points to the danger of uncoordinated health or general awareness messages which add to the risk created by inadequate or misinformation.

Asked about their views about SARS patients, 31.2% see them as careless persons, 24.6% as ignorant, 12% describe them as dirty (unhygienic) while 31.2% see them as victims. Although no question to explain their judgment or view was asked, from the answer, it seems that most respondents were having poultry farm worker in the back of their mind when they answered which has shaped the answers. Victimization seem to be linked to business owners (capital) and state failure to provide protection (laws), prevention, control of the disease or treatment of patients (services).

The above is confirmed by the response to the question of "which category of people is at high risk of catching the virus?", for which 55.4% mentioned poultry farm workers, 21.5% farm owners, 24.2% backyard producers, 17.8% children in backyard producing household, 17.8% egg and poultry distributor and 16.9% animal and human health cadre with 9.5% don't know answers.

When asked about their reactions in case a relative or a colleague was infected, responses varied substantially. For example, respondents were more ready to avoid relatives than work mates but chose to deal more cautiously with work mates than relatives. This again points to the importance of the economic factor where decisions are controlled by others, than the social factors where decisions are personally controlled. In fact, within the work relationship 13.6% expressed their readiness to terminate the contracts of infected persons, and 7.4% of workers asserted that they will quit the job, which reflects the importance of decision making powers in shaping the response and/or reaction to infection occurrence.

Table 1.11: Respondents Reaction to Human Infection

Reaction	Relative	Work Mate
Treat normally	11.6	9.9
Avoid him /her or keep a distance	37.0	19.6
Sit with but not touch	9.3	
Isolate from other people	13.2	0.6
Deal cautiously/ use goggles for contact	18.4	34.3
Terminate contact		13.6
Quit the job		7.4
Others	5.2	4.3
Don't know	5.2	7.9
Missing	0.4	0.8
Total	100	100

Regarding the ideal response to the human infection occurrence among workers, responses were the isolation of infected person and provision of health care (66.5%), permitting continuity of work and treatment (6.8%), removing patients from the area altogether (7.0%), and 7.4 % responding as don't knows.

2.2.4 Backyard producers

It was mentioned earlier that 23.1% of the population surveyed are backyard producers. As shown in table 1.12 below, most of them are involved in the daily routine activities of cleaning poultry cages, watering and feeding and egg collection. Very few of them are involved in marketing (5.3%) or slaughtering of chicken (0.2%), which is usually for domestic consumption since backyard poultry is usual raised for eggs.

Table 1.12 : Daily Tasks Performed by Backyard Producers

Tasks	% of people involved	% of total population
Cleaning cages	84.8	19.6
Feeding and watering	68.8	15.9
Collection of eggs	57.1	13.9
All previous tasks	6.3	1.4
Marketing of poultry or poultry products	46.2	10.7
Slaughtering of chicken	0.9	0.2

Backyard production in 45.5% of the surveyed households (10.5% of total population) depends primarily on women, adult males lead in 27.6% of households, children 9.8% and over 14% have workers to do the work, which may dictates the larger size of the flock. In

general, the daily work routine for backyard producers involves cleaning the cages, providing food and changing water, collecting eggs twice a day in addition to continuous observation. In smaller cages, the routine might involve allowing chicken out of the cage and returning them back at least once a day. In most cases, most of the family members are involved in work, though the bulk of work is performed by women. Some male heads of households are involved in marketing when production is high.

About 31% of backyard producers claim to use special uniform when handling poultry. Those who do not use uniform gave the following as the reasons (a) they do not see it necessary (58.4%, 9.3% of total population), (b) its high cost (22.1%) and (c) they do not know about it (19.5%).

2.2.5 Farm workers:

Farm workers represent 44.8% of the total sample population, they also represent the group that is in close contact with poultry both in numbers handled and / or length of time spent with poultry. More than half the farm workers (52.5%) are from western Sudan, 14.8% from the north and the remainders are from southern and eastern Sudan (96.9%) and foreigners (1.4%).

Table 1.13: Percentage Distribution of Farm Workers by Education Status

State / Education		Illiterate	Basic	Secondary	University	Unspecified	Total
Nahr El Nil	% of State	35.7	42.9	14.3	0.0	7.1	19.2
	% of Total	6.9	8.2	2.7	0.0	1.4	
Khartoum	% of State	22.2	40.7	25.9	7.4	3.7	37.0
	% of Total	8.2	15.1	9.6	2.7	1.4	
White Nile	% of State	33.3	55.6	0.0	11.1	0.0	12.3
	% of Total	4.1	6.9	0.0	1.4	0.0	
Gezira	% of State	43.5	47.8	4.4	4.4	0.0	31.5
	% of Total	13.7	15.17	1.4	1.4	0.0	
Total		32.9	45.2	13.7	5.5	2.7	100.0

As shown in table 1.14 below, the vast majority of workers are normally involved in the daily activities of clean cages, feeding and watering and egg collection. Only 12.4% are involved in marketing which is usually performed by farm owners or by distributors who collect the product from the farm gate. About 10.6% are involved in slaughtering of birds, mainly because the of smaller number of farms that produces poultry for meat compared to egg production farms. About 21% of workers perform health care tasks which is mainly disinfecting of tools used but may also include technical tasks such as vaccination and administration of vitamins etc..

Table 1.14 : Tasks performed by backyard producers

Tasks	% of Farm Workers	% of Total Population
Cleaning cages	83.4	37.4
Feeding and watering	85.3	38.2
Collection of eggs	72.4	32.4
Health care activities	20.7	9.3
Slaughtering of birds	10.6	4.8
Marketing of poultry & poultry products	12.4	5.6
All the above	14.3	6.4

Other than the duration of their direct contact with birds and their limited awareness about the risk entailed, farm workers vulnerability is also raised by the way they practice their jobs. In most farms as shown in the table above, workers are involved in all stages of production

except the slaughtering of chicken and marketing which are limited or performed by others. To assess the level of vulnerability during their direct contact with poultry, farm workers were asked 12 questions on how they perform their tasks and conduct themselves within the farm. The answers are summarized in Table 1.15 below

Table 1.15: Percentage Distribution of Farm Workers Daily Practices

Practice	% of users	% of total population	Best practice States	Worst practice States
Use of disinfection shoes	57.1	25.6	Khartoum	River Nile
Use of gloves	22.1	9.9	Central Equatoria	Gezira, Khatoum
Use of goggles	38.7	17.4	Khartoum, Central Equatoria	Gezira
Use of special uniform	63.6	28.5	Khartoum	W. Nile, Gezira
Daily disinfection of shoes	54.4	24.4	Khartoum	Gezira
Drinking from open water source	53.9	24.2	Khartoum	W. Nile
Washing from open water source	41.9	18.8	Central Equatoria	R. Nile
Other workers use of disinfected shoes	53.9	24.2	Central Equatoria	R. Nile
Other workers use of gloves	24.0	10.7	Central Equatoria	Khartoum, Gezira
Other workers use of goggles	40.6	18.2	Khartoum	Gezira
Other worker use of special uniform	63.6	28.5	Khartoum	Gezira

It is clear from the table that farm workers are extremely vulnerable since the only protective measure they widely use is the disinfected shoe which in fact protects the poultry and not the worker. Use of gloves and goggles is very limited and use of open water sources for drinking and washing is common practice. About 64% of farm workers use special uniform (overall) but mainly to keep their clothes clean, as from our observations the overalls used are generally dirty and no disinfection measures are applied to it. However, there are some significant variations between the various states. In general, with regard to protective measures to reduce workers vulnerability, Khartoum state recorded the highest best practice among the five states and Gezira state came at the bottom of the list.

The reasons given for not using adequate protective measures were: farm owners do not provide them (40.6%), lack of knowledge about them (22.6%), high costs (7.8%) and that they are not seen as necessary (16.1%) and other reasons (6%). About 25% of farm workers (11% of total sample) claim to have experienced an AI infection case in their farms. Although the claim was made in all states, including the White Nile where officially no case was reported, the majority (67%) of them were Khartoum.

2.2.6 Knowledge about Causes of Birds and Human Infection

According to the sample population the main causes of the AI virus spread among birds are migratory wild birds, imported poultry and poultry products poor hygiene in farms and houses and low level of awareness (Table 1.16). Regarding the causes of human infection, respondents' views were: unclean poultry and poultry products, failure to use adequate tools and equipment, the rise in the consumption of poultry and importation of birds, among others (Table 1.17)

It is consistent in all states that wild birds and importation of poultry, both external to farms, were the highest rated causes. The poor hygiene is the second reported cause in Central Equatoria and also highly rated in Gezira and White Nile States. It is important to note that, the highest don't know answer was recorded in the River Nile, Khartoum and Gezira states, where education and public awareness are believed to be higher.

Table 1.16: Sample Population Perceived Causes of AI Outbreaks

	Khartoum	Gezira	White Nile	River Nile	Central Equatoria	All States	
						Total %	Adjusted %
Migratory wild birds	56.0	67.2	69.2	63.1	58.0	63.0	39.6
Imported poultry & poultry products	28.0	18.9	33.8	7.7	20.0	23.3	14.0
Low awareness	8.8	14.8	15.4	0.0	14.0	14.7	9.2
poor hygiene in farms & homes	11.0	18.0	16.9	3.1	26.0	15.5	9.7
inadequate equipments & tools	5.5	4.1	10.8	0.0	6.0	7.4	4.7
poverty and lack economic resources	6.6	7.4	7.7	1.5	10.0	7.0	4.4
Others	4.9	0.8	4.6	4.6	2.0	2.9	1.8
Don't know	16.5	15.6	13.8	21.5	10.0	15.9	15.9

Table 1.17 : Causes of SARS Spread Among Human Population

Causes	Khartoum	Gezira	White Nile	River Nile	Central Equatoria	All States	
						Total %	Adjusted %
High consumption of poultry & poultry products	9.3	13.9	26.2	26.2	18.0	15.9	11.1
Unclean birds and products	18.7	15.6	26.2	26.2	26.0	22.7	15.8
Imported birds	8.8	19.7	12.3	12.3	24.0	18.8	13.1
Use of inadequate tools and equipment	18.7	9.8	15.4	15.4	14.0	13.8	9.6
Low level of awareness	27.5	27.9	38.5	38.5	30.0	25.4	17.7
Poverty	7.7	4.1	3.1	3.1	10.0	5.6	3.9
Others	6.0	9.8	3.1	3.1	0.0	7.2	5.1
Don't know	26.9	22.1	16.9	16.9	18.0	23.6	23.6

Concerning respondents evaluation of AI spread 40.1% of them see it as primarily a health problem, 13.8% see it as an economic problem, 3.5% see it as a social problem and 15.5% do not see it as a problem at all.

2.2.7 Means for communicating Awareness Messages

Radio and TV are considered in all states to be the most reaching means of communication as indicated by population responses to the question on the effective means of communicating messages (Table 1.18). Gathering places such as mosques and churches were more highly rated in the peripheral states of White Nile, River Nile and Central Equatoria. Personal contact was particularly rated high in the River Nile State and so was the cinema and video shows in Juba .

Table 1.18: Population Views on Effective Means of Communicating Awareness Messages

Means/State	Khartoum	Gezira	White Nile	River Nile	Central Equatoria	All States
Radio	87.9	88.5	95.4	90.8	94.0	90.1
TV	76.4	82.0	90.8	84.6	88.0	82.0
Mosques & Churches	24.2	20.5	35.4	38.5	45.0	29.8
Theatre/Drama	8.2	2.5	12.3	13.8	38.0	11.2
Schools	22.5	21.3	21.5	15.4	44.0	23.3
Person to person contacts	17.6	9.0	7.7	46.2	28.0	19.0
Books/leaflets	28.0	16.4	16.9	36.9	46.0	26.7
Cinema & video shows	4.9	11.5	16.9	9.2	44.0	12.8
Public lectures	21.4	20.5	30.8	46.2	56.0	29.3

3. Farm Owners:

A total of 67 farm owners were interviewed in the four northern states, about 72% of them in Khartoum and Gezira States where the culture of poultry farming is more dominant and with a longer history.

Generally, as shown in Table 2.1, farm owners are young as 66% of them were under 45 years of age and all of them were males. The majority of owners are university graduates (63%) and only 3% have education level below secondary school.

Table 2.1: Percentage Distribution of Farm Owners by State and Age Group

State/Age		<30 years	30-45	46-60	> 60 years	Total
Nahr El Nil	% of State	20.0	60	20.0	-	14.9
	% of Total	3.0	9.0	3.0	-	
Khartoum	% of State	32.0	28.0	28.0	1.0	37.1
	% of Total	11.9	10.4	10.4	0.4	
White Nile	% of State	-	66.7	33.3	-	13.5
	% of Total	-	9.0	4.5	-	
Gezira	% of State	17.4	47.8	30.4	4.3	34.3
	% of Total	6.0	16.4	10.4	1.5	
Total		20.9	44.8	28.4	6.0	100

Table 2.2: Percentage Distribution of Farm Owners by State and Education Attainment

State/ education		Illiterate	Basic	Secondary	University	Graduate	Total
Nahr El Nil	% of State	-	-	50.0	50.0	-	14.9
	% of Total	-	-	7.5	7.5	-	
Khartoum	% of State	-	4	40.0	48.0	8.0	37.1
	% of Total	-	1.50	14.9	17.9	3.0	
White Nile	% of State	11.1	-	33.3	55.5	-	13.5
	% of Total	1.5	-	4.5	7.5	-	
Gezira	% of State	-	-	17.4	78.3	4.3	34.3
	% of Total	-	-	6.0	26.9	6.7	
Total		1.5	1.5	32.8	59.7	4.5	100

Over 13% of owners live within their farms (all of them in Gezira and Khartoum), 79% in first or second class residential areas and the rest in third class areas, all in Khartoum State, which reflects the economic status of owners. It is important to note that most of those in first class residential areas are ex-government officials. About 54% of the farm owners own their farms while remaining 46% are renting farms or poultry cages within the farm.

Involvement in poultry production, from the sample is generally recent since over 60% of farm owners started working in poultry production during the last ten years, about two thirds of them during the last five years and 9% actually started during 2006. The latter figures suggest that the International fears of 2003-4 linked to SARS and the well covered suspected cases in Sudan did not cause panic or negatively impacted on investment in the poultry sector (Table 2.3).

**Table 2.3: Percentage Distribution of Farm Owners
by State and Length of Period of Engagement with Poultry**

State/period		<1 year	1-5	6-10	10+	Total
Nahr El Nil	% of State	10.0	30.0	40.0	20.0	14.9
	% of Total	1.5	4.5	6.0	2.9	
Khartoum	% of State	8.0	24.0	28.0	40.0	37.1
	% of Total	3.0	9.0	10.4	15.0	
White Nile	% of State	-	55.6	11.1	33.3	13.5
	% of Total	-	7.5	1.5	4.3	
Gezira	% of State	13.0	21.7	17.4	47.8	34.3
	% of Total	4.5	7.5	6.0	16.4	
Total	% of Total	9.0	28.5	23.9	38.6	100

About 12% of owners reported having more than one poultry farm, half of them in Khartoum and the other half in Gezira state, representing respectively 16% and 17.4% of Khartoum and Gezira State farm owners. All surveyed farms except those in the White Nile State (88%) are in situated within their agricultural areas, while the remaining (12%) of the White Nile State where 8 out of 9 farms are situated within the urban area.

In general, most of the farms surveyed are small. About 57% are under 5 feddans in size, 16.5% 6-10 feddans and 28% are over 10 feddans. The larger farms are heavily concentrated in Gezira state as about 61% of farms are over 10 feddans in area, compared to 12% in Khartoum and 22% in the White Nile State in the same group. (Table 2.4).

**Table 2.4: Percentage Distribution of Farm Owners
by State and Farm Size**

State/period		< 1 Fed	1-3	4-5	6-10	10+	Total
Nahr El Nil	% of State	-	40.0	40.0	20.0	-	14.9
	% of Total	-	6.0	5.6	3.0	-	
Khartoum	% of State	16.0	20.0	40.0	12.0	12.0	37.3
	% of Total	6.0	7.5	14.9	4.5	4.5	
White Nile	% of State	55.6	11.1	-	11.1	22.2	13.5
	% of Total	7.7	1.5	-	1.5	3	
Gezira	% of State	13.6	8.7	4.4	8.7	65.2	34.3
	% of Total	4.5	3.0	1.5	3.0	22.4	
Total	% of Total	17.9	17.9	22.4	11.9	29.9	100

About 40.3% of owners, in addition to, poultry raise animals within their farms. The percentage is much higher in Gezira state (56.5%), which may explain the larger size of farms, while the ratio is 28% in Khartoum, 40% in Nahr Nil and 33.3% in the White Nile State. Also about 7.5% raise ducks and 4.5% raise ostrich and others type of birds in addition to chicken.

Chicken represent the main type of poultry raised by all owners, although the size of the stock varies considerably between owners. In the White Nile and Nahr El Nil states all farm owners have 3,000 birds or less in their farms, while 20% of farm owners in Khartoum and 35% in Gezira raise over 5,000 birds in their farms. The main reasons for the variations seems to be, in addition to suitability of natural conditions and availability of services, are the ready market and easy access to suppliers and inputs in Khartoum and Gezira, (Table 2.5).

Table 2.5: Percentage Distribution of Farm Owners by State and Size of Flock

State/Flock		0-500	500-1000	1001-3000	3001-5000	5000+	Total
Nahr El Nil	% of state	20.0	60.0	20.0	-	-	14.9
	% of total	3.0	9.0	3.0	-	-	
Khartoum	% of state	8.0	8.0	40.0	24.0	20.0	37.3
	%of total	3.0	3.0	15.0	9.0	7.5	
White Nile	%of state	22.2	11.1	66.7	-	-	13.4
	%of total	3.0	1.5	9.0	-	-	
Gezira	%of state	-	8.69	21.7	34.8	34.8	34.3
	%of total	-	3.0	7.5	11.9	11.6	
Total	%of total	9.0	16.5	34.5	20.9	19.1	100.0

Regarding the type of production, the vast majority (82%) concentrate on egg production while 3.1% produce poultry for meat, 12% combine egg and meat production and only 1.5% produce chicks (in Khartoum State).

Based on farm owners' information and as shown in Table 2.6, the overall average is one farm per owner containing an average of four chicken enclosures/cages. In the White Nile State, however, the number of enclosures is small but the size of the enclosure is exceptionally large, almost double the average size for all other states. The number of birds is, as expected, higher in Khartoum and Gezira and low in the River Nile and White Nile States.

Table 2.6: Percentage Distribution of Farm Owners by State and No of Poultry Cages

State/		1	2-3	4-5	6-10	10+	Total
Nahr El Nil	% of state	-	66.7	11.1	22.2	-	13.6
	% of total	-	9.1	1.5	3.0	-	
Khartoum	% of state	24.0	24.0	28.0	24.0	-	37.9
	%of total	9.1	9.1	10.6	9.1	-	
White Nile	%of state	11.1	88.9	-	-	-	13.6
	%of total	1.5	12.1	-	-	-	
Gezira	%of state	13.0	39.1	26.1	8.7	13.0	34.8
	%of total	4.5	13.6	9.1	3.0	4.5	
Total	%of total	15.2	43.9	21.2	15.2	4.5	100

The River Nile State has smallest number of birds per enclosure with an overall average of 0.66 M² per bird for all states and 0.63 m² for other three States.

3.1 Workers Employed:

About 55% of farm owners employ 1-2 workers per farm, 37% of owners employ 3-6 workers and 6% (all in the Gezira State) employ more than 10 workers (Table 2.7). About 75% of owners depend on wage labor, 16% on sharecropping basis and 9% on family labor.

Table 2.7: Percentage Distribution of Farm Owners by State and No of Workers

State/Enclosures		0-3	4-6	7-10	10+	TOTAL
Nahr El Nil	% of state	60	40			14.8
	% of total	8.8	6			
Khartoum	% of state	64	36			37.3
	%of total	23.9	13.4			
White Nile	%of state	77.8	22			13.4
	%of total	10.4	3			
Gezira	%of state	34.8	43.5	4.3	17.4	34.5
	%of total	12.0	15.0	1.5	6.0	
Total	%of total	55.1	37.4	1.5	6.0	100

In all states, most of the activities in the farm are performed by workers including some of the health-care activities. The main activities performed include poultry feeding, watering, cleaning of enclosures and disposal of garbage, collection of eggs and slaughtering of chicken. Slight variations were reported in the different states. For example, in Nahr el Nil state all activities are performed by workers except for marketing which is done by farm owners and the health-care activities in 30% of farms that are conducted by specialists (veterinary doctors). However, most farms depend on part-time veterinary doctors.

About 60% of farm owners claim that their workers had been trained (50% of them in Gezira State). However, the training referred to seems to be primarily instructions and directives for operation more than training per se. None reported any training on SARS detection or response method. It is important to note that about 36% of farm workers are illiterates, 46.2% have basic education.

3.2 Poultry Imports:

Just over 70% of farm owners depend on the local market for the supply of chicken from poultry production companies in Khartoum, 27% import poultry from Europe and 3% import from Arab countries (Egypt), all in Gezira State (Table 2.8). Egg importation is very limited and only 6% of owners reported importing eggs, half of them in Khartoum and the other half in Nahr El Nil State.

Table 2.8: Percentage Distribution of Farm Owners by State and Poultry Import

State/		Local market	Arab countries	Europe	Total
Nahr El Nil	% of state	30	-	70.0	14.9
	% of total	4.5	-	10.4	
Khartoum	% of state	88.0	-	12.0	37.3
	%of total	32.8	-	4.5	
White Nile	%of state	66.7	-	33.3	13.4
	%of total	9.0	-	4.4	
Gezira	%of state	69.6	8.7	21.7	34.3
	%of total	23.9	3.0	7.5	
Total	%of total	70.2	3.0	26.8	100

Marketing of products (chicken, eggs, chicken meat and faeces) in 91% of farms is done within the farm, most under the supervision of farm owners. Workers, owners, buyers and transport workers are all involved in the loading process. Marketing through middlemen is mostly outside the farm. Except for the slaughtered chicken when refrigerator cars are used, transportation of live birds (chicks and chicken) and eggs is done by commercial or private vehicles. Refrigerator cars are used in 24% of farms mostly in Khartoum and Gezira States.

Only 9% of farm owners claim to treat birds excretion before selling it. This include 4% of farm owners in Khartoum and 22% Gezira States, but all 91% remaining farms do not have any treatment before sale.

In the farms where poultry is raised for meat production, slaughter remains are burnt and buried within the farm by 57%, buried without burning by 4.8%, burnt within the farm (9.5%) and thrown out of the farm or in garbage collection points by 23.8%. It is important to note that no burring or burying were reported in Nahr el Nil and White Nile States.

Table 2.9: Percentage Distribution of Farms by Tasks and Performers

State /tasks performed		Actors (%)			
		<i>workers</i>	<i>specialists</i>	<i>Owners</i>	<i>Others</i>
Nahr El Nil	feeding	81.8	-	18.2	-
	watering	81.8	-	18.2	-
	health care	37.5	37.5	25.0	-
	egg collection	85.7	-	14.3	-
	slaughtering	100.0	-	-	-
	marketing	-	16.7	83.3	-
	cleaning	100.0	-	-	-
Khartoum	feeding	95.7	-	4.4	-
	watering	95.7	-	4.4	-
	health care	33.3	38.1	28.6	-
	egg collection	100.0	-	-	-
	slaughtering	100.0	-	-	-
	marketing	31.3	-	68.8	-
	cleaning	100.0	-	-	-
White Nile	feeding	90.0	-	10.0	-
	watering	90.0	-	10.0	-
	health care	57.1	14.3	28.6	-
	egg collection	83.3	-	16.7	-
	slaughtering	100.0	-	-	-
	marketing	57.1	14.3	14.3	14.3
	cleaning	88.9	-	11.1	-
Gezira	feeding	100.0	-	-	-
	watering	100.0	-	-	-
	health care	31.8	22.7	45.5	-
	egg collection	100.0	0.0	0.0	-
	slaughtering	75.0	0.0	0.0	25.0
	marketing	16.7	5.6	66.7	11.1
	cleaning	100.0	-	-	-
All States	feeding	93.9	-	6.1	-
	watering	93.9	-	6.1	-
	health care	36.2	29.3	34.5	-
	egg collection	95.2	-	4.8	-
	slaughtering	84.6	-	-	15.4
	marketing	25.5	6.4	61.7	6.4
	cleaning	98.5	-	1.5	-

Table 2.10: Percentage Distribution of Farms by Type of Precautionary Health Measures

State	% of Farms With			
	Trained workers	Use of safety uniform	Specialists for health care activities	Pre-Sale Excrete Treatment
Nahr El Nil	80.0	50.0	70.00	0.00
Khartoum	36.0	52.0	80.00	4.00
White Nile	33.3	66.7	55.56	0.00
Gezira	87.0	60.	78.26	20.83
Total	40.3	56.72	74.63	9.09

Table 2.11: Percentage Distribution of Farms by Type of Production

State/ Production	Meat & Live Poultry	Chicks & Eggs	Poultry meat & Eggs	Eggs	Live Poultry	Total
Nahr El Nil	0.0	20.0	20.0	50.0	10.0	14.1
Khartoum	3.6	3.6	10.7	42.9	39.3	39.4
White Nile	0.0	10.0	0.0	90.0	0.0	14.1
Gezira	4.4	17.4	4.4	52.2	21.8	32.6
Total	2.8	11.3	8.5	53.5	24.0	100.0

Table 2.12: Percentage Distribution of Farms by Method of Disposal of Slaughtered Poultry Remains

State/ Method of disposal	Burning & burying	Throwing outside farm	Garbage Collection cars	Use as fertilizer	Burying	Burning	% of Total
Nahr El Nil	-	-	-	-	-	-	0.0
Khartoum	24.0	4.0	-	-	4.0	8.0	15.0
White Nile	-	-	22.2	11.1	11.1	-	6.0
Gezira	26.1	8.70	-	-	-	-	12.0
Total	18.0	4.5	3.0	1.5	3.0	3.0	

4. Conclusion:

The basic strategy that controlled SARS outbreaks worldwide was rapid and decisive surveillance and containment. The keys to successful implementation of such a strategy are up-to-date information on local, national, and global levels on SARS, rapid and effective institutions of control measures; resources, organizational and decision-making structure, and trained staff vital to swift and decisive implementation. This guidance WHO document accounts for two important features of SARS outbreaks: (1) they are neither regional nor national but rather confined to limited geographic and even to institutional settings, and (2) they are dynamic, i.e. the characteristics of an outbreak can change quickly (WHO, 2005).

That means although the outbreaks can be sudden, quick response can lead to successful control if applied in timely and adequately where the virus appears. That in turn requires:

1. continued surveillance and monitoring and alert system
2. accurate and up-to-date information
3. logistical provisions
4. trained cadre
5. public awareness for reporting cases
6. coordination between concerned parties

4.1 Lessons learned from worldwide experience with AI and SARS

4.1.1 Lessons on Technical Aspects¹:

1. In backyard production settings, the practices of home slaughtering, de-feathering, and eviscerating, related to the marketing of live birds, create opportunities for further and extensive exposure
2. Good hygiene practices are essential during slaughter and post- slaughter handling to prevent exposure via raw poultry meat or cross contamination from poultry to other foods, food preparation surfaces or equipment
3. Though well cooked poultry meat is safe, in areas affected by H5N1 avian influenza, the handling of frozen raw infected poultry meat prior to cooking could be hazardous if good hygienic practices are not observed
4. Evidence from Asia and Europe shows that the vast majority of human cases have acquired their infection following direct contact with infected live or dead poultry, inhaling the through dust and/or contact with surfaces contaminated with the virus (Infected poultry excrete in saliva and faeces.
5. The majority of H5N1 avian influenza infection of human cases have occurred in previously healthy children and young adults. The virus crossing from birds to humans is linked to close contact with live or dead infected poultry or their secretions, causing rapid deterioration, multiple organ failure and high fatality.
6. The greater risk to human health is that the virus changes into a form that is highly infectious for humans and spreads easily from person to person. This occurs with close contacts between humans and infected birds, which requires changes in human behaviour.

¹ Summarized from WHO/FAO International Food Safety Authorities Network (INFOSAN), Highly pathogenic H5N1 avian influenza outbreaks in poultry and in humans: Food safety implications, INFOSAN Information Note No. 7/2005, 4 November 2005

7. The greatest risk of exposure to the virus is through the handling and slaughter of live infected poultry.
8. Though public health education campaigns about the disease and measures for protection have reached rural people, changing behaviour proved particularly difficult, e.g. activities such as retaining of sick birds or their consumption
9. In areas where diseased/ dead chicken are valued rapid socio-economic improvements are ultimately needed. So the problem is not only technical or health related
10. Densely populated livestock areas are vulnerable to the introduction and spread of infectious diseases, compounded by the presence of forest reserves and open water bodies in the production area, movement of animals, contamination of lorries, feed and other supplies, and hygiene on farms, the processing chain and markets.
11. Conditions that make transmission to humans more likely, include poor sanitation of chicken stalls in retail outlets, the proximity of markets to living areas, the absence of controlled slaughtering facilities, and, the practice of chicken slaughtering without veterinary inspection.
12. Soapy water, detergents and disinfectants can destroy the avian influenza virus which is more simple to destroy than many viruses
13. Attempts to control the spread of H5N1 by culling large numbers of wild birds are not recommended because they are costly, unlikely to be effective, may disperse the infected birds over a wider area, may kill or cause disturbance to non-target species and they require resources to be diverted from more effective ways of combating the virus, such as improving bio-security and clamping down on illegal or unregulated movements of poultry.

4.1.2 Lessons on Controlling Outbreaks

Because of the multifaceted nature of response and impact of AI and SARS outbreaks on many sectors of society; political, economic, social, healthcare, in addition to the primary stakeholders, the most important lessons learned from the international experience with AI and SARS and include¹

1. knowledge about the concerned local community social and economic systems, the country's legal system and laws statutes and the technical capacities available on site
2. a clear organizational and well defined roles and responsibilities and operational authority is necessary for an effective responses.
3. Strong leadership to coordinate response, allow efficient allocation of resources and disseminate consistent information is critical. Coordination should include policymakers, healthcare and public health professionals, the media, community leaders, and the public to work within a well-defined collaborative framework
4. A command structure, supported by adequate information system, allow for rapids and efficient responses.
5. A suitable legislative framework is necessary to impost emergency and containment measures at both the individual and community level.

¹ Source CDC, Dept of health and Human service, fact Sheet, Basic information about SARS 2003-2004.

4.2 Survey Findings:

4.2.1 General

Generally, from the survey and field observations it can be said that:

1. Contrary to the widely held belief, it seem that poultry production is progressively locating a commercial activity (large scale term production) paralleled with a decrease in backyard production, at least in the major towns and their surrounding rural hinterland.
2. Although commercial poultry production is on the rise in all northern states, in Central Equatoria State, backyard poultry is most dominant. The instability caused by war, high cost of inputs (all were to be imported from Khartoum) and the limited private investment seem to be the main reasons. However, there is an active poultry trade market in Juba in which quite a sizable portion is imported from Uganda and in fact several of the distributors in Juba are Ugandans
3. No significant damage and / or impact of Avian Influenza breakout (2006) was reported by poultry producers surveyed
4. Despite the wide coverage by international media of the extensive economic damage and loss of lives in South East Asia, and the alarm raised by the concerned international agencies, particularly during 2005-2006, the engagement in and scale of commercial poultry production has been on the rise in Sudan during the last 5 years. The expansion in poultry production can be attributed, among other things to
 - a. The limited scale of the outbreak in the country and the limited media coverage of it.
 - b. The quick profit and increasing demand and guaranteed market of the product in addition to the relatively low production costs and low labor demand and limited skills needed compared to other investments.
 - c. The limited knowledge about AI and SARS among producers, particularly about the risk to humans. The disease is thus for largely linked to birds.
 - d. One negative impact of international media coverage, was that most people took the alerts about AI and SARS lightly because they typified it with pervious alerts about Mad Cow disease, Foot and Mouth disease and Rift Valley Fever which they saw as an unnecessary panic and an "external" issue..
5. The factors behind the limited incidents or scale of AI outbreak in the country as suggested by available information, and also the comforting factors with regard to it's occurrence include
 - a. The dry and hot climate of the country which on the one hand reduces the influx of migratory wild birds and on the other, contribute to the destruction of the virus.
 - b. The large area of the country and poor transport which reduces the likelihood of transmission and intensity of movement of birds and mobility of humans.
 - c. Limited international trade (imports and export) on poultry and poultry products
 - d. Most of the backyard poultry is indoor domestic poultry that is small in number in large space and well controlled and generally kept in clean environment, except for the few chicken that are lift with animals to control insects, which are more vulnerable to set in contact with wild/infected birds.
6. No evidence was found in any of the five states visited of having an emergency plan prepared or in process to address possible AI outbreak

7. With the present state of the country, there are three categories of factors that cause concern vis-à-vis AI and raise vulnerability in the Sudan. These are include state policies and technical practices at the field level, issues relating to community social behaviour and economic conditions and global issues that are beyond control at national level

7.1 State policies and technical practice: These included

1. The absence of or failure to implement production standards with regard to poultry production and best practices, particularly with regard to protection of workers and best practices. Indicators of low/no standards include
 - i. Most of the farms visited in all four states of the north, asserted that, they have never been inspected by health authorities.
 - ii. The presence of many farms close to residential areas (Khartoum, Gezira and White Nile States)
 - iii. Congestion of bird population in poultry farms.
 - iv. Lack of standards on the type, size or building materials of poultry farms or accommodation of workers in farms.
 - v. No standards on clothing or other protective measures for poultry workers.
2. Emphasis in veterinary and animal production units have largely been on animal and have excluded owners and other stakeholders.
3. Poor or lack of coordination between concerned government institutions, particularly between federal state and locality levels.
4. Weak technical and logistical capacities of concerned government institutions.
5. Limited media coverage or support to public awareness compares to present and / or control AI spread.
6. Absence of legislation or it's dissemination or enactment if it exists, with regard to best practices for protection and / or response in case of outbreaks, including human health and economic measures.

7.2 Community behaviour

1. high illiteracy and low awareness in society including those in direct contacts with birds specially about issues of safety best practices .
2. heavy concentration and high congestion of poultry prompted by the high demand for the product.
3. Increased urbanization, income rise and changes in food habits and dietary systems which increase the demand for animal production
4. high poverty rate which force some people to accept some forms of work practices that put them at risk and they may be tempted to consume infected or suspected products because they are cheap or free.

7.3 Global and difficult to control factors

1. the massive increase in traffic and trade and the consequent movement of people and goods including bird/poultry products
2. wild migratory birds
3. the nature of the AI virus and its ability to change during a short time.
4. insecurity and population instability in several parts of the country which paralyses the functioning of both institutions and programmes .
5. according to the WHO the clinical signs of both AI and SARS are not specific enough to reliably distinguish from signs of other diseases.
6. climate change which alters the distribution and abundance of insect vectors and influences bird migration.

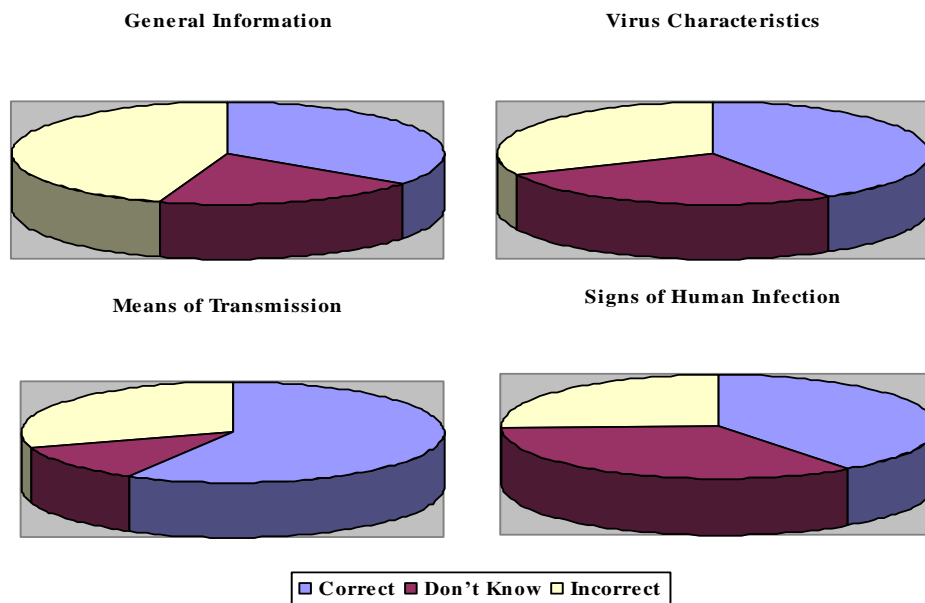
Other challenges include

- a. the size of the country, coupled with poor infrastructure which hinders the capacity to control movement or outbreaks; and
- b. the delicate issue, in case of AI or SARS outbreak, of the ability to maintain balance between one the one hand ensuring public safety and the economic interest of poultry owners and other stakeholders, particularly when measures are taken as precaution more than certainty-based action, and on the other balancing between maximizing the outreach of the alert or awareness messages about AI/SARS and avoiding public panic and maintaining public confidence in the national public health care systems.

4.2.2 Survey Results and Findings:

Fig. 2 below provides a summary for the state of knowledge about farm categories of information investigated. The over all average of accurate information known about Avian Influenza is about 42% and 22.5% for the total lack of information. Paradoxically, the White Nile State, which was not affected by an AI outbreak, recorded the highest accurate answers (49.2%) and the lowest don't know answers (16.9%). The level of accuracy for the other four states, ranges between a maximum of 30.5% in Gezira and a minimum of 20% recorded in Khartoum State (Fig. 2)

Fig. 2: Knowledge by Category of Information



As for the type of information about 51% of the surveyed population have good knowledge about the means of transmission, although 18% of them expressed total ignorance about the way the virus is transmitted between animals and /or humans. Given the fact that these are the primary stakeholders in poultry production, the short proximity of poultry farms to markets the unorganized poultry markets and the extensive mobility in the country, this percentage seems very slender compared to the risks economic and health risks attached to AI, particularly the survey was conducted in some of the largest towns in the country and their direct vicinity where the level of education and general public awareness are expected to be relatively high.

Fig. 3: State of Knowledge

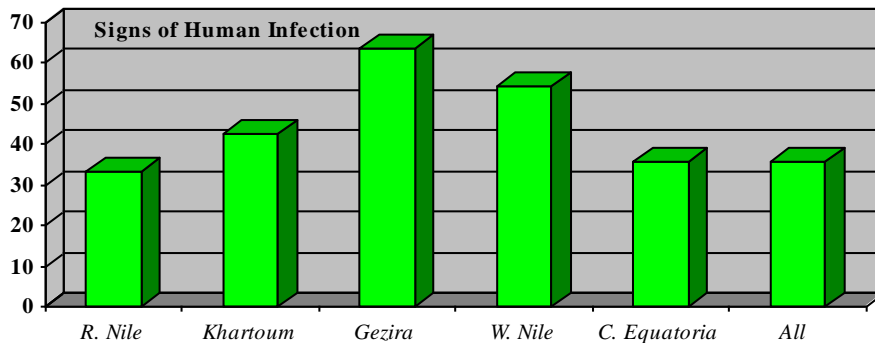
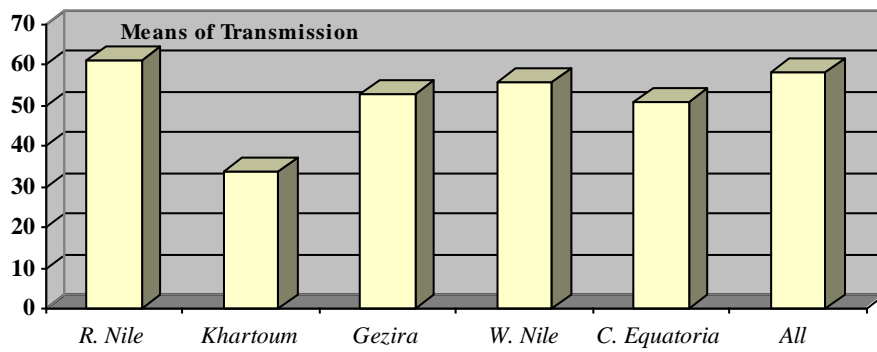
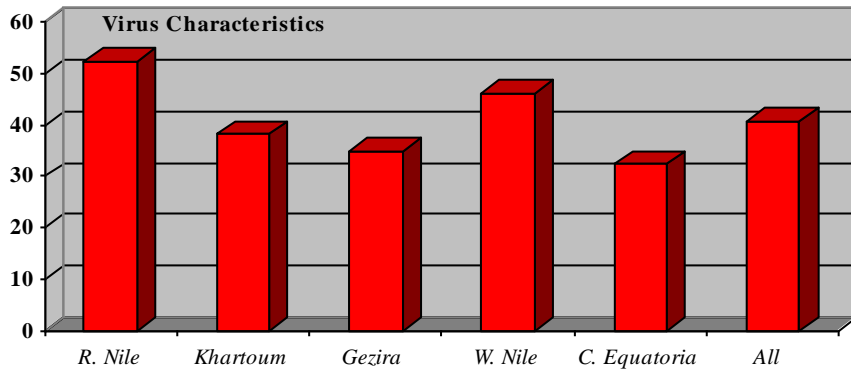
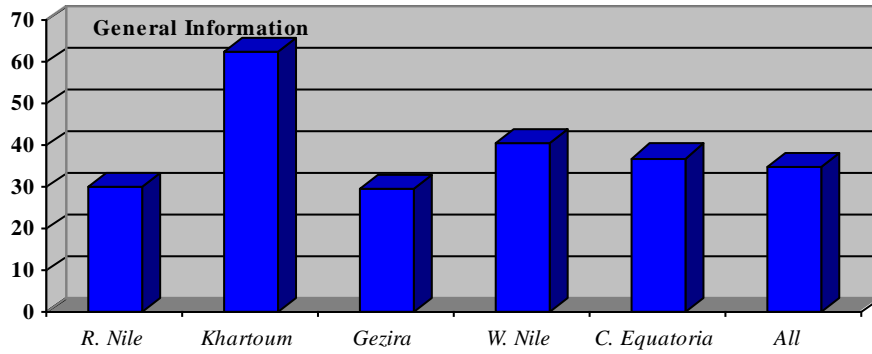
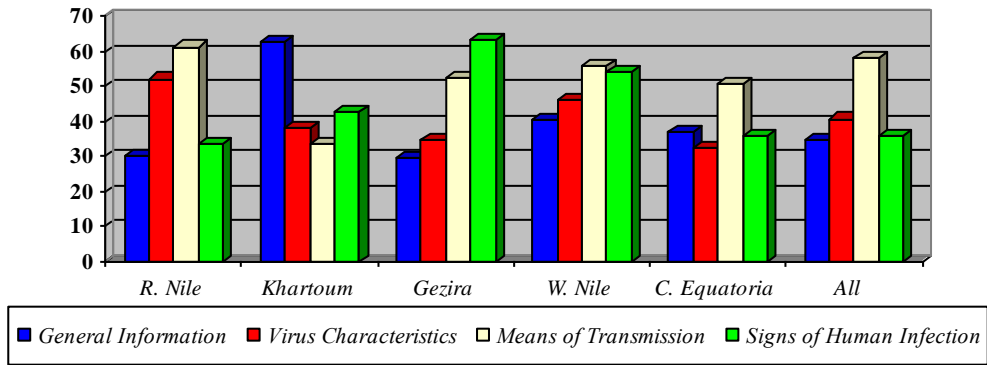
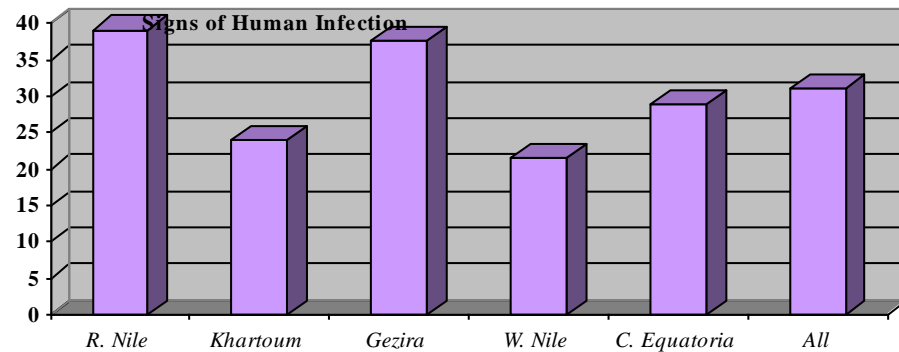
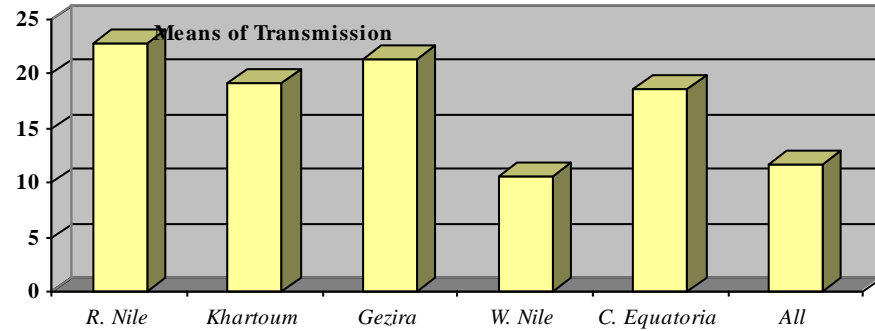
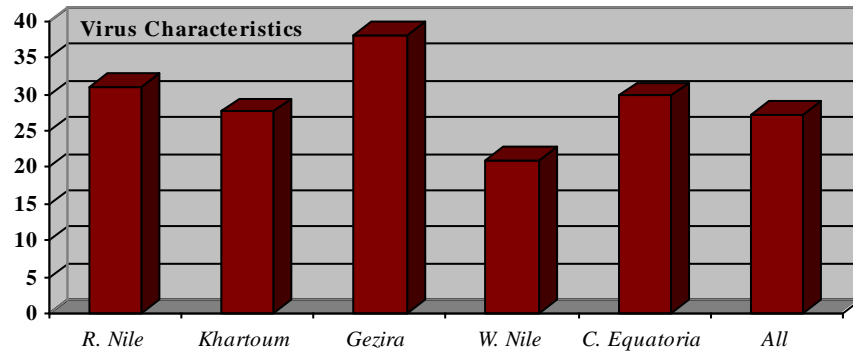
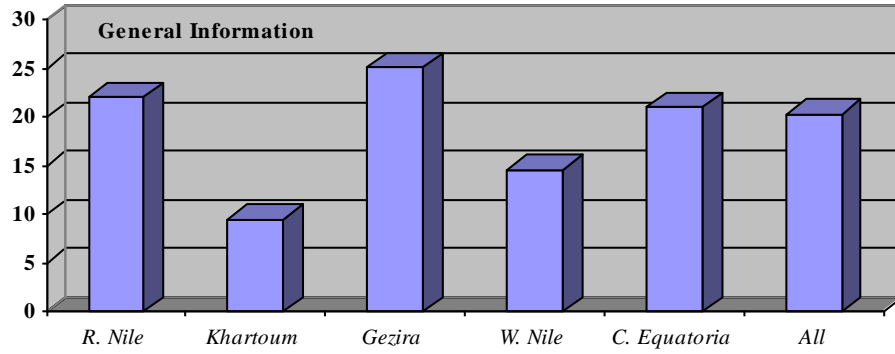
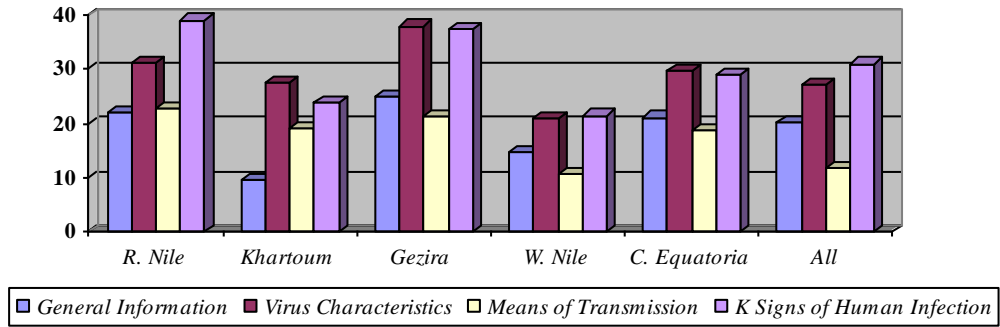


Fig. 4: Population With No Information



For the general information (news-based), information about the virus and human infections 40-45% of the population commands accurate information while 18% declared their lack of knowledge about the basic information and about how the disease is transmitted. A significant 30% of the population admitted their ignorance about the AI virus (poultry) and about signs of human infections (Fig. 2)

Although the overall averages are similar for all the five states, there are some important variations between them in the status of knowledge about each of the four categories of information. For example, Khartoum State population is the most knowledgeable about the general information, the River Nile and White Nile states population recorded the highest accuracy with regard to virus characteristics and the means of transmission, while Gezira state population tops the list on the signs of human infection, while the White Nile State recorded the lowest level of don't know answers in all categories. The River Nile and Gezira states, on the other hand, recorded the highest don't know answers in all categories of information (Fig 3.b). It is important to note, however, that a "don't know" answer might indicate a higher level of awareness by avoiding guessing in appreciation of the sensitivity of issue.

For the vast majority (67%) radio and TV were the main sources of information and for about 30% the sources were the general public discussions, chatting and personal communication. Under 14% of the population acquired their information from reliable sources such as health and poultry production specialists or certified information such as leaflets, posters or newsletters by specialized institutions.

Only 5% of the population claimed not to have heard about AI or SARS, most of them Gezira and Central Equatoria states. Surprisingly, very few acquired the information from specialized persons (3.2%) and 0.9% from NGOs, most of them in Central Equatoria. It is important to note also that the follow up of Radio and TV is much higher in the White Nile and River Nile compared to other states, while newspapers readership is highest in Gezira, White Nile and Central Equatoria states.

Regarding best practices relating to protective measures in their daily activities in poultry production, Khartoum and Central Equatoria states' population are far ahead of the others, whereas Gezira and the River Nile states are the lowest. However, the overall average of population with the best practices in poultry production is about 21%, all of them in the commercial sector and their best practice is primarily the use of disinfected shoes (Table 1.15)

One important finding that needs to be stressed is that an insignificant correlation was found when we tried to relate the factors of age and education attainment with both the level of knowledge (accurate responses) and the form of daily practices in poultry management¹.

The perception of causes of AI outbreaks, to a large extent contradicts commonly known realities, the statistical results of the survey and the survey team observations. For example, while about 60% of respondents attributed the spread of AI to migratory wild birds and importation of poultry (Table 1.16), few of the farm owners reported engagement in poultry importation (Table 2.8) and none reported the presence of migratory wild birds in their farms. Yet, at the same time the poor hygienic practices that were observed by the survey team in most of the farms visited, was mentioned by slightly over 10% of respondents. Besides, on the

¹ The data was not disaggregated by the rural-urban divide because most of the sample was within or close to major towns

causes of human infection (SARS), over 25% of respondents mentioned poor hygiene, which was the largest single response among all other perceived causes (Table 1.17).

Radio and TV, gathering places (e.g. mosques and churches) and person to person contacts are considered the most effective and/or preferred means for disseminating information about AI, in addition to written materials. However, learning from the experience of HIV/AIDS awareness campaign in most parts of Sudan, NGOs proved very effective in expanding the outreach and in getting the message through to the target groups, using a combination of methods, most important of which were the direct contacts (in groups) and facilitating the linkage between communities and technical experts and the peer education methods, in addition to the conventional methods of leaflets, posters and booklets. etc..

Finally, the other important observations that need to be mentioned are:

1. In all states surveyed there is no work on the ground relating to AI, be it campaign, training or any significant technical efforts
2. No standards seem to be in place with regard to the facilities or management systems of poultry production, except for the very large production companies
3. Other than Khartoum state, concerned government institutions are neither giving the due consideration to the AI issue nor have the capacity to adequately do so
4. Many of the technical staff met, do not seem to command the basic knowledgeable about AI virus and its possible consequences
5. NGOs, civil society and community organizations are not engaged in addressing the issue of awareness raising about AI or have it in their agenda and probably unaware about it
6. Practices in poultry production (of farm owners) seems to be governed by economic factors rather than technical knowledge or regulations and/or production standards

5. Recommendations:

1. Maximum use should be made of the lessons generated from the international experience with AI and SARS, especially with regard to preparedness and response to outbreaks. Obviously some of the measures and operational methods need to be adapted to suit the local socio-economic and cultural contexts. Other than the pure technical aspects, priority should be given to
 - a. Ensuring the availability of basic, preferably up to date, information
 - b. Learning about the legal structures and local laws necessary for enforcing individual and community containment measures and lobbying the concerned bodies to enact and/or issue new laws to allow for preventive measures and appropriate responses in case of emergency.
 - c. Reviewing the status of the available cadre, especially at the states' level and in areas with high likelihood of outbreaks, assess their needs and build their technical capacities.
2. For emergency preparedness and response
 - a. Ensure the availability of information and/or establish an adequate information system
 - b. Learn about the targeted community systems, entry points and influential persons to
 - c. Conduct local preparedness planning for outbreak of AI and /or emergence of SARS with participation by persons representing all concerned institutions, experts and the primary stakeholders
 - d. Draft and formally adopt a national AI and SARS response plans, and
 - e. Maximize the use of limited resources,
3. To enable local institutions to respond to possible outbreaks, the following is needed
 - a. Maintaining regular supply of technical information to these institutions, preferably in Arabic and in small but dense doses
 - b. FAO jointly with the Ministry of Animal Wealth should set guidelines and develop directives on best practices for both technical staff and the poultry sector in general (farm owners and workers)
 - c. Providing technical support to local/state institutions including information, training and logistical support to improve their capacity to develop and implement local prevention and response programmes
 - d. FAO and the Federal Ministry of Animal Wealth should father the development of a national preparedness plan and a vertical and horizontal coordination body to lead the implementation and follow up of the plan and any emergency situation
 - e. Start an advocacy programme targeting the legislature to produce or enact laws that can provide the legal framework for the national plan and best practices guidelines to be implemented both at the federal and state levels
4. Practical steps urgently needed include
 - a. Setting standards for best practices
 - b. Implementing a regular inspection programme for poultry farms
 - c. Establishing a register for poultry farms that can be a base for the supply of information and the nuclei for the surveillance and monitoring programme
 - d. Set some control measures and organize poultry markets, especially slaughtering and distribution processes

5. Although AI and SARS, can influence all the population, effective and economically viable targeting is critical at the start, each of the targets on its specialization and/or the role and function it is expected to play. Priority targeting should be for

- a. The legislature
- b. Technical staff and authorities in the relevant / concerned institutions
- c. Farm owners
- d. The media, and
- e. For the awareness campaign, farm workers, backyard producers, community leaders and the public at large. Also affected and most vulnerable areas should be targeted with the awareness campaign

6. For an effective awareness raising campaign it is important that

- a. Use in made of the previous similar campaign and their fate. For example, while the FGM campaign has been going on since the 1960s, it proved less effective than the HIV/AIDS campaign that started less than decade ago. Factors of the type of message, the form in which it is presented, the actors/medium, the targeting and the compatibility to the local contexts to which it is delivered are essential to consider
- b. The message should be simple, clear and indigenous in its language, content and spirit and the more visible it is the more it is likely to be received, believed and hopefully acted upon
- c. Since there is a wide range of target groups and stakeholders who are to be addressed by the awareness message, the message content should contain and be classified according to the objective and target, e.g. providing information, explaining methods, behavioural change etc..
- d. Note should also be taken of the facts that
 - A technically capable person is not necessary a good message carrier as in most cases the recipients do not prefer "dry" technical language and "frightening" presentations
 - As much as many stand to benefit from good practices, e.g. those who gain protection, some stand to loose, ever if temporarily, such as farm owners e.g. by supplying protective clothes, appropriate construction .etc, hence the message should highlight the incentive to the possible looser.

8. The engagement of NGOs, where they are operating, is important to make use of the experience they gained in previous campaigns, the community organizations they formed and of course their resources. Other community organizations and tribal associations can also enhance the process at local levels.

9. One of the methods that proved very effective in the HIV/AIDS awareness campaign, among the high risk and difficult to reach groups, was the peer education. It is therefore recommended that farm owners and some lead farm workers be trained as peer educators and be supported to spread the message.

Part II
States Reports

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1. River Nile State

Background Information¹:

The state falls between latitudes 16-22°N and longitudes 32-36° East. The total area is about 122,123 sq. kms (47,152 sq. miles or 29.2 million feddans) of which about 11% is arable land (3.2 million feddans). The climate is a desert climate with temperature range of 48 C° maximum in summer and 8.5 C° minimum in winter. Mean annual rainfall is 58 mm and the lowest mean recorded is 9.8 mm. Evaporation rates are high in summer 20.7 mm (June) and about 10.5 in winter (December).



Except for a small underground aquifers with an estimated capacity of 21 milliard M³, most of the state surface is underlain by Basement Complex rocks that are poor in water content, particularly the clay soils of the Butana area. The main sources of water in the state are the River Nile and the River Atbara, 21 seasonal Khors mainly flowing from Butana towards the Nile.

Population:

The total population of the state is estimated to be 936,000 persons (2004), with a 7.3% increase over its level in 1993. By mode of living, 34.3% of the population is classified as urban, 61.2% rural settled and 4.5% nomadic. The over all population density is about 7.5 persons per square kilometer but the actual density is much higher exceeding 150 persons per square kilometre along the Nile Banks. The aridity and desert climate and the have dictated the heavy concentration along the Nile banks. Population density is also much higher in the southern parts (Ed Damer, Shendi and Matama localities) where 70% of the population resides and it goes thinner as one moves northwards, mainly because of the presence of large towns and better conditions of resources in the southern parts .

Fertility rate, standing at 4.7, is one of the highest in the country, yet the population growth rate is under 2%, mainly as a result of out migration upon which livelihoods is heavily dependent. For example, while net in migration to the northern region (River Nile and Northern States) was 100,000, in 1993 net out-migration was 425,000 which, as a result of its male selectivity has translated into a M/F ratio of 97%. According to official statistics, female-headed households constitute about 7% of total (Table 3.1). However, actual figures seem to be much higher, particularly if headship is not only measured in economic terms, as most migrants leave wives behind to take care of children and the elderly. Official figures for women participation in the labor force also state the figure of 8% but that does not take into account, women contribution within the family labor processes in agriculture, where reference is only made to tilling the land and cultivation.

¹ Based on Dr. Hassan A. Abdel Ati "Flood Early Warning, Preparedness and Mitigation, Eastern Nile, Sudan" a Baseline Social Survey Report for Eastern Nile Flood Preparedness and Early Warning Project (FPEW), Nile Basin Initiative and The World Bank, July 2005

Table 3.1: River Nile State: Some Human Development Indicators

Indicator	No/%	Indicator	No/%
Total population	936000	Mothers Mortality per 100,000	488
Urban population	34.30	Infant mortality per 1000	57
Nomadic population	4.50	Infant mortality per 1000 – Female	88
Population Under 15 years	40.70	Infant mortality per 1000 – Male	95
Population 15-59	54.20	Under 5 Mortality per 1000	81
Population 60 years & over	5.10	Life expectancy at birth	57.90
Population growth rate	1.95	Male life expectancy at birth	53.4
Male/Female Ratio	97.70	Female life expectancy at birth	58.8
Fertility Rate	4.70	Population over 60 years	5.3
Crude birth rate (1998-2003)	3.5	Access to health services-rural	20%
Access to health services-urban	70%	Public expenditure on health of GDP	5%
Women heads of households	6.90	Participation in the labor force	7.90

Compared to other parts of Sudan, the state fares well in education and enrollment rates for the 6-14 age groups is 68% which is much higher than Khartoum (45.7%) and the national average of 40.4%. The same applies to pre-schools. For secondary education the state is almost equal to Khartoum in spite of the heavy private investment in education in Khartoum state

Unemployment rate is estimated at 24.9%, the highest in northern Sudan, and 30% higher than the national average.

During the last three decades, the State was subject to several environmental hazards and stresses including excessive drought, dust storms, desert encroachment on productive lands and settlements (desert creep), depletion of natural vegetation and sheet and gully erosion. Those problems caused huge losses of livestock and large scale human displacement for the nomadic communities many of whom moved from Butana and north eastern Sudan towards the river banks.

Poverty in the State:

According to the UNDP National Human Development Report (1997), about 92% of the State population are living under the poverty line, an increase of about 18% from 1990. The most noticeable feature in the report is the massive increase in poverty rates in rural areas (55%), in contrast to the situation of 1990 when poverty rate was lower in rural areas than urban centres (UNDP, 1997, Khartoum). The increase in poverty and the reversal of the situation between urban and rural areas can be attributed, in addition to the national/macro economic factors such as the negative impact of SAPs, the civil war, the trade embargo against the country .etc. to:

1. Successive droughts that hit the pastoral and agro-pastoral groups, particularly in Butana and lower river Atbara areas
2. The extensive damage caused by the floods, particularly in 1988, 1994 and 1999 both to crops and settlements
3. Severe shortages of fuel during the first half of the 1990s, upon which irrigation depends
4. The government agricultural policies, particularly towards wheat production that was forcibly confiscated by the State as well as the taxation system
5. The decline of the Sudan Railways that used to absorb rural surplus labour
6. The large scale mass redundancies from the public sector under the state policies of what was known as *Al Salih Al Am* political retirement, the surplus labour resulting

from the privatization policies and the returnees who came back as a result of the Gulf War.

The Economy:

As a result of its physical characteristics, life is heavily concentrated along the river Nile and its main tributary of the River Atbara. In fact, most of the arable area referred to, is dependent on rainfall which is generally low and irregular.

Total livestock population is estimated at 582,000 heads: 9.9% cattle, 13.5% camels, 37.8% sheep and 38.8% goats. About 86,000 feddans are demarcated as reserved forests and about 545,000 feddans are under cultivation

Agriculture is the main economic activity in the state, involving 75% of the labor force, contributing 92% of the Gross Domestic Product and over 95% of the exports value (El Rashid, 2005, p.2). Irrigated agriculture is practiced in three seasons (winter, summer and damira (flood)). The main winter crops are wheat, horse beans and onions, while sorghum is the main summer crop and in damira vegetables and fodder are grown. Fodder crops such as alfalfa and Abu Sabieen are also intercropped with fruit trees (in the southern parts) or outside the agricultural rotation. Horticulture and vegetable production are more dominant in the southern parts and primarily marketed in Khartoum. In the rain-fed areas (Butana), sorghum is the main crop grown when climatic conditions permit but it is mostly used as animal feed as a result of the low level and short season of rains.

Historically, poultry has been raised by most families in the state for domestic consumption and also to control creeping insects and pests. It also constituted a source, though not significant, of cash income to house wives. With the growth in urbanization, changes in life style (housing) and the emergence of commercial poultry production, backyard poultry production started to decline in towns. Since the 1970s, and encouraged by the support of the Ministry of Agriculture and its successful experimental farms, private commercial production started to appear in the towns of Atbara, Ed Damer and Shendi.

However, the number of poultry farms in the state is still very small, most probably because of the small population and low demand, the high cost of inputs, particularly with the dry and hot weather and the easy access to the product from Khartoum State.

Survey Results:

A sample of 65 cases (13.4% of total sample population) was interviewed, mainly from Ed Damer and Atbara towns and three suburban villages within their vicinity. The sample taken comprised of urban dwellers (49.2%), rural backyard producers (18.5%) and 32.2% farm workers and it included 78.5% males and 21.5% females. Of the sample population 72.3% were born within the state, the remaining 27.75 were born in other parts of Sudan.

Sample Population: Demographic Characteristics:

Population engaged with poultry production as Table 1.2 shows are generally young with 81.6% under 45 years of age, including 18.5% under 18 years.

Compared to other states, education attainment is generally high with only 30% illiterates, half of them originally from other parts of Sudan working as wage labor in the region.

University degrees holders account for 7.7% of the sample and all of them are either farm owners or farm superiors (veterinary doctors) (Table 1.3).

Just under 50% of the sample population are married with children, 46% are singles and 4.6% are divorcees. Family sizes are relatively large. About 57% have 4 or more children, which with the young age of the population, indicates the possibility of yet larger families.

As shown in Table 3.2, the population engagement with poultry production is almost 50/50 between commercial and backyard production. All professionals are either farm owners or technical specialists (veterinary doctors). Other major groups involved in commercial production include farm workers 64% (32.2% of total population) and distributors or sellers of poultry and poultry products 21.2% (10.8% of total). Backyard production has been reported mainly by working class respondents and housewives, who together constitute 84% of backyard producers.

Table 3.2: Sample Population by Occupation and Type of Poultry Production

Occupation	Commercial Production	Backyard production	Total
Professional	7.7	-	7.7
clerical	-	1.5	1.5
Worker	-	27.7	27.7
Farm worker	32.2	-	32.2
Unemployed/house wives	-	13	13.8
Student	-	4.6	4.6
Others	10.8	1.5	12.3
Total	50.7	45.3	100.0

Over 81% of the respondents have been engaged with poultry production for less than five years and only 10.8% of them have been dealing with poultry for more 10 years, all of them backyard producers. While 10.8% of respondents claim to consider poultry production their major investment project, 43% are engaged with poultry as their main source of incomes (including farm workers and poultry and egg sellers), while the most (46%) raise poultry to supplement their incomes and/or a mechanism of coping with rising cost of living.

Incomes generated from poultry production are relatively high as shown in Table 3.3 below and as indicated by the rush towards poultry production in recent years. That rush, however, may also suggest either lack of knowledge about Avian Influenza (AI) or a conscious choice between the income generated and the risks entailed. For 47.7% of the sample population poultry production is the main source of income, which include farm owners, farm workers, distributors of poultry products and a few of the backyard producer (Table 3.4).

Table 3.3 : Sample Population by Monthly Income Level

Monthly income levels (SDG)	%
< 100 pounds	20.0
100-250 pounds	33.8
251-1000 pounds	30.8
501-1,000	4.6
1,001-3,000	6.2
> 3,000	4.6
Total	100.0

Table 3.4: Sample Population by Main Source of Income

Income Source	Population %
Poultry and poultry products	47.7
Agriculture	15.4
Trade	3.1
Office work	6.2
Other jobs	18.5
Poultry production and other activities	9.2
Total	100.0

Knowledge about Avian Influenza:

About 97% of respondents interviewed claimed to have heard about AI, most of them (63%) through radio and/or TV and 26.2% from general public discussions and chatting. Ironically, no more than 1.5% reported learning about the disease from the expected sources such as newspapers, health or specialized personnel or NGOs, which indicates the limited scale, if any of awareness raising campaigns. Most of the respondents (57%) heard about the disease during the last two years but only 28.5% of them asserted asking a specialist about the disease, most of them are either veterinary doctors or individuals with direct access to veterinarians, such as poultry farms workers.

On the general information about the status of AI in Sudan, although only 7.7% of the surveyed population was accurate about the number of infected persons in Sudan, 72.3% and 87.7% respectively were accurate about the states with reported cases and the level of AI danger. However, the response to the question of states with reported cases seem to have been a guess rather than a sourced information since 98% of those who correctly responded, mentioned Khartoum State and the remaining 2% mentioned the River Nile State. Also the high level of accuracy about the danger of AI again seems to be prompted by the concern indicated by the survey itself.

Table 3.5: General Basic Information

Information	Accurate	Inaccurate	Don't know
Number of infected persons	7.7	36.9	55.4
States with reported cases	72.3	6.2	21.5
Level of AI danger	81.7	-	12.3
Overall Average	55.9	14.4	29.4

The inadequacy of public information and the limited level of knowledge is clearly indicated by the responses to the more specific questions summarized in Table 3.6 below, which provides a general picture about the state of knowledge about AI among primary stakeholders in the state.

Table 3.6: Summary of Response to Questions on Knowledge about AI and SARS**3.6.a General Information**

Statement	Responses %			
	Correct	Wrong	Partially correct	Don't Know
AI is a disease that infects only chicken	38.5	40.0	13.8	6.2
AI is a widely spread in Africa	58.5	12.3	-	29.2
Continuous hygiene and cleaning are important safety measures	80.0	9.2	4.6	6.2
Poultry infection occurred in most states of Sudan	35.4	18.5	24.6	21.5
Human infection occurred in some states of Sudan	27.7	40.0	6.2	26.2
Use of respirator and gloves are one of the preventive means	80.0	3.1	1.5	15.4
Pigs can be infected by Avian Influenza	27.7	21.5	1.5	49.2

3.6.b Knowledge about the Disease

Statement	Responses %			
	Correct	Wrong	Partially correct	Don't Know
Vaccination is an effective measure to control the disease	75.4	10.8	1.5	12.3
The disease infects the nervous system of birds	23.1	21.5	6.2	49.2
Avian influenza infects the respiratory system	67.7	6.2	-	26.2
One of the disease signs is the shedding of feathers	33.8	18.5	1.5	46.2
One of the signs of the disease is the swelling of bird feet	35.4	9.2	1.5	53.8
One of the disease signs is continuous screaming	32.3	15.4	1.5	50.8
One of disease signs is respiratory distress	56.9	1.5	1.5	40.0
One of disease signs is that produced eggs are covered with blood	27.7	23.1	-	49.2
One of disease signs is bleeding from the nose	27.7	13.8	-	58.5
The virus could be eliminated by boiling meat over 70 degree C	58.5	24.6	3.1	13.8
The vaccination protect poultry against disease and death	75.4	13.8	4.6	6.2
The virus can survive on the surface of and inside the eggs	46.2	26.2	-	27.7
Vaccination protects against infection	80.0	12.3	1.5	6.2
Vaccination reduces the effect of disease and mask clinical signs	73.8	10.8	-	15.4
Virus in eggs can be killed at sixty degree C	61.5	21.5	3.1	13.8
The bird can transmit the virus without showing any clinical signs	60.0	12.3	-	27.7

3.6.c Knowledge about Means of Transmission and Human Infection

Statement	Responses %			
	Correct	Wrong	Partially correct	Don't Know
The disease could be transmitted to humans by cats	36.3	32.3	1.5	29.2
The disease could be transmitted by shoes	61.5	21.5	6.2	10.8
The disease can be transmitted between different birds flocks	73.8	10.8	1.5	13.8
The disease can be transmitted by broken eggs	70.8	15.4	1.5	112.3
The disease can be transmitted by cars used for poultry transport	66.2	15.4	1.5	16.9
The virus can be transmitted from raw to cooked meat	56.9	20.0	9.2	13.8
The disease can be transmitted by touching infected birds	78.5	10.8	1.5	9.2
Virus is transmitted by eating infected bird meat	75.4	12.3	4.6	7.7
The disease is transmitted by air	76.9	10.8	3.1	9.2
The disease is transmitted by insects and mosquitoes	52.3	26.2	1.5	20.0
AI is transmitted by drinking from open water sources in infected area	67.7	112.3	1.5	18.5
AI can be transmitted through animals' milk in infected poultry farms	43.1	32.3	3.1	21.5
AI can be transmitted by work tools in infected area (Feeder, Mob etc)	72.3	12.3	3.1	12.3

3.6.d Knowledge about Signs of Human AI Infection

Statement	Responses %			
	Correct	Wrong	Partially correct	Don't Know
The disease is transmitted from birds to human	84.6	3.1	1.5	10.8
The disease can be transmitted from human to human	56.9	21.5	3.1	18.5
The disease can be transmitted through hand shaking	30.8	27.7	3.1	36.9
The disease can be transmitted by using infected person mobile	16.9	41.5	4.6	36.9
One of the sign is in human is conjunctivitis	33.8	7.7	-	58.5
One of the signs is the patient inability to walk	33.8	12.3	1.5	52.3
One of the signs is respiratory distress	55.4	6.2	1.5	35.4
One of the signs is muscle aching	38.5	6.2	4.6	49.2
One of the signs is arthritis and bone pains	35.4	6.2	4.6	53.8

From Table 3.6 it can be said that the level of accuracy of information is generally low for the category of the general information about SARS and AI, although those were well covered by the media particularly during 2006. Only 30% provided accurate answers and 22% admitted their ignorance.

The accuracy in response were much higher on the means of transmission and for the more logical and common knowledge such as the protective impact of hygiene and vaccination or the killing of the virus at high temperature, where 52% and 61% respectively, provided accurate answers. Signs of the disease and methods of transmission among humans is much less known than that of birds with 34% of respondents providing accurate answers and 39% don't know.

The above picture confirms the absence or the limited impact or effectiveness of awareness and/or media campaigns among the public including those directly engaged with poultry production. It also indicates the limited engagement of specialists in these campaigns, if ever organized, and their minimum direct contact with the stakeholders.

Respondents Practical Experience with AI:

Only one respondent in the state (1.5%) claimed to have been exposed to the experience of dealing with a suspected case of an infected bird, which was isolated from other birds and later burnt within the farm. Both the diagnoses of the bird condition and reaction were under the supervision of a specialist. Another 20% of respondents claimed to have handled "sick" birds which they considered AI cases. But, as shown in Table 3.7 below, several of the signs observed and used for determining AI cases are irrelevant, e.g. screaming, blood on eggs.. etc.

Table 3.7: Indicators Used for Determining Suspected AI Cases

Indicator	Respondents	
	<i>% of cases exposed</i>	<i>% of Total</i>
Continuous screaming	23.1	4.7
Swelling of the wattle	15.4	3.1
Inability to move	38.5	7.7
Blood on eggs	15.4	3.1
Swelling of feet	15.4	3.1
Others	16.5	7.7
Not Applicable	-	78.5

Note: all respondents used more than one indicator

Knowledge about Human Infection:

None of the surveyed population had any contact or had seen a case of human infection (H5N1). Yet, over half of them (50.8%) alleged their knowledge of the signs and symptoms of the disease. The signs perceived are shown in Table 3.8 below. While the vast majority (79%) correctly pointed to respiratory distress, most of them combined it with other signs that are more compatible with diseases like HIV/AIDS. This on the one hand indicates the shortage or inadequacy of the awareness messages, compared to that for example of HIV/AIDS, and on the other is more risky than ignorance as those who do not know are more likely to seek advice while those with confused or inadequate knowledge many act upon their perceived facts and cause more damage.

Table 3.8: Respondents Perceived Symptoms of Human SARS infection

Signs	Respondents %	
	% of Group	% of Total
Loss of weight	15.2	7.7
Diarrhea with unknown cause	12.1	6.2
Loss of appetite	12.1	6.2
Respiratory distress	78.9	40.0
Fever	21.1	10.8
Inability to move	3.1	3.1
Don't know	-	49.2
Total	100.0	100.0

Note: Most respondents mentioned more than one sign

Asked about how they consider a person infected with SARS, of the 83% who responded, the views were careless (59.3%), ignorant (16.7%), dirty (9.3%) and a victim (14.8%). Regarding the groups most vulnerable to catch the virus, the majority (72.3%) pointed to farm workers, 20% to farm owners, 17% backyard producers, 6.2% to children of backyard producers and 7.7% to those trading in poultry and poultry products.

Attitudes and Behaviour towards Infected Persons:

In response to the question of how they would deal with infected persons in an abstract form, most respondents (63%) opted to avoidance of and /or isolation of patients, 10.5% claim to deal with infected persons as usual while 7.7% will only avoid touching them and only 6.1% mentioned contacting infected persons using goggles or keeping a distance from patients. When asked the questions more specifically about their reaction to discovering an infected work mate or relative, responses differed considerably from those about the ideal practice/behaviour (Table 3.9).

Table 3.9: Respondent's Behavior Towards Infected Persons

Form of behavior	Ideal	Towards Relatives	Towards Work mates
Treat as usual	-	10.8	4.6
Avoid infected persons	-	49.2	35.4
Deal with but cautiously	-	-	27.7
Contact using goggles	-	4.6	-
Keep a distance from patients	-	1.5	-
Avoid touching patients	-	7.7	-
Stop him / her from work	10.8	-	7.7
Continue work and treatment	3.1	-	-
Isolation and treatment	58.5	13.8	-
Leave from area	6.2	-	-
Quit the job	-	-	9.2
Others	9.2	4.6	6.2
Don't know	12.2	7.7	9.2
total	100.0	100.0	100.0

While 76% of respondents opted to total isolation, including stopping from work and deportation away from the area in the general case, when the question was more specific about colleagues that ratio went down to about 43%, although 9.2% went as far as quitting their jobs to avoid the risk.

These responses reflect a real grasp of the danger and risks attached to the AI infection but at the same time, it also indicate a lack of clarity about how to respond to its occurrence both at the personal level and towards others.

Activities Performed in Poultry Production in the State:

This section is meant to assess the degree of vulnerability of poultry workers and their possible exposure to AI infection in the process of their work. As shown in table 3.10 below, the majority of people engaged in poultry production within both the commercial sector and backyard production tend to perform all activities of cleaning cages, feeding, watering and egg collection with limited specialization between various actors. Collection and slaughtering of birds is limited to farm production and too a few number of farms. Of the backyard producers, 48% claim that no family members are involved in poultry work except the respondent, while 52% involve family members. Those involved include spouses and adult family members (50%), children (16.7%), only women 9.3% and 25% claim to hire workers. Hired workers in the backyard sector are mainly used for cleaning cages, usually on temporary/ daily basis.

Table 3.10: Sample Population by Daily Routine Activities Performed

Activities	Backyard / family workers		Farm workers	
	<i>Total</i>	<i>Group</i>	<i>of Total</i>	<i>of group</i>
Cleaning cages	21.5	60.1	44.6	67.4
Feeding and watering	29.2	82.6	60.0	90.7
Collection of eggs	29.2	82.6	55.4	83.7
Slaughtering of chicken	-	-	4.6	7.0
All the above	6.6	17.4	1.5	2.3
Not App.	64.6	-	33.8	-

About 23% of backyard produced claim to use special uniform (mainly shoes) compared to 38% in the commercial sector (farm workers). The majority of non-users among backyard producers (62.5%) attributed that to not seeing it necessary, lack of knowledge about it (18.8%) and to it's high cost (12.5%).

Level of Exposure of Farm Workers:

In order to assess the level of knowledge and assess the level of vulnerability and risks attached to production, a number of questions relating to daily practices and protective precautions taken by those working in the commercial poultry production sector, were asked to farm workers, owners and distributors who together constitute 66.2% of the state sample population. The answers are summarized in Table 3.11 below.

Table 3.11: Percentage Distribution of Farm Owners, Workers and Distributors by Protective Measures Used

Measures/ precautions	% of farm workers	% total
Use of sterilized shoes	37.2	24.6
Use of gloves	18.6	12.3
Use of goggles	34.9	23.1
Use of special clothes	48.8	32.3
Daily sterilization of shoes	37.2	24.6
Drinking from open water containers in farm	76.7	50.8
Washing from open water containers in farm	69.8	46.2
Use of special shoe by other workers	27.9	18.5
Use of gloves by other workers	18.6	12.3
Use of goggles by other workers	32.3	15.3
Use of special uniform by other workers	32.6	21.5
Overall average	39.7	25.3

The above picture, combined with the fact that most farm workers in particular are involved in all production stages and daily activities within the farm, means that their exposure to catch

and transmit the disease is extremely high both within and outside the farm. The justification given for not taking protective measures include not being aware about them (46.5%), not being provided by farm owners (employers) (37.2%), the high cost (4.7%) and they do not seen as necessary (14%).

Views on Causes of AI Outbreaks and Methods of Addressing it:

Based on their personal observations and knowledge about bird flew (irrespective of the quality, accuracy or sources of information), respondents rated the following as the main causes of the disease spread:

- a. Wild and migration birds (61.5%);
- b. Imported poultry and poultry products (7.7%);
- c. Poor hygienic in farms and homes (3.1%); and
- d. Other reasons such as poverty and lack of economic resources, illiteracy, irresponsible behavior etc. (6.1%)

About 21.5% of respondents admitted their lack of information about the sources or causes of Avian Influenza virus. From the answers, it is clear that very limited attention was given to local and internal factors under their control and the spread of the disease was almost solely attributed to external factors, e.g. wild and imported birds.

Regarding the causes of spread among humans, 27.7% of respondents claim not to know the causes. For the rest the answers were the increase in the consumption of poultry and poultry products (21.5%), lack of hygiene standards for poultry and poultry products (18.5%), importation of birds (16.9%), low level of public awareness (12.3%) and poverty (3.1%).

About half the respondents (49.2%) consider the AI virus a purely economic problem, and 37% view it as both economic and health problem, while about 11% do not see it as a problem at all.

Channels of Communicating Awareness Messages:

The most effective means of spreading awareness messages among the public according to the surveyed population are radio, TV and direct public meetings (Table 3.12).

Table 3.12: Effective Methods for Awareness Messages

Methods	Respondents Preference %
Radio	90.8
TV	84.6
Mosques and churches	38.5
Theatre and drama	13.8
Schools	15.4
Direct personal contacts	46.2
Books and leaflets	36.9
Cinema and shows	9.2
Public lecture and meetings	46.2

Concluding Remarks:

Generally, the River Nile State is known for its low population but its heavy concentration along the River Nile banks. It is also the state with the highest education enrollment rate in the country but also with high out migration rate of the educated.

Although commercial poultry production started in the early 1970s, it did not expand at the same rate of other northern states, possibly because of the hot and arid climate, the relatively

high costs of inputs or the easy access to Khartoum market supply. Commercial production is limited to the few urban centers in the state. However, one of the important observations made during the field work is the noticeable drop in the traditional backyard poultry production in Atbara and Ed Damer towns and the villages between them. Also the local traditional breeds are giving way to Bovan and other imported breeds.

However, it is important to note that in many of the rural settlements (not covered by the survey) and through the income generation programmes supported by NGOs for poor families and/or the Productive Family programme implemented by the government, many households have established poultry projects that are somewhere between the traditional backyard systems and commercial production in terms of breeds raised, management system and the economic utilization. This may have contributed to the saturation of the small local market and reduced the demand for commercial production.

Knowledge about AI and SARS is generally poor and distorted and largely news-based. Also many of the respondents admitted their total ignorance about the both AI and SARS, but the majority attributed the spread of the virus to migratory wild birds, (62%) and imported poultry (8%) with only 3% making reference to local factors. This, on the one hand, indicates the lack of information and, or the other reduces their incentive to seek knowledge or respond to awareness messages. It also indicates the limited, or absent, effort to disseminate information about AI or SARS, specially the sample was focused on the primary stakeholders of poultry production

Encouraging factors for a successful awareness campaign include the close proximity to Khartoum, good transportation and communication facilities in the state and the population close follow up of the media (Radio, TV and Newspapers).

In general, the state does not deviate much from the general trends of the population of the five states surveyed but the state of knowledge AI and SARS issues and best practice is expected to be much lower in the distant rural areas of the state.

2. Khartoum State

2.1 Background Information:

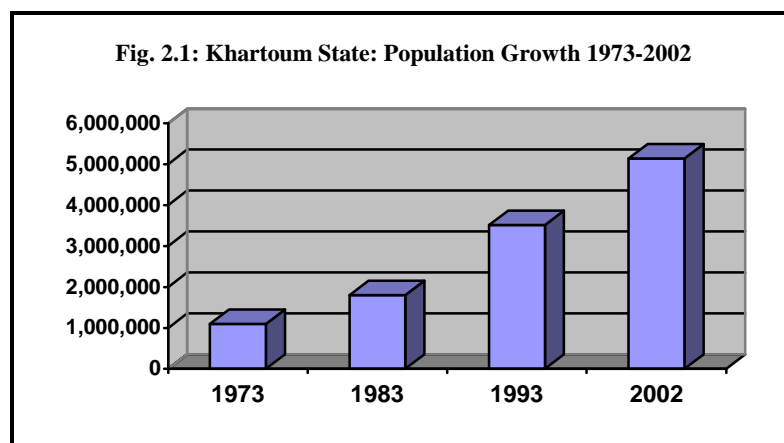
Khartoum State falls between latitude 15° 9' and 16° 25' N. and longitudes 21° 25' and 24° 45' East. With a total area of 22,122 Km², it is the smallest State in Sudan but the largest in terms of population. The climate is a semi desert climate with a dry winter (10 -25° C) and a hot dry summer with a maximum temperature of up to 45° C. Relative humidity is generally low (under 30%). Annual rainfall ranges between 100 and 200 mm. The maximum rainfall recorded was 420 mm (1988) and the lowest recorded was 4 mm (1984).



Geologically, the Basement Complex is the dominant base rock in the north-eastern and south western parts of the region, while Nubian sandstone which comprises about 80% of the region, holding an aquifer with an estimated capacity of 77 Milliard M³. Exploitation of underground water can hardly reach 1% (about 70 million cubic meters).

About 97% of the state area is considered arable lands but the fertile soils are limited to the semi delta of Khartoum Mahaliya between the Blue and white Niles, and the small strip along the river banks. Away from the river soil fertility is generally low because of the high content of sand. This has led to the heavy concentration of agriculture along the river banks, though some rain-fed cultivation is sporadically practiced when rainfall conditions allow. Agriculture in the state is primarily “urban agriculture”, commercially oriented to meet the demand of the urban population, focusing on the production of vegetables, horticultural products, poultry and cattle milk production. Cereals are also produced on a small scale but mainly for domestic consumption.

The total population of the state is estimated to be 5,139,000 (2002), an increase of 46.3% from its level in 1993 and with an annual growth rate of 4.04% (Fig. 2). Population density is about 248 persons per sq. km.



This massive increase in population is primarily a result of the influx of IDPs driven by war and adverse environmental conditions in southern and western Sudan. Estimates of the number of IDPs in the state ranged between 2 and 3 millions. Sex ratio is 112%. According to the mode of living, 85.5% of the population is urban, rural settled (13.9%) and nomadic 0.6%. Unemployment rate is 22.3% in urban areas and 18.3% in rural areas.

Economically, the conurbation of the three towns of Khartoum, Omdurman and Khartoum north forms a typical primate centre, holding over 40% of the industrial establishments in the country (384), 80% of financial institutions, and receiving 61% of foreign direct investment flows (Abdel Ati, 2002).

Table 3.13 below provides an overview of the main demographic characteristics and human development indicators. Population is generally young, compared to other states, with the highest M/F ratio in the country, mainly because of the high rates of migration.

All indicators confirm the gender gap in favour of males. However, although in terms of numbers, Khartoum has the highest number of service institutions and specialized cadres, in terms of population ratios (e.g. health) it is not the best among the States.

Poverty rates are also high and paradoxically higher in urban than rural areas, 80% and 77% respectively. It is clear from table that, although the numbers of health facilities have substantially increased between 1993 and 2000, the ratios of population to facilities and cadre have risen considerably (UNICEF 1999, States Encyclopedia, 2000), which confirms that the population is growing at a rate higher than those facilities.

Table 3.13: Khartoum State: Demographic and Human development Indicators 2000

Indicator	No/%	Indicator	No/%
Total population	5,139,000	Illiteracy Rate (10 Yrs +) Male	18.9
Urban population	86.5	Illiteracy Rate (10 Yrs +) Female	35.0
Nomadic population	0.6	Basic education (6-14) Enrollment rate	45.7
Population Under 15 years	36.3	Basic education (6-14) Enrollment rate- Male	43.1
Population 15-59	59.1	Basic education (6-14) Enrollment - Female	48.4
Population 60 years & over	3.8	Population per specialized doctor	15,377
Population growth rate	4.04	Population per general doctor	7,453
Male/Female Ratio	112.1	Population per dentist	41,164
Fertility Rate	4.8	Population per medical Ass.	3,943
Mothers Mortality per 100,000	634	Population per Nurse	4,155
Infant mortality per 1000- Male	98	Population per Midwife	3,451
Infant mortality per 1000-female	85	Women heads of households	17.8
Under 5 Mortality per 1000	103	Participation in the labor force	12.8
Life expectancy at birth -both	57.5	Women parliamentary seats	6.8
Life expectancy at birth-Male	56.1	Poverty Rate – Urban (1998)	80.0*
Life expectancy at birth -Female	59.8	Poverty Rate – Rural (1998)	76.9*

Source: States Encyclopedia, 2000, * CNS

Survey Results::

A sample of 182 cases (37.6% of total sample population) was interviewed in 38 cites in Khartoum, Jebel Aulia, Sharg el Nil, Khartoum North and Omdurman. About 89.5% of the sample population are urban dwellers who include farm owners, farm workers, the rest are mainly rural backyard producers. About 86 % of the sample was males and 14% females. The sample respondents were composed of farm owners/ commercial producers (22.3%), backyard producers (12.8%), farm workers 56% and distributors of poultry or poultry products (6%).

Population Characteristics:

None of the surveyed population was born within the State. About 43.5% of respondents were born in western Sudan, 38.5% in central Sudan, 9.3% in the north, 5.5% in southern Sudan and about 3% were born outside Sudan.

As shown in Table 1.2 above, the people engaged with poultry production are generally young with 87.5% of them under 45 years of age, including 8.8% under 8 years. Education attainment as shown is relatively high with only 11% of the population illiterate, and university degree holders, who are either farm owners or veterinary doctors, account for 17.6% of the sample population (Table 1.3).

About 34% of the population is married, 63.2% are singles, 1.1% are divorces and 1.6% are widows (Table 1.4). Out of those who are or have been married and have children, about 38.5% are supporting 1-3 children, 53% (20.7% of total) have four or more children and 8.5% have more than seven children (Table 1.5).

Occupational Structure:

Classified by type of occupation, groups engaged with poultry production are comprised of professionals (commercial producers) 17%, manual workers 61.5% and other engagements including clerical work, schooling and home activities for housewives (Table 1.6).

About 68.7% of the respondents have been engaged with poultry production for less than five years, 16% of them for more than ten years. More than half (53%) of the surveyed population consider poultry production as their main source of income, 17.8% are engaged in trade and business, 12% are engaged in agriculture and about 17.2% are engaged in other jobs.

Poultry production constitutes the main source of income for 53% of those engaged. a major source (about 50%) for 17% of them and a secondary source for the remaining 30%. As shown in Table 3.14, incomes generated from poultry production for farm owners, farm workers, and poultry products' distributors are relatively high. Table 3.14 below provides some indications about incomes generated from poultry production for farm owners, farm workers, and distributors of poultry products are relatively high.

Table 3.14: Sample Population by Monthly Income

Monthly income levels	%
> 100	7.1
100-250	51.1
251-500	23.1
501-1,000	7.7
1,001-3,000	7.7
< 3,000	3.3
Total	100.0

Knowledge about Avian Influenza:

About 95% of the surveyed population claimed to have heard about AI, more than half of them (53%) through radio and TV, about 25 % from public discussion, chatting, friends and acquaintances, 8.1% from news papers and 7.6% from health or specialized personnel. Only one respondent among the State sample population (0.5%) claimed to have heard about the disease from NGOs. The vast majority of respondents (90 %) heard about the disease during

the last two years, and only 3.7% of them asserted to have asked a specialist about the disease, most of them are veterinary doctors or individual with direct access to veterinarians, including farm workers.

In their response to the questions on the general information about the status of AI in the Sudan, 13.2 % of the surveyed population was accurate about number of the infected persons in Sudan, 70% and 90% respectively were accurate about the states with reported cases and the level of AI danger. Khartoum state was mentioned by 68 % of respondents as the State with the highest number of reported cases. However, 13% of respondents admitted their lack of information about AI situation and 11.5 % mentioned east Sudan state as the region with the highest number of cases, although, at least officially, no cases were reported.

About 27% of the respondent in the State claimed too have experienced dealing with suspected cases of infected birds, which were isolated from other birds and burnt within the farm.

Only 1.6 % of the respondents claimed to have seen a case of human infection, but about 90% claim to know the signs and symptoms of the disease The signs perceived are shown in table 3.15 below.

Table 3.15: Respondent Perceived Symptoms of Human SARS Infection.

Signs	% of respondent
Continuous fever	18.7
Loss of weight	12
Diarrhea	2.1
Loss of appetite	11.5
Inability to move	12.2
Respiratory disease	24.5
Other	19.2
Total	100.0

Asked about their views about the person infected with SARS, of the 87.4% who responded, about 26% of them consider him/her careless, 25% ignorant 11% dirty while 38% see the infected person as a victim. Regarding the groups most vulnerable to catch the virus, the majority (43.%) see farm workers as the most vulnerable, 12.6% farm owners, 19% backyard producers and about 13% view those trading in poultry and poultry products as the most likely to catch the virus.

Attitudes and Behaviour Towards Infected Persons:

In response to the question of how they would deal with infected persons, about 37.4% of the respondents reported avoidance of and/or isolation of the patients, 12.9% claim to deal with the infected persons as usual, 12.4% will avoid touching patients and 30.6% mentioned contact infected persons using goggles or keeping a distance from patients as shown in Table 3.16.

Table 3.16: Respondent's Behaviour Towards Infected Persons

Behaviour	Respondents %
Deal as usual	12.9
Avoid infected persons	25.4
Sit with him but don't touch them	12.4
Isolate them	12.0
Don't get close to patients	8.1
Contact using goggles and gloves	22.5
Others	5.3
Don't know	1.4
Total	100.0

When asked about their reactions to discovering an infected relative, over 77% of respondents claimed that they will opt to total isolation of patient. When the same question was asked about colleagues, responses differed considerably, the majority, however, 43% mentioned that they will deal with them cautiously, 5.4% claim to deal as usual, 12% said they will quit the job and 17% opted to the termination of infected persons contacts. The latter group are all farm owners.

Poultry Production: Daily Performed Activities:

Table 3.17 shows that the majority of those engaged in poultry production, both in the commercial sector and backyard production, tend to perform all daily activities of cleaning cages, feeding, watering, and egg collection.. The main difference is that health care activities, which were not mentioned by backyard producers, is a part of the daily work of farm workers. Also slaughtering is a home activity for backyard producers as it is mainly for consumption, while specialized people are used in poultry meat production farms.

Table 3.17: Daily activities performed by Sample Population

Activity	Backyard / family workers	Farm workers
Cleaning of cages	54.5	63.8
Feeding and watering	51.5	75.4
Collection of eggs	24.2	52.9
Slaughtering of chicken	12.1	8.7
Health care activities	-	18.1
All the above	39.4	3.6

About 53% backyard producers claim that no family members, other than heads of households, are involved in poultry work, while 47% involve other family members. Those who are involved include spouses and adult family members (58%), children (14%), only women (24%) and about 5% use hired workers (mainly for cleaning cages).

77% of farm workers in the commercial sector use special uniform for work, compared to about 42% of backyard producers. Most of the backyard producers, however, use only special shoes for entering cages. More than half of the backyard non-users of uniforms (52%) attribute that to not seeing it necessary, while 24% claim to lack of knowledge about it and 24% are hindered by it's high cost.

Level of Exposure of Farm Workers:

To assess the level of vulnerability and degree of exposure (risks) attached to poultry production in the commercial sector, a series of questions relating to daily practices and protective precautions taken by those working were asked to farm workers, owners and distributors, who together constitute over 87% of the total sample population. Responses are summarized in table 3.18 below.

Table 3.18: Protective Measures Used in the Commercial Sector*

Measures / precautions	% of Farm Workers*	% of Total
Use of gloves	14.7	12.8
Use of gloves by their by other worker	17.2	15.0
Use of goggles	41.1	35.9
Use of goggles by their by other workers	45.1	39.4
Use of special clothes	76.7	67.0
Use of special uniform by other workers	77.3	67.5
Daily sterilization of shoes	65.4	57.1
Use of sterilized shoes by other workers	62.1	54.3
Drinking from open water containers in farm	53.7	46.9
Washing from open water containers in farm	40.8	35.6

**Note: Farm workers here include farm owners and workers and distributors*

It is clear from the table that the standard measures used are the sterilized shoes and uniform (overall). Other precautionary measures are adopted by less than half the commercial sector workers. Besides, about 54% and 41% respectively, drink and wash from open water sources in the farm.

:

3. Gezira State

Gezira generally refers to the area between the Blue and White Niles, used to be the Central State that in 1994 was spilt into three states: Sennar, Blue Nile and the Gezira State that forms the northern part of the old one. Gezira State falls between latitudes 13° 32" and 15° 30" North and longitudes 32° 22" and 34° 20" east, in the semi-desert zone which is characterized by a dry climatic, with an annual rainfall range between 150 mms in the extreme north and 350 mms in the southern parts. The state borders Khartoum State from the north, Gedarif from the east, Sinnar to the south and White Nile State in the west. The state total area is about 23,373 Km². According to the last administrative re-division in 2003, Gezira State is composed of 6 localities; Eastern Gezira, Northern Gezira, Hasaheisa, Kamlin, Um Algura and Managil.



The Physical Environment:

The topography of the state is predominantly flat, except for a very few hills in the southern parts, with a gentle gradient sloping towards the northwest. The state is part of the Central Sudan flood clay plain, which is composed of the Gezira and Nubian Sandstone formations, covering most of the state area, with Basement Complex in the eastern and southwestern part of the state.

The soil cover is predominantly clay known as cracking black cotton soil, known for its high fertility. According to the soil classification, most of the soil cover falls under the first and second-class categories.

Natural vegetation is mainly of semi-desert and dry savannah species and includes *Acacia Melifera*, *Balanites Egyptiaca*, *Zizaphus Spina* and towards the River Nile *Ficus* species, *Ac. Nilotica* and *Seyal* are more dominant. Besides, there are the irrigated forests that are mainly *Eucalyptus* and *Ac. Nilotica*. The state is also rich in annuals and considered 90% covered with annual vegetation.

The Blue Nile is the main permanent water course crossing the state from south to north with numerous small and seasonal Khors, most of them on the eastern side.

Population¹:

The total population has been estimated to be about 3.6 million (2002) recording an increase of 32% over the 1993 census figures. Average population density is about 141 persons per square kilometer, the second highest in the country, after Khartoum. The state sex ratio is 98.9 and the average household size is 5 persons, in a population classified as 80.4% rural settled, 19.1% urban and only 0.5% nomadic. The crude birth rate (CBR) for the state is 38.5 per 1,000; the crude death rate (CDR) is 29.1 per 1,000 live births. The annual population growth rate is 3%. The noticeable features in these demographic characteristics are (a) the sharp increase of population, resulting mainly from migration and (b) the high percentage of settled population, the high population density and relatively even distribution of the population between Mahaliyas, and (c) the largely balanced sex ratio, all reflecting the rich economy and stability of population of the state. Despite the fact that the state is second to Khartoum in terms of receiving migrants, the population sex ratio is fairly balanced. The reason seems to

¹ This section is based on Abdel Ati (2005), op. cit.

be that most of the migrants move into the state with their families with the intention of permanent settlement.

Table 3.19: Gezira State Area; and Population (1993) by Mahaliya

Mahaliya	Area (Km ²)	No of Districts	No of villages	Population (1993)	Population (2003 est.)	% Increase (1993-2003)	Density per Sq. Km
Gezira	90125	12	558	775,578	788,000	1.6	8.7
Hasahisa	35792	10	448	480,360	645,000	34.3	17.9
Managil	63517	13	749	682,565	1,075,000	57.5	16.9
Butana	16994	9	365	499,219	645,000	29.2	38.0
Kamleen	18994	7	297	277,878	430,000	54.7	22.6
Gezira State	275492	51	2417	2,715,705	3583000	31.9	15.9

As shown in Table 3.20, in several of the human development indicators the state is the best among the five states surveyed including Khartoum and in many others it is only second to Khartoum. There are five specialized hospitals in the state, 36 rural hospitals and 226 health centers, scattered all over the state. With the total number of 2400 settlements in the state, that makes a ratio of about one health centre for every 10 settlements. The state also has the highest life expectancy rate, highest literacy rate and the lowest maternity, infant and under-5 mortality rates among all the surveyed states (Table 3.20).

Table 3.20: Gezira State: Demographic and Human Development Indicators

Indicator	No/%	Indicator	No/%
Total population	3,583,000	Household Daily water consumption L/D/C	25.5**
Urban population	22.7	Safe water Daily consumption L/D/C	21.7**
Nomadic population	0.56	Severe Nutritional Deficiency (1999)	6
Population Under 15 years	42.2	Mothers Mortality per 100,000	469*
Population 15-59	53.0	Infant mortality per 1000	43*
Population 60 years & over	4.8	Under 5 Mortality per 1000	59*
Population growth rate	3.0	Adult (15+) literacy (universal)	59.8*
Male/Female Ratio	98.9	Adult literacy (male)	71.5**
Fertility Rate	5.5	Adult literacy (female)	49.6
Life expectancy at birth	58.4*	Women heads of households	7.8
Gross enrollment	54.0**	Women in the labor force	12.9
Gross enrollment (male)	55.7**	Women parliamentary seats	9.1
Gross enrollment(female)	49.8**		

Source: Abdel Ati, 2005

The Economy:

The economy of the state is dominated by irrigated agriculture. The state, in addition to the Gezira scheme with its Managil extension (2.5 million acres), also hosts the Rahad and Genaid agricultural schemes. The total area available for cultivation is 5.9 millions feddans, representing 92% of the total area in the state. The main crops production in the state are cotton, wheat, sorghum, groundnuts, sugar cape, vegetable and fruits. Historically cotton production was the most dominant, at present the increase in the production of wheat, dura, vegetable and other crops pushed cotton to fourth in terms of area under cultivation.

Livestock also plays an important role in the economy of the state. The state possesses 5.9 millions heads of livestock.

The state also hosts about 20% of the industrial establishments in the country (266 factories), second to Khartoum (41%). The concentration of industries in the state has been a result of the state comparative advantages of availability of raw materials, labor power, water supply and proximity to the market. Most of the industrial establishments are agro-industries,

including sugar, textile, leather and food processing units. However, less the 25% of these factories is now operation for various reasons, most important of which are related to energy and high costs of inputs.

Although backyard production has for a long time been a common social practice in the state, commercial poultry production is a fairly new activity in the area. It started during the seventies but was boosted during the 1990s with the establishment of a number of companies in the northern part of the state, attracted by the lower taxes and concessions offered by Government to investment outside Khartoum, while maintaining access to the urban markets both in Khartoum and Gezira.

Survey Results:

A sample of 122 cases (25.3% of total sample population) were interviewed in 29 sites in Wad Madani town and selected suburban villagers within its vicinity. Out of the sample taken, 56.1% were urban dwellers, 19.8 rural backyard producers and 24% farm workers.

Demographic Characteristics:

The gender composition of the sample population was 71.3 % males and 28.7% females. About 46% of the surveyed population was born within the state, while the rest were born outside the state, most of them (40%) in western Sudan.

Regarding age structure, population engaged with poultry production, as the sample indicates, are generally young with over 80% under 45 years of age. When compared with other states, education attainment in Gezira is fairly high among the respondents, with about 16% illiterate, most of them are originally from western Sudan. Those who hold university degrees account for 21% of the sample population.

41% of the sample population is married with children, 52.5% of them are singles, 5% are divorcees and 1.5% are widows.

Some 47% of the married and ever married respondents (24.6% of total) have less than 4 children and the rest 52.7% (28% of total) have 4 children or more, which indicates a relatively large family size,.

Poultry Production:

Almost two thirds (66.6%) for the respondents have been engaged with poultry production for five years or less, while 20% of them have been engaged with poultry production for more than ten years, but most of them as backyard producers.

Backyard producers depend entirely on family labor, while commercial producers largely depend on hired labor, although some of them and the distributors use family labor. About 60% of the sample population considers poultry their main source of income, compared to 4.2% who rate it second to agriculture. Other sources of income include office work 18.5%, trade and other business 7.3% (Table 3.21)

Table 3.21: Percentage Distribution of Sample Population by Main Sources of Income

Income sources	Population %
Poultry and poultry products	60.0
Agriculture	4.2
Trade	1.7
Office work	18.5
Poultry production % other activities	6.8
Other jobs	8.8
Total	100.0

Incomes generated from poultry production for farm owners, farm workers, poultry products distributors and some of the backyard producers are relatively high as shown in table (???)

Table 3.22: Sample Population by Monthly Income

Monthly income	%
< 100	10.1
100-250	52.1
251-500	19.3
501-1000	14.3
1001-3000	3.0
> 3000	1.2
Total	100.0

Knowledge about AI:

About 87% of the interviewed respondents claimed to have heard about AI, about 54.9% of the respondents heard about the disease through radio and / or TV. 30.3% from general public discussions and chatting, 14% from newspaper, health or specialized personnel or NGOs. More than half if the respondents (55%) heard about the disease during the last two years, about 36.1% of them claimed asking a specialist about the disease and this category comprised of veterinary doctor or poultry farm workers.

On the basis of information about the status of the disease in Sudan, limited level or knowledge is clearly included by more than half (51.6%) of the surveyed population who admitted their lack of information about the number of infected persons in Sudan. About 10% of the respondents reported less than ten persons were affected.

Khartoum State was mentioned by almost half (49.5%) of the respondents to have more cases and high level of AI danger, followed by Gezira state and eastern Sudan States.

Respondents experience with AI:

Only two respondents in the state (1.6%) claimed to have been exposed to the experience of dealing with a suspected cases of infected and that were only isolated away from other birds.

Knowledge about Human Infection:

The overall level of population knowledge and accuracy of information about AI and human infection is summarized in Table 2.23 below.

Table 3.23: Population Knowledge about AI and Human Infection

General Information:	Population Responses %			
	Correct	Wrong	Partially Correct	Don't Know
AI is a disease that infects only chicken	27.9	50.8	9.8	11.5
AI is a widely spread in Africa	48.4	14.8	13.9	23.0
Continuous hygiene and cleaning are important safety measures	71.3	13.9	4.9	9.8
Poultry infection occurred in most states of Sudan	30.3	28.7	9.8	31.1
Human infection occurred in some states of Sudan	13.1	45.1	8.2	33.6
Use of respirator and gloves are one of the preventive means	73.0	9.0	0.8	17.2
Pigs can be infected by Avian Influenza	21.3	26.2	3.3	49.2
Knowledge about the Disease				
Vaccination is an effective measure to control the disease	62.3	11.5	4.9	21.3
The disease infects the nervous system of birds	29.5	29.5	1.6	39.3
Avian influenza infects the respiratory system	57.4	11.5	0.8	30.3
One of the disease signs is the shedding of feathers	32.0	21.3	5.7	41.0
One of the signs of the disease is the swelling of bird feet	32.8	18.0	4.9	44.3
One of the disease signs is continuous screaming	27.9	22.1	5.7	44.3
One of disease signs is respiratory distress	52.5	10.7	3.3	33.6
One of disease signs is that produced eggs are covered with blood	21.3	28.7	5.7	44.3
One of disease signs is bleeding from the nose	29.5	23.0	4.9	42.6
The virus could be eliminated by boiling meet over 70 degree C	61.5	18.0	2.5	18.0
The vaccination protect poultry against disease and death	60.7	13.9	8.2	17.2
The virus can survive on the surface of and inside the eggs	34.4	23.8	6.6	35.5
Vaccination protects against infection	66.4	8.2	3.3	19.7
Vaccination reduces the effect of disease and mask clinical signs	43.4	17.2	4.9	34.4
Virus in eggs can be killed at sixty degree C	45.1	23.0	2.5	29.5
The bird can transmit the virus without showing any clinical signs	36.1	27.9	0.8	35.2
Knowledge about Means of Transmission				
The disease could be transmitted to humans by cats	31.1	37.7	4.1	27.0
The disease could be transmitted by shoes	56.6	22.1	5.7	15.6
The disease can be transmitted between different birds flocks	71.3	10.7	0.8	17.2
The disease can be transmitted by broken eggs	55.7	18.0	4.1	22.1
The disease can be transmitted by cars used for poultry transport	62.3	13.1	1.6	23.0
The virus can be transmitted from raw to cooked meat	48.4	16.4	4.1	31.1
The disease can be transmitted by touching infected birds	58.2	23.0	1.6	17.2
Virus is transmitted by eating infected bird meat	55.7	24.6	4.9	14.8
The disease is transmitted by air	63.1	16.4	1.6	18.9
The disease is transmitted by insects and mosquitoes	33.6	37.7	5.7	23.0
AI is transmitted by drinking from open water sources in infected area	55.7	19.7	2.5	22.1
AI can be transmitted through animals' milk in infected poultry farms	36.1	26.2	7.4	30.3
AI can be transmitted by work tools in infected area (Feeder, Mob)	62.3	19.7	4.9	13.1
Knowledge About Means of Human Infection & Transmission				
The disease is transmitted from birds to human	66.4	12.3	1.6	19.7
The disease can be transmitted from human to human	50.0	26.2	4.9	18.9
The disease can be transmitted through hand shaking	18.9	50.8	5.7	24.6
The disease can be transmitted by using infected person mobile	15.6	50.0	4.9	29.5
One of the sign is in human is conjunctivitis	23.0	18.9	6.6	51.6
One of the signs is the patient inability to walk	25.4	18.9	4.6	50.8
One of the signs is respiratory distress	49.2	9.0	2.5	39.3
One of the signs is muscle aching	33.6	10.7	4.9	50.8
One of the signs is arthritis and bone pains	26.2	11.5	9.0	52.5

None of the surveyed population had any experience or had seen a case of human infection. Yet almost two thirds of them (66.4%) claimed their knowledge of the signs and symptoms of the disease as shown in table 3.24.

Table 3.24: Respondents Perception of Symptoms of Human Infection

Signs	% of Population
Continuous fever	19.3
Loss of weight	6.1
Diarrhea	8.1
Distress	26.9
Inability to move	10.8
Loss or appetite	10.4
Others	18.4
Total	100.0

Regarding the group most vulnerable to catch the virus, 41% of the respondents pointed to farm workers, 9.5% farm owners, 11.3% backyard producers, 10.4% children of backyard producers, 10.4% veterinarians and health personnel and 8.5% to those trading in poultry and poultry products.

Attitudes and behaviour Towards Persons:

When asked about how they consider a person infected with the disease, the respondents views were careless 23.7%, ignorant 18.5%, dirty 8.2% and a victim 31.1%.

On the question of how they would deal with an infected person, about half (49.6%) of the respondents reported total avoidance of and/or isolation of the person, 13.3% asserted dealing with infected persons as usual, 6.7% mentioned avoiding direct contact (touching) and 21.5% mentioned contacting infected persons using goggles and/or gloves (Table 3.25)

Table 3.25: Respondents Behaviour Towards Infected Persons

Behaviour	Sample Population %
Deal as usual	13.3
Avoid infected persons	30.3
Sit with him but don't touch him	6.6
Isolate him from others	11.1
Do not get closer to patients	8.5
Contact using goggles	2.2
Don't know	6.6
Total	100.0

About their reactions to discovering an infected relatives, response were 82% mentioned total isolation and deportation away from the area, but when the question was regarding the work mates or colleagues, responses differed considerably only 13% mentioned terminating the person's contact, while 14.5% claim to deal as usual, 24.2% would avoid infected persons, 31.5% would deal cautiously with patients and 10% don't know.

Activities Performed in Poultry Production:

In the state as shown in table 3.26, the majority of people engaged in poultry production, in both the backyard and commercial sector tend to perform all the routine activities of cleaning cages, feeding and watering and collection of eggs. About 40% of backyard producers claim that no family member, other than the head of household, is involved in poultry work, while for 60% of them family members are involved; spouses and adult family members (78%), children (4.4%), women (13%) and others (4.4%).

Table 3.26: Sample Population: Daily Routine Activities

Activities	Backyard Producers		Farm workers	
	Total%	Group%	Total%	Group%
Cleaning cages	28.2	55.6	31.5	75.0
Feeding and watering	22.5	44.5	37.8	90.0
Collection of eggs	18.5	36.1	21.0	50.0
Slaughtering of chicken	7.1	13.9	1.4	3.3
Health care	-	-	3.5	8.3
All the above	24.0	47.2	2.1	5.0
Others	-	-	2.8	6.7
Not applicable	70.5	-	49.2	-

Protection and Level of Workers Exposure:

About 51.5% of backyard producers and 54% of those working in the commercial sector claim to use special uniform when handling poultry. 59% of the non-users among backyard producers attributed that to not seeing it necessary, it's high cost (35%) and lack of knowledge about it (6%).

:

To assess the level of knowledge danger attached to poultry production and level of poultry workers' vulnerability to catch the virus, a set of questions related to precautions taken by those concerned in the commercial poultry production, were asked to farm workers, owners and distributors, who together constitute about 80% of the sample population. Responses are summarized in the following table.

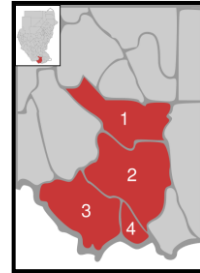
Table 2.27: Protective Measures Taken and Vulnerability of Poultry Farm Workers

Measures/ precautions	% of farm workers	% of total
Use of sterilized shoes	60.3	31.2
Use of special shoes by other workers	50.9	23.8
Daily sterilization of shoes	52.6	25.4
Use of gloves	17.5	9.0
Use of gloves by their by other worker	18.7	9.0
Use of goggles	28.6	14.8
Use of goggles by their by other workers	27.8	12.3
Use of special uniform	54.0	27.9
Use of special uniform by other workers	53.5	25.4
Drinking from open water containers in farm	46.8	23.8
Washing from open water containers in farm	41.3	21.3

It is clear that the level of workers vulnerability is generally high as the only measure that is used by workers is the use of sterilized shoes, which has been, before the spread of information about AI, meant to protect poultry. This further confirmed by the mal-behaviour of drinking and washing from open water sources in farms.

4. Central Equatoria State:

Central Equatoria, formerly Bahr al Jabal, State is in southern Sudan. The state total area is 22,956 km². It is crossed by Bahr El Jabal River, a tributary of the White Nile that crosses the State from North to South. Juba town is the capital of the state and the seat of the Government of Southern Sudan. Administratively, the state is sub-divided into six counties: Juba, Lainya, Morobo, Terekeka, Yei, and Kajo Keji. These are further divided into Payams and further to Bomas.

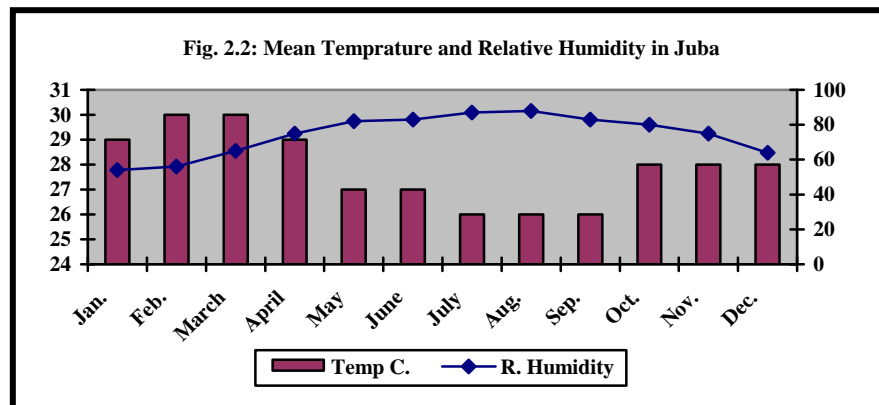


The Natural Environment¹:

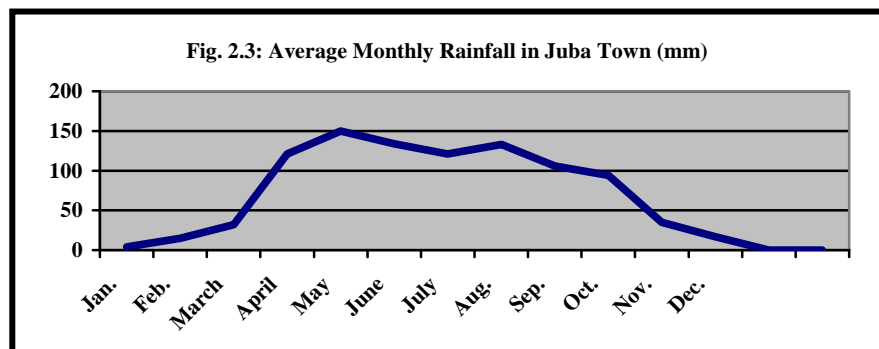
Climate:

The state falls within the sub-equatorial and rich savannah regions and characterized by hot and humid climate and a long rainfall season, that extends from May to October (Fig. 3.1, 3.2). Rainfall distribution is closely related to the seasonal movements of the Inter Tropical Convergence Zone ITCZ and the density of the rain belt to the south of it. The ITCZ moves

north and south from Latitude 3° N in Jan to its most southern position in August. It advances more slowly then it retreats and hence its April position at 10° N is considerably south of its October position at 13° N which implies the length of the wet season increases south of the ITCZ. (Zahran, 1969)



The average annual rainfall in the state annual rain falls of about 990 mm (40-60 inches per annum), expanding over six to eight months and with a marked dry season extending from December to March, with a mean annual frequency of 85 rainy days.



The area is subject to moderate wind having the maximum mean surface speed during March and April reaching 303 Knots and its lowest speed during July and September reaching 109 Knots.

¹ This section is based on Dr. Hassan A. Abdel Ati (1999), Socio-economic Conditions in ARS-Juba Project Area, a Baseline Survey Report, for Sudan Government the (UNDP), Khartoum, November, 1999

The mean annual temperature is 27.3° C. The diurnal are considerably lower than in the northern Sudan where it is 12.7° C in Juba. Relative humidity follows the rainfall regime and its duration of high humidity in the study area is 7-9 month

Geology and Soils:

Geologically, the state and southern Sudan in general is composed of ancient igneous and metamorphic rocks known as the basement complex which are masked in many areas by more deposits of continental origin and very well known for their poor underground water resources. One important effect of geological factors is the marked variations in soil structure. While the 'alkaline' and 'red loam catenas' soils are derived from fresh mountain masses (igneous rocks), usually having genesis foliation, the soils of the 'toich' and 'ironstone catenas' close to the Nile are formed from material which had been weathered much earlier and forms dense beds of pellets. These beds are sometimes cemented together by later depositions of iron, forming a hard but permeable mass, a meter or more in thickness¹.

The impact of seasonal rains on soils is extensive in the region as they impose migration on wildlife, domestic animals and insects. The topography also contribute to the distribution of water, leading to the leaching of soils from high lands (weathering of rocks and dissolving iron and aluminum materials into solution as hydroxides) and water logging on low lands. These natural characteristics and the civil conflict that led to the concentration of population around towns and the continuous use of land have resulted in a continuous trend of declining productivity and output and undermines the likelihood of soil recovery.

Generally, soils are well drained sandy looms underlain by ironstone gravel and intersected by numerous short streams and catchment swampy areas (Sudd), which, together with River Bahr el Jebel, form the main sources of water supply.

Natural Vegetation and Forest Resources:

The State falls within what Andrews (1948)² classified as the “*broad-leafed woodland and forests*” zone, which includes both thick forests and low land swampy areas (*toich*). The ground cover is a multiplicity of grass and shrubs ranging in height from 6 to 15 feet in the south and declines in density s a result of variations in topography, rainfall and human settlements and grasses become shorter with and more patchy and open cover areas as one moves north into Juba area. Predominant trees include Terminalia mollis Laws, (Khaya senegalensis A. Juss.(*mahogany*),

The dominant tree species are the tropical rain forest and moist and dry savanna types with large deciduous trees south of Juba town and semi-deciduous and thorny trees in the flat country to the north. Open patches are apparent throughout many forest areas indicating the state of degradation resulting from human activities and repeated forest fires. Degradation is clearer around villages and settlements where thickets with little economic value have replaced the cleared sizable trees.

¹ See G. F. March “Soils of the Anglo-Egyptian Sudan”, in Tothill *Agriculture in the Sudan*, London Univ. press, 1948

²See F. W. Andrews “The Vegetation of The Sudan”, in Tothil (1948), op. cit.

Logging in the natural forests by the army has contributed greatly to the disappearance of some valuable tree species, especially *mahogany*, *teak* and *aradeb* (tamarindi) that have high economic value in the market as they represent the main source for furniture in all parts of Sudan. Annual losses as a result of logging is estimated to be 50,000 logs (i.e. 300-500 M³).

Population and Human Development:

According to the 1993 census figures the State population dropped by about 50% of its level in 1983, from 1.4 to 0.99 million, 89% of them classified as rural. Juba population was estimated to be 163,442 in 2005 but, based on analysis of aerial photos, the estimate of several donors working in Juba of the population in 2006 was approximately 250,000. Just over 44% of the State population are classified as economically active of whom 9.5% are unemployed (2000).

Level of services in the area is far below the acceptable standards. About 51% of the population has access to sanitation facilities, 11.1% to piped water and only 9.2% to electricity, all in Juba town. In the field of health there is an acute shortage in the provision of medical services, as indicated by the ratios of population to medical staff and facilities. There are 8 medical doctors and 83 hospital beds per 100,000¹ Health institutions are also heavily concentrated in Juba town.

The same applies to education services as 45.6% of the population aged 6-24 never attended school and only 27.3 of the urban population reported attending school, although there is a very heavy concentration of education facilities in Juba. About 31% of primary schools and 100% of all other institutions above that level are based in Juba town².

The long years of armed conflict (civil and tribal), natural resources' degradation and high population growth rates have created a state of underdevelopment and led to massive exodus from the region, to northern Sudan and some took refuge in neighboring countries. The majority of those who remained are heavily concentrated in and around urban areas, particularly Juba town. Political instability and the state of underdevelopment in the region (in infrastructure, services, economy and human development) resulted in a very sparse population distribution, especially in rural areas. It also resulted in lack of reliable information about the region.

With the signing of the peace agreement, in addition to the return of the SPLA forces, Juba town also received large scores of returnees and migrants from rural areas. A number of service institutions are currently under construction but still far below needs.

The Economy:

Most of the population is engaged in primary crop production, fishing and livestock raising, in a largely hand-to-mouth economy. The conflict, physical isolation, poor infrastructure and the low level of technological development in the state have all contributed to shackle the economy and the local market, which for most of the past fifty years has been dependent on supplies from the north or neighbouring countries. Economic activities remained traditional and particularly sensitive to changes and variations in natural conditions (soil, hydrology and rain fall). As a result production remained strained by the poor technology and traditional production methods, resulting in low productivity and output and hence perpetual state of food shortages. As a result, large numbers of the population are still dependent on relief and

¹ Source: UNDP "Sudan Human development Report (NSHD)", 1998 (Not officially released).

² Ibid.

assistance provided by NGOs and Aid Agencies that flooded the area after the signing of the peace Agreement in 2005.

Livestock raising is the most common activity. There are no reliable statistics on the area but it is estimated that there are about 3.6 million heads of livestock in the state, half of it cattle. All the animal stock is traditional breeds that are characterized by low productivity. For example cattle milk production ranges between ½ -1 liter as compared to 5 liters a day under slightly improved management system. This can be attributed to poor management systems, long distances animals walk, especially during dry season (average 20 miles), poor value of the natural range feed and the spread of endemic diseases and the poor or absent veterinary services in the area.

Poultry production, because of the natural environmental conditions (humidity and rainfall) and the local economy has been very limited in the state. The recent flourishing of Juba town market in particular, as a result of stability and the increase of population, the establishment of the GoSS and the economic boom brought by the oil revenues, have all raised the demand for poultry and poultry products. There are no poultry farms in the proper sense in Juba and the supply is heavily dependent on external sources. This is probably why most of those included in the sample were distributors.

There are six poultry markets in Juba. Distributors of poultry and poultry products are mainly Ugandans who get their supply from Uganda, with few Sudanese who depend on supply from Khartoum. Consumers are mainly hotels, restaurants and senior government officials

Survey Results:

A sample of 50 cases (10.3% of the total sample population) was interviewed, mainly from Juba town and three villages around it. 80% of the sample population were urban dwellers and 20% were rural backyard producers, all of them women. The gender composition of the sample was 62% males and 38% females.

Demographic Characteristics:

- About two thirds of the sample population (66%) were born within the Central Equatoria state, 24% in northern and central States and 8% were born outside Sudan.
- As shown in table (1.2), population engaged with poultry production are generally young with 90% under 45 years of age, including 4% under 18 years of age.
- Compared to other states, education attainment is generally high with only 8% illiterates and with the highest ratio of university graduates (Table 1.3).
- 48% of the sample population is married with children, 48% are singles and 4% are widows (Table 1.4). Of those who have been married and have children, about 62% have less than 4 children and the remaining 38% have 4 or more children. (Table 1.5)

According to type of work, 32% of the sample population are professionals, 14% on clerical jobs, 20% manual workers and 10% working in the informal sector, 8% unemployed with the remaining 16% housewives and students (Table 1.6).

Major groups involved in poultry production include farm owners or commercial producers 6%, backyard producers 26%, farm workers 2% and 66% distributors and consumers of poultry or poultry products. 72% of the surveyed population has been engaged with poultry

production for five years or less and those with longer engagement are mostly backyard producers.

Poultry production constitutes the major source of income for 12% of the population, for the rest it is a major supplement and secondary source of income. The percentage, however, may be higher since many of those involved do not include their household consumption as part of the income. Other major income sources are salaried jobs, trade and manual/wage labor.

Table 3.28: Percentage Distribution of Sample Population by Main Source of Income

Income Sources	Population %
Poultry and poultry products	12.0
Agriculture	8.0
Trade	18.0
Office /professional work	32.0
Manual/wage Labor	16.0
Other business	4.0
No Response	10.0
Total	100.0

As table 3.29 below shows, incomes generated from poultry works and distributors of poultry products, are generally high as about 30% of the sample population (36% of those who declared their income) earn over SDG 500.

Table 3.29: Sample Population by Monthly Earnings Generated from Poultry (SDG)

Monthly Earning	Population %
> 100	16.0
100-250	24.0
251-500	14.0
501-1000	18.0
1001-3000	12.0
No Response	16.0
Total	100.0

Knowledge about AI:

A total of 94% of the respondents interviewed claimed to have heard about AI, about half of them through radio and / or TV, 27.7% from newspapers and posters, 6.5% from general public discussions and chatting, 8.4% from health or specialized personnel and 5% from NGOs. The great majority of the respondents (74%) heard about the disease during the last two years and about 36.2% of them claimed to have asked a specialist about the disease.

On the general information about the status of AI in Sudan, over 60% were correct about the common sense questions such as the negative correlation between hygiene and AI, the use of gloves and goggles for protection and the level of danger attached to AI. For all other questions accuracy of responses ranged between 22-34%. Only 24% of the respondents interviewed were accurate about the number of persons infected/suspected in Sudan. On the geographical distributed of the reported AI cases, 28% mentioned Khartoum State compared to 4% referring to Central Equatoria State. Table 3.30 provides a detailed picture about the state of knowledge in the state.

Table 3.30: Population Knowledge about AI and Human Infection

General Information:	Responses %			
	Correct	Wrong	Partially correct	Don't Know
AI is a disease that infects only chicken	28.0	56.0	14.0	2.0
AI is a widely spread in Africa	28.0	20.0	32.0	20.0
Continuous hygiene and cleaning are important safety measures	66.0	14.0	8.0	12.0
Poultry infection occurred in most states of Sudan	24.0	26.0	26.0	24.0
Human infection occurred in some states of Sudan	22.0	30.0	16.0	32.0
Use of respirator and gloves are one of the preventive means	82.0	2.0	4.0	12.0
Pigs can be infected by Avian Influenza	34.0	14.0	6.0	46.0
Knowledge about the Disease				
Vaccination is an effective measure to control the disease	46.0	8.0	10.0	18.0
The disease infects the nervous system of birds	34.0	22.0	16.0	28.0
Avian influenza infects the respiratory system	64.0	10.0	6.0	20.0
One of the disease signs is the shedding of feathers	40.0	18.0	8.0	34.0
One of the disease signs is the swelling of bird feet	34.0	18.0	8.0	40.0
One of the disease signs is continuous screaming	26.0	30.0	6.0	38.0
One of disease signs is respiratory distress	60.0	6.0	2.0	32.0
One sign is that produced eggs are covered with blood	26.0	20.0	8.0	46.0
One of disease signs is bleeding from the nose	38.0	12.0	4.0	46.0
The virus could be eliminated by boiling meat over 70 C°	64.0	6.0	10.0	20.0
The vaccination protect poultry against disease and death	72.0	6.0	6.0	16.0
The virus can survive on the surface of and inside the eggs	42.0	8.0	6.0	44.0
Vaccination protects against infection	68.0	6.6	14.0	12.0
Vaccination reduces effect of disease & mask clinical signs	44.0	16.0	8.0	32.0
Virus in eggs can be killed at sixty degree C	44.0	14.0	8.0	34.0
Birds can transmit the virus without showing clinical signs	70.0	6.0	6.0	18.0
Knowledge about Means of Transmission				
The disease could be transmitted to humans by cats	38.0	38.0	4.0	20.0
The disease could be transmitted by shoes	34.0	30.0	12.0	24.0
The disease can be transmitted between different birds flocks	76.0	8.0	6.0	10.0
The disease can be transmitted by broken eggs	52.0	16.0	4.0	28.0
The disease can be transmitted by cars used for poultry transport	58.0	18.0	6.0	18.0
The virus can be transmitted from raw to cooked meat	54.0	22.0	6.0	18.0
The disease can be transmitted by touching infected birds	87.0	6.0	8.0	8.0
Virus is transmitted by eating infected bird meat	82.0	6.0	4.0	8.0
The disease is transmitted by air	52.0	14.0	12.0	22.0
The disease is transmitted by insects and mosquitoes	24.0	56.0	2.0	18.0
AI is transmitted by drinking from open water sources in infected area	41.0	28.0	10.0	22.0
AI can be transmitted through animals' milk in infected poultry farms	44.0	2.0	12.0	22.0
AI can be transmitted by work tools in infected area (Feeder, Mob etc)	46.0	22.0	8.0	24.0
Knowledge About Human Infection & Means of Transmission				
The disease is transmitted from birds to human	86.0	8.0	0.0	6.0
The disease can be transmitted from human to human	54.0	16.0	12.0	18.0
The disease can be transmitted through hand shaking	26.0	50.0	6.0	18.0
The disease can be transmitted by using infected person mobile	34.0	42.0	4.0	20.0
One of the sign is in human is conjunctivitis	32.0	14.0	6.0	48.0
One of the signs is the patient inability to walk	38.0	16.0	12.0	34.0
One of the signs is respiratory distress	56.0	4.0	6.0	34.0
One of the signs is muscle aching	38.0	14.0	6.0	42.0
One of the signs is arthritis and bone pains	42.0	14.0	4.0	40.0

Respondents Practical Experience with AI:

Although, only 4% of the state sample population referred to central Ekuatoria as a state with reported cases, 38% of them claimed to have been exposed to the experience of dealing with a

suspected case of an infected bird. Indicator signs for AI cases used by respondents were mainly the bird inability to move or swelling of its feet.

The majority of the population attributed the spread of the virus to migratory and imported birds, the increased consumption of poultry, poor hygiene and low awareness of those dealing with poultry.

Knowledge about Human Infection:

Three respondents (6% of sample) claimed to have seen a case of human infection and more than half asserted their knowledge about the signs and symptoms of the disease. The signs perceived are shown in table 3.31 below. Continuous fever, respiratory problems and loss of weight are the main perceived symptoms of SARS infection.

Table 3.31: Population Perceived Symptoms of Human SARS Infection

Signs	Actual %	Weighted %
Continuous fever	60.0	44.1
Loss of weight	14.0	10.3
Diarrhea	-	-
Loss of appetite	-	-
Inability to move	10.0	7.4
Respiratory disease	30.0	22.1
Others	22.0	16.2
Total	-	100.0

Note: Some respondents used more than one sign

Asked about how they consider a person infected with SARS, of the 62% who responded, the views were careless (28.4%), ignorant (24.5%), dirty (22.6%) and a victim (24.5%). Regarding the groups more vulnerable to catch the virus, 46% of the respondents pointed to farm workers, 12% farm owners, 26% backyard producers and 16% mentioned traders and distributors of poultry and products.

Behaviour Towards Infected Persons:

In response to the question of how they would deal with an infected person, about 40% of respondents opted to isolation or avoidance of infected persons, 41% would deal cautiously, 1.6% deal normally and 11% do not know how to behave (Table 3.31).

Table 3.31: Respondents Behaviour Towards Infected Persons

Reaction	% of respondents	
	Actual %	% weighted
Deal as usual	2.0	1.6
Avoid infected persons	22.0	17.5
Sit with him but don't touch him	6.0	4.8
Isolate him from others	28.0	22.2
Don't get close to patients	12.0	9.5
Contact using goggles	34.0	27.0
Others	8.0	6.3
Don't know	14.0	11.1
Total		100.0

Reactions were considerably different when asked about their responses in the occasion of human infection of a colleague and a work mate. Responses are summarized in Table 3.32 below. Extremism appeared with reaction to work mates which included isolation,

termination of contract and quitting the job. For relative, the vast majority called for isolation and provision of treatment and continued work and treatment.

Table 3.32: Reaction to Occurrence of Human Infection

Reactions	Work mate	Relative/Friend
Deal as usual	6.0	
Isolate and provide health care		66.0
Avoid	12.0	8.0
Continue work and treatment		10.0
Termination of contract	20.0	
Deportation from the area	8.0	
Quit the job	2.0	
Deal cautiously	14.0	
Others	12.0	6.0
Do not know	24.0	10.0

Routine Activities and Level of Exposure:

As shown in table 3.33, about one third of people engaged with poultry production tend to performed all daily routine activities, except for health care and slaughtering of birds. These are mostly backyard producers as the largest proportion of the sample are those trading on poultry and its products.

Table 3.33: Sample population: Daily Routine Activities

Activity performed	Respondents %	
	% Actual	% weighted
Cleaning cages	38.0	28.4
Feeding and watering	18.0	13.4
Collection of eggs	10.0	7.5
Slaughtering of chicken	2.0	1.5
Health care	6.0	4.5
All the above	34.0	25.4
Not Applicable	26.0	19.4

48% of backyard producers claim that no family members are involved in poultry work and the for majority (52%) poultry work involves spouses and adult family members (61.5%), women and children (23.1%), and hired workers (15.4%).

About 28% of the sample population claim to use special uniform for work. The non-users (72%) attributed that to not seeing it necessary, lack of knowledge about it and to its high cost.

Table 3.34 shows that the overall average of best practices in dealing with poultry for the state sample population is 39.3%. The highest percentage is linked to the no cost behaviour, such as not drinking or washing from open water containers (which might have been prompted by other factors), followed by those that protect birds (e.g. shoes disinfection) and last are the ones that protect humans.

Table 3.34: Percentage Distribution of Population by Selected Forms of Practice

Best Practice Measures	Population %
Use of sterilized shoes	30.0
Use of gloves	32.0
Use of goggles	28.0
Use of special clothes	34.0
Daily sterilization of shoes	26.0
Do not drink from open water containers in farm	92.0
Do not washing from open water containers in farm	96.0
Use of special shoes by other workers	22.0
Use of gloves by their by other worker	22.0
Use of goggles by their by other workers	24.0
Use of special uniform by other workers	26.0
Overall average	39.3

5. White Nile State:

White Nile State is located more or less in the centre of the Sudan, between latitudes 12° and 13°:30' North and longitudes 31° and 33°:30' east. The total area of the State is 31,411 Km². The total population of the state is about 1.4 million (2000) (representing 4% of Sudan's population), with an average population density of 44.6 persons per Square Kilometer. Administratively the State is divided into four localities; El-Getaina, Ed-Dueim, Kosti and El-Jabelien, each is further subdivided into a number of administrative units.



The state is generally flat covered with clay soil, especially along the White Nile River. In the western part of the state, the surface is covered with sandy soil with few hills towards the west.

The state largely depends on the White Nile as the main water source, especially in its northern parts that do not receive sufficient rains for cultivation. This river is the main source of irrigation water for the numerous pump schemes in the state. The southern part of the state receives rain amounts sufficient to support crop production. Sorghum is the main staple crop produced on a large scale in the mechanized farming schemes.

The state also hosts large industrial establishments, chief among them Kenana Sugar and Assalaya Sugar Factories, with their large agricultural plantations, Rabak Cement Factory, in addition to several small food processing industries. The livestock wealth in the state is estimated to be 7.6 millions heads, which is about 6% of Sudan's total livestock population. The state is highest producer of white cheese in Sudan, with over 80 processing factories and contributes over 60% of the total cheese production in the country. The state is also rich in fresh water fish resources and it supplies about 60% of total fish production in Sudan.

Due to war, drought and economic problems in southern and western Sudan, and also attracted by the employment opportunities, the State has attracted large numbers of IDPs, who now constitute about 6% of the state population. The state was included in the survey sample as a control or comparator group as it was not one of the states where the AI was reported.

Survey Results:

A sample of 65 cases was taken from Kosti, Rabak and ElGezira Aba towns and the two suburban villages of Asalaya and Kobera. The sample included 58.5% males and 41.5% females. Urban population constitutes 52.3% of the sample population, 7.7% were from rural areas (suburban villages), 33.8% working in farms (urban) and 6.2% from the market. According to type of engagement with poultry, the sample taken included farm owners (16.9%), backyard producers (33.8%), farm workers (43.1%) and poultry traders and distributors (6.1%).

Sample Population: General Characteristics:

According to the survey results:

- Just over 63% of the surveyed population was born within the state, 22% in western Sudan 9% in northern Sudan and the rest from other parts of the country.
- 83% of those involved with poultry production are less than 45 years of age, including about 9% under 18 years.

- Education attainment is very high among the respondents with university degrees holders accounting for 35.4% of the sample and almost half the population have secondary school education (including graduates) while illiterates constitute 18.5% of the sample population.
- 30% of the sample population is married and with children, 54 singles and 6% are divorcees.
- Family size is relatively small, about 53% of the respondents have less than 4 children as opposed to 10% with more than 7 children.
- Groups engaged in poultry production include professionals and white collar employees (46.2%), skilled and manual workers (43.1%), housewives (5.2%) and students (4.6%).
- About 70.8% of the surveyed population has been engaged with poultry production during the last five years and only 18.5% of them have been dealing with poultry for over 10 years.
- About 51% of respondents depend on poultry as the main source of income (Table 3.35). Those include most of the farm workers, poultry and poultry products distributors and some of the farm owners. For the rest poultry is a secondary but important source of food and/or cash. Incomes generated from poultry production as indicated by Table 3.36 are fairly high particularly almost half the population has other sources.

Table 3.35: Sample Population by Monthly Income Generated from Poultry Production (SDG)

Monthly Income (SDG)	Population %
< 100	27.7
100-250	30.8
251-500	29.2
501-1000	4.6
1001-3000	7.7
Total	100.0

Table 3.36: Sample Population by Sources of Income

Income Sources	Population %
Poultry and poultry production	50.8
Agriculture	16.9
Trade	3.1
Professional/Office work	3.1
Other jobs	18.4
Poultry production and other activities	7.7
Total	100.0

Knowledge about AI:

About 94% of the interviewed population reported to have heard about AI, 57.5% of them (54% of total) during the last two years. As for the source of information, 63% heard through radio and/or TV, 29% of them from public discussions and about 5% from newspapers. None of the respondents reported learning about the disease from specialists. However, about half the population (49.2%) reported asking a specialist about the disease, the highest percentage in all five states surveyed.

On the general information about the status of the disease in Sudan, 29.2% of the surveyed population were accurate about the number of cases reported/suspected in Sudan (under 10), and while over 64% accurately mentioned Khartoum as the state with highest number of detected cases, 7.7% mentioned eastern Sudan, 18.5% indicated their total lack of information about the subject and 4.6% of them claimed to have seen cases of human infection!. Only 3% of the respondents claimed to know the clinical signs of birds AI infection, and the shared indicator used was the swelling of the wattle (all of them were vets)

A general account about the level and accuracy of information population command about AI is provided in Table 3.37 below, grouped into four categories. From the table, the following can be observed:

- a. Overall about 44% of the population commands accurate information about AI but 17% do not have any information about it.
- b. Information is highest about means of transmission with 52.3% of accurate responses and the lowest percentage (11.4%) of don't know answers.
- c. Knowledge about human infection and means of transmission is the least accurate with an average of 38% of accurate responses and the highest don't know answers (22.6%). Ironically also the general information about the disease is the second lowest known as about 60% either have inadequate information or do not know.
- d. Accuracy is much higher with questions of common sense and logical deduction
- e. the high percentage of educated persons (i.e. university graduates) in the White Nile, compared to other states, did not produce a parallel improvement in population knowledge

Attitudes, Behavior and Practice:

Asked about how they view a person infected with AI, of the 65.6% who responded, 21.5% consider him/her careless, 24.6% ignorant, 4.6% dirty and 16.9% see him/her as a victim. The vast majority, (83.1%) consider poultry farm workers as the most vulnerable to catch the AI virus, followed by poultry traders and distributors (35.4%) and last were the backyard producers (17%).

Regarding the ideal practice in dealing with an infected person and their reaction to discovering an AI infected person, like in other states response varied according to whether the person is a relative or a colleague. For the relatives, 12.3% of respondents claim that they would deal as usual, 41.5% will deal cautiously (keep a distance or use protective measures), 18.5% will totally avoid him/her and 16.9% called for the complete isolation of infected persons. For colleagues on the other hand, the main responses were, 70.8% called for isolation and treatment, 7.7% called for termination of infected person contract, 4.6% to continue work and get treatment and 4.6% see that the infected person should be deported out of the area altogether.

As shown in the table below, the most common best practice among farm workers is the use of sterilized shoes, which has long been there before AI was publicly known in Sudan and it primarily intended to protect poultry. Use of protective measures (i.e. gloves and goggles) by farm workers is very limited (18-28%), while about half do not use uniforms for work. Over 41% of farm worker also use open water sources in farms to drink and wash. (Table 3.38)

Table 3.37: Population Knowledge About AI

General Information	Responses %	
	Correct	Don't Know
AI is a disease that infects only chicken	50.8	4.6
AI is a widely spread in Africa	26.2	16.9
Continuous hygiene and cleaning are important safety measures	7.7	16.9
Poultry infection occurred in most states of Sudan	46.2	12.3
Human infection occurred in some states of Sudan	38.5	19.5
Use of respirator and gloves are one of the preventive means	73.8	9.2
Pigs can be infected by Avian Influenza	40.0	20.0
Average	40.5	14.2
Knowledge about the disease		
Vaccination is an effective measure to control the disease	67.7	9.2
The disease infects the nervous system of birds	38.5	33.8
Avian influenza infects the respiratory system	75.4	13.9
One of the disease signs is the shedding of feathers	40.0	21.5
One of the signs of the disease is the swelling of bird feet	32.3	32.3
One of the disease signs is continuous screaming	36.9	23.1
One of disease signs is respiratory distress	72.3	12.3
One of disease signs is that produced eggs are covered with blood	29.2	27.7
One of disease signs is bleeding from the nose	44.6	18.5
The virus could be eliminated by boiling meat over 70 degree C	70.0	16.9
The vaccination protect poultry against disease and death	12.3	9.2
The virus can survive on the surface of and inside the eggs	40.0	32.3
Vaccination protects against infection	10.8	6.2
Vaccination reduces the effect of disease and mask clinical signs	46.2	29.2
Virus in eggs can be killed at sixty degree C°	63.1	18.5
The bird can transmit the virus without showing any clinical signs	58.5	15.4
Average	46.1	20.0
Knowledge about Means of Transmission		
The disease could be transmitted to humans by cats	46.2	21.5
The disease could be transmitted by shoes	46.6	9.2
The disease can be transmitted between different birds flocks	76.9	7.7
The disease can be transmitted by broken eggs	61.5	12.3
The disease can be transmitted by cars used for poultry transport	56.9	16.9
The virus can be transmitted from raw to cooked meat	52.3	16.9
The disease can be transmitted by touching infected birds	66.2	4.6
Virus is transmitted by eating infected bird meat	58.5	4.6
The disease is transmitted by air	63.1	7.7
The disease is transmitted by insects and mosquitoes	41.5	6.2
AI is transmitted by drinking from open water sources in infected area	50.8	13.8
AI can be transmitted through animals' milk in infected poultry farms	26.2	12.3
AI can be transmitted by work tools in infected area (Feeder, Mob)	78.5	4.6
Average	52.3	11.4
Knowledge about Human Infection		
The disease is transmitted from birds to human	75.4	15.4
The disease can be transmitted from human to human	44.6	24.6
The disease can be transmitted through hand shaking	35.4	10.8
The disease can be transmitted by using infected person mobile	50.8	13.8
One of the sign is in human is conjunctivitis	21.5	21.5
One of the signs is the patient inability to walk	20.0	18.5
One of the signs is respiratory distress	66.2	21.5
One of the signs is muscle aching	13.8	33.8
One of the signs is arthritis and bone pains	13.8	33.8
Average	37.9	22.6
Overall Average	44.2	17.1

Table 3.38: Protective Measures Taken and Vulnerability of Poultry Farm Workers

Measures/ precautions	% of farm workers	% of total
Use of sterilized shoes	60.3	31.2
Use of sterilized shoes by other workers	50.9	23.8
Daily sterilization of shoes	52.6	25.4
Use of gloves	17.5	9.0
Use of gloves by other workers	18.7	9.0
Use of goggles	28.6	14.8
Use of goggles by other workers	27.8	12.3
Use of special uniform	54.0	27.9
Use of special uniform by other workers	53.5	25.4
Drinking from open water containers in farm	46.8	23.8
Washing from open water containers in farm	41.3	21.3