Animal Welfare and Food safety

Virtual Webinar 04 - How to Animal welfare
28/04/2023

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WTS Welttierschutz-stiftung

Outline

- Animal welfare
- Animal Welfare & Food Safety
- The TRAWIFS initiative in Uganda
- Questions / Discussions

Animal welfare (AW)

Welfare = is it all about well being / health happiness or comfort

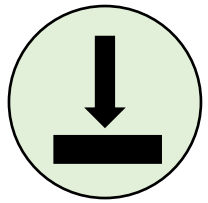
Animal welfare is a complex subject (scientific, ethical, economic, cultural, social, religious and political dimensions) (WOAH)

One of the priorities of the WOAH

The WOAH, at the request of its Member Countries, is the international organization responsible for setting standards on this topic

According to the WOAH *Terrestrial Code,* animal welfare means the physical and mental state of an animal in relation to the conditions in which it lives and dies

Current and past editions of the Terrestrial Animal Health Codes (volumes 1 and 2)



https://rr-africa.oie.int/en/news/new-oie-terrestrial-codes-available-for-download-in-pdf-2021/

https://rr-africa.woah.org/en/news/new-oie-terrestrial-codes-available-for-download-in-pdf-2021/

The WOAH Global AW Strategy

Adopted in 2017 by all Member Countries

Source of guidance for WOAH's AW activities

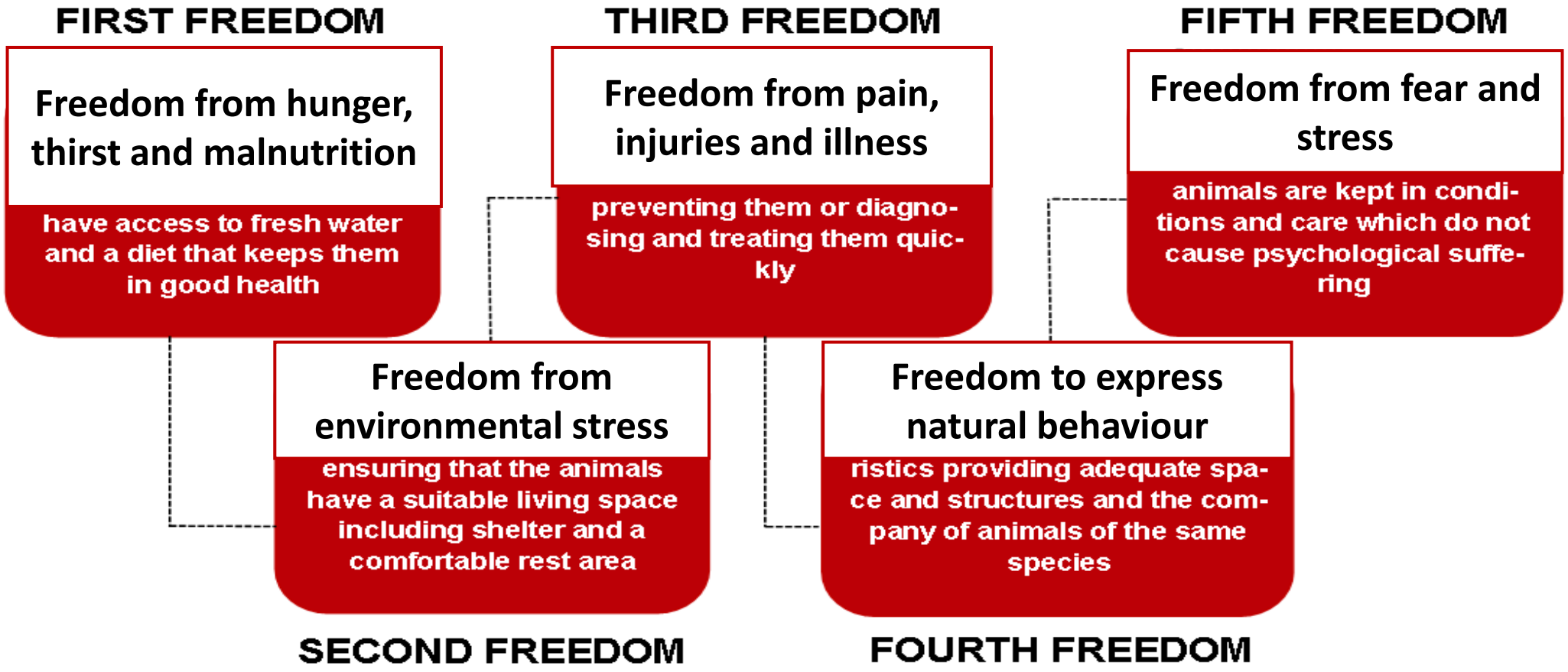
Developed from lessons learned from actions taken at national and regional level

Objective: "A world where the welfare of animals is respected, promoted and advanced, in ways that complement the pursuit of animal health, human well-being, socio-economic development and environmental sustainability"

The strategy focuses on

1. **Development of international standards** on AW
2. **Developing the capacity of Veterinary Services**
3. Improving **communication with governments**
4. Raising **awareness** around the issue
5. Supporting member countries in the **implementation of these standards**

The 5 freedoms and the 3 Rs



The Globe and food security

Animals play many important roles in humans' lives: source of food, companionship and wealth

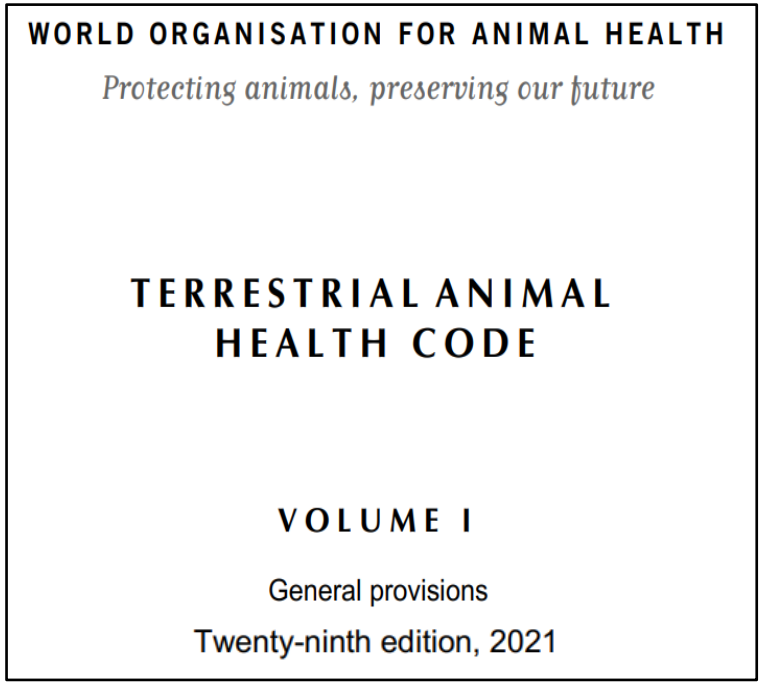
Future projections by FAO study – a high demand for poultry meat, pork, beef and goat or mutton in developing countries (Uganda inclusive) by the year 2030 (Bruinsma, 2017)

Global need resulted in the intensification of livestock production to meet the cumulative global food demands

Forecasted decline in animal friendly production systems (Madzingira, 2018)

High volume of unsafe products – threatens public health

AW and food safety (FS)



Guiding principles for AW

Guiding principles for animal welfare

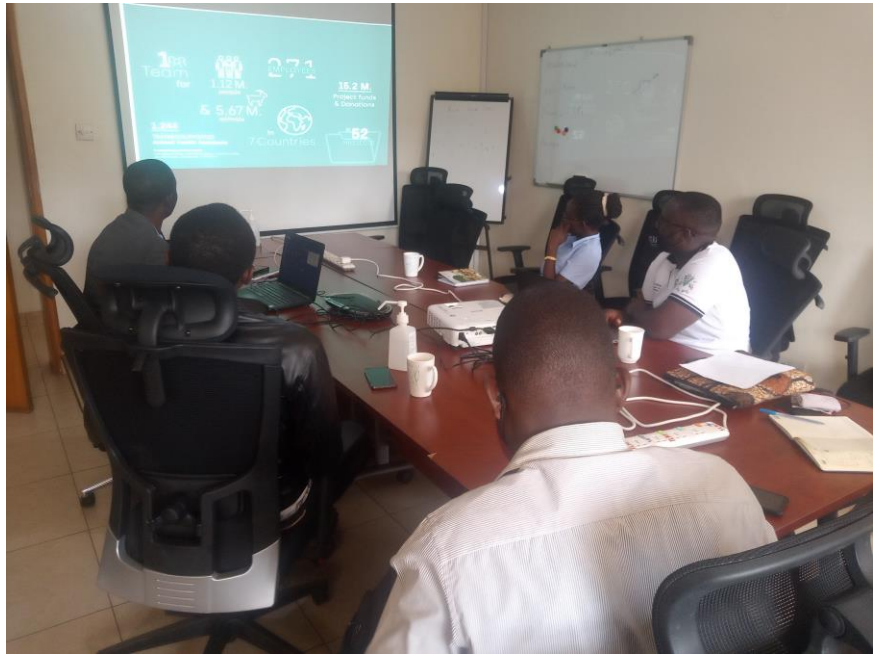
1) That there is a critical relationship between animal health and *animal welfare*.
2) That the internationally recognised "five freedoms" (freedom from hunger, thirst and malnutrition; freedom from fear and distress; freedom from physical and thermal discomfort; freedom from pain, injury and disease; and freedom to express normal patterns of behaviour) provide valuable guidance in *animal welfare*.
3) That the internationally recognised "three Rs" (reduction in numbers of *animals*, refinement of experimental methods and replacement of *animals* with non-animal techniques) provide valuable guidance for the use of *animals* in science.
4) That the scientific assessment of *animal welfare* involves diverse elements which need to be considered together, and that selecting and weighing these elements often involves value-based assumptions which should be made as explicit as possible.
5) That the use of *animals* in agriculture, education and research, and for companionship, recreation and entertainment, makes a major contribution to the wellbeing of people.
6) That the use of *animals* carries with it an ethical responsibility to ensure the welfare of such *animals* to the greatest extent practicable.
7) That improvements in farm *animal welfare* can often improve productivity and food safety, and hence lead to economic benefits.
8) That equivalent outcomes based on performance criteria, rather than identical systems based on design criteria, be the basis for comparison of *animal welfare* standards and recommendations.

Animal Welfare and Food safety: The TRAWIFS initiative in Uganda

Funding for six months

TRAWIFS: The Role of Animal Welfare in Influencing Food Safety

Funder: Welttierschutz stiftung (WTS)



Inception meeting – Hybrid event

In Uganda…..

The current wave - government support to a number of **operation wealth creation schemes to increase the volume of animal products on the market** [anticipation that this also has economic gains to the natives]

The unseen priorities - public health risks in animal products, poor growth and breeding issues are likely to increase in food animals [threatens food safety, food security and nutrition gains]

The benefits of **improving animal welfare** are towards enhancing physical and mental health of animals (Sinclair, Fryer, & Phillips, 2019)

This in the long run has been proven to have an impact on stress-induced immunosuppression, reduced on-farm incidence of infectious disease, reduced shedding of zoonotic pathogens by farm animals, and also lower antibiotic use and antibiotic resistance (De Passillé & Rushen, 2005)

In Uganda…..

Popular meat consumption list

1. Beef 
2. Chicken 
3. Goat 
4. Pork 

What is the most consumed meat type in Uganda?

Ugandans named biggest pork consumers in Africa

Thursday, December 08, 2016 – updated on January 18, 2021

The need

A large proportion of humans globally depend on animal source foods for survival (FAO, 2017)

The increasing demand for the animal foods calls for better strategies to eliminate barriers to food safety

Major concern being public health hazards (biological, chemical and physical)

Advances in animal welfare have the potential to reduce risks to food safety (particularly on-farm) but these are found lacking in a number of developing countries, Uganda inclusive

Neglect of animal friendly production systems could affect the quality of animal products on the market with a forecasted negative economic impact

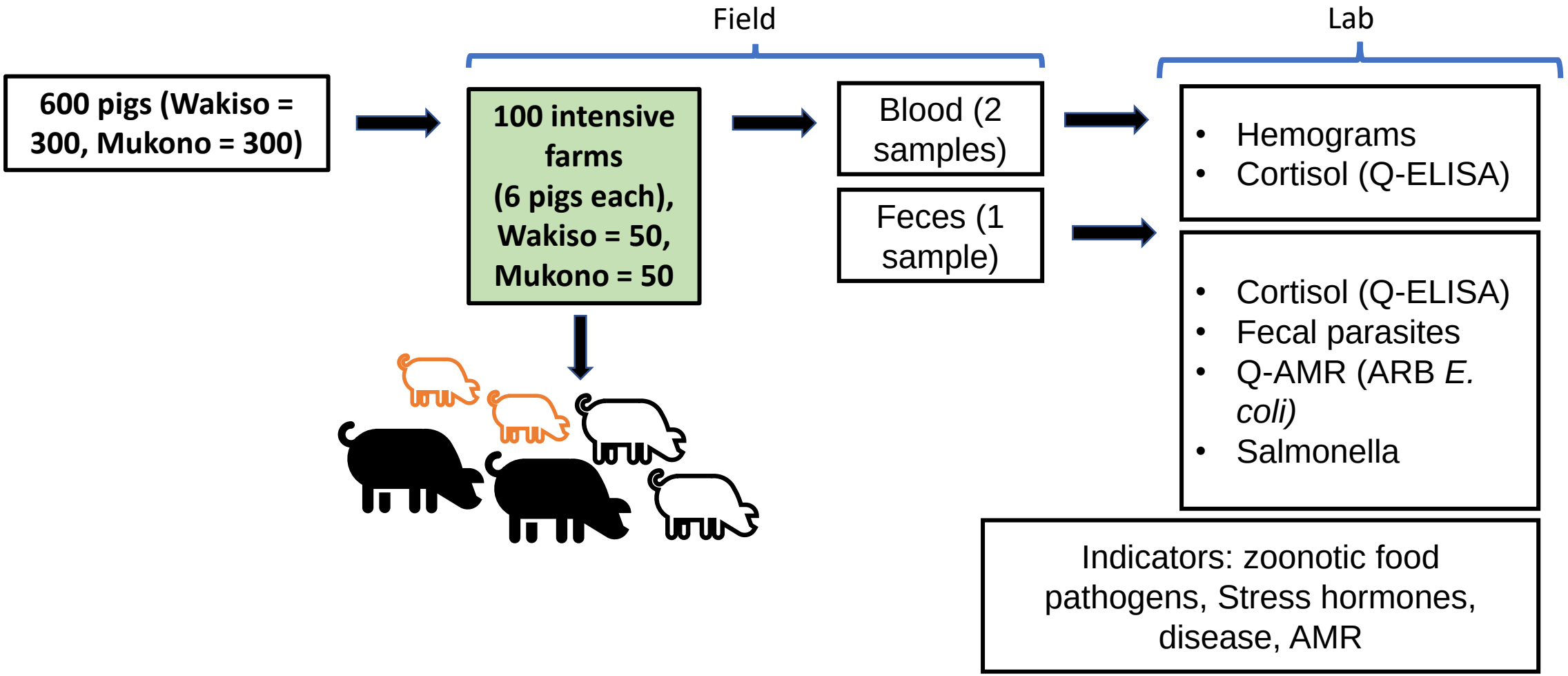
Goals and objectives

Overall: To demonstrate and strengthen the role of on-farm animal welfare practices on pork safety in Uganda

Specific objectives

1. Determine and evaluate selected food safety indicators for monitoring animal welfare in pigs
2. Use the data from objective 1 to create linkages between the on-farm welfare scores (feeding, housing, health, behaviour) and occurrence of food safety risks in pigs

Methodology



Farm characteristics

89 farms visited, 49 in Mukono and 40 in Wakiso district

The farms in Mukono were all found in Kasawo sub-county whereas the ones in Wakiso were located in Gombe division (10), Kakiri Town council (10), Masulita (10), Mende (10) sub-counties

Ownership was majorly by **men** (Wakiso: 34 men, 6 women; Mukono: 26 men, 23 women)

Majority of the farms were **small holder with herd sizes of less than 20 pigs** (Mukono: 30/49, 61.2%; Wakiso: 23/40, 57.5%) and the rest having over 20 pigs (Mukono: 19/49, 38.8%; Wakiso: 17/40, 42.5%)

Results

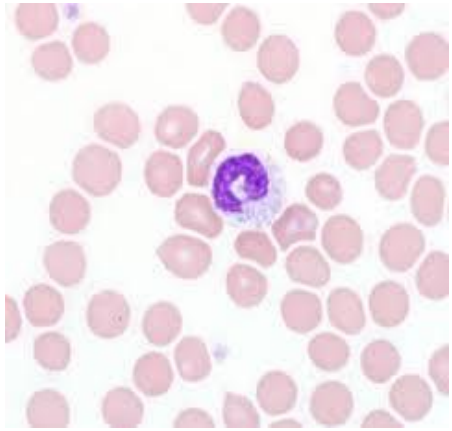
1. Determine and evaluate selected food safety indicators for monitoring animal welfare in pigs

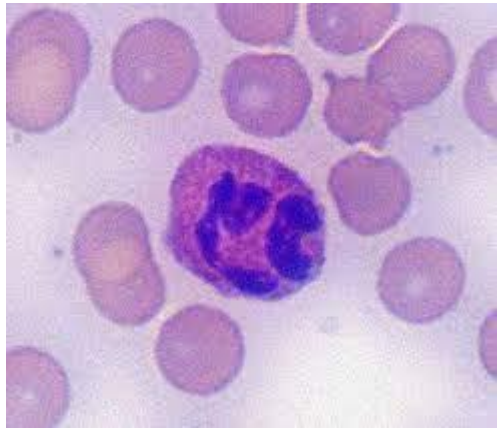
Researched Indicators: general health, zoonotic foodborne pathogens, Stress hormones

- Hemograms (blood parasites inclusive)
- Cortisol (Q-ELISA)
- Fecal parasites
- Antimicrobial resistant *E. coli*
- Salmonella

Hemograms

Provide information about blood cells in the system to aid in diagnosing of abnormalities





Hypoproteinemia - **89.0% (406/456)**. The Pearson chi-square analysis revealed a significant association between the variables: gastro-intestinal parasitemia, district, age groups and detection of hypoproteinemia in pigs ($p < 0.05$)

456 hemograms (from 456 pigs) interpreted to ascertain plausible health conditions in the herds

No blood parasites in the smears

1.3% (6/456) had an abnormal erythrogram and **90.4% (412/456) had an abnormal leukogram**

Health conditions diagnosed from the hemograms: **stress (322 cases)**, aplastic anemia (48 cases), **inflammatory disease (151 cases)**, intestinal parasitic disease (29 cases), allergic reaction (31 cases), bacterial infection (3 cases) and hypersensitivity (4 cases)

Cortisol Q-ELISA

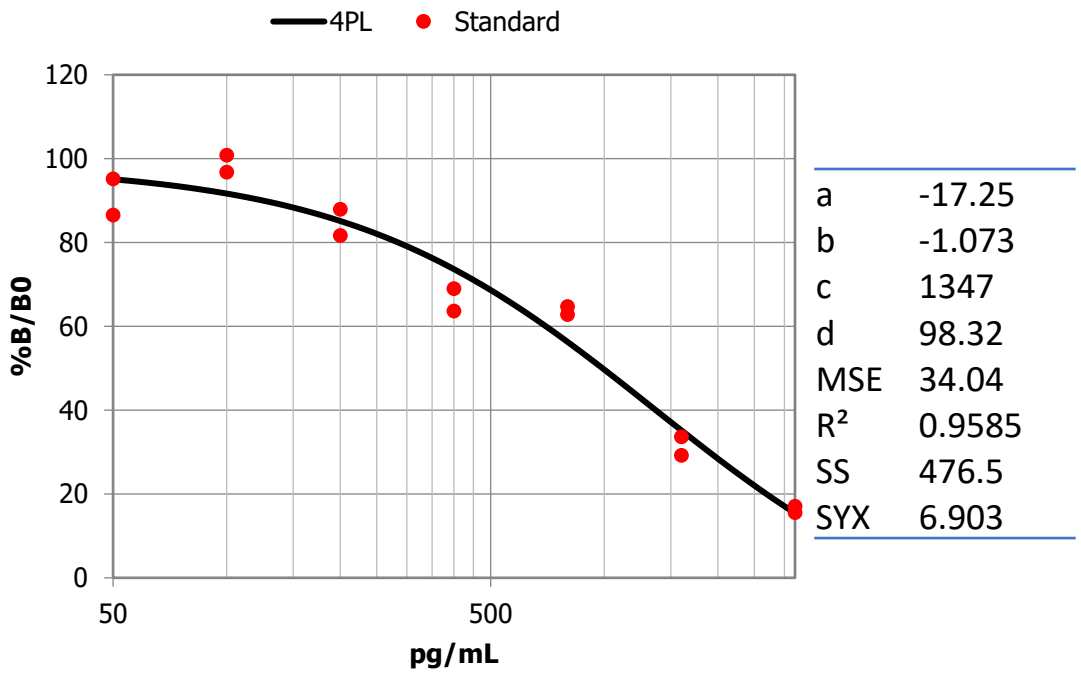
Extraction of fecal cortisol done by protocols from the kit manufacturer

The quantitative DetectX® Cortisol Immunoassay kit (Ann Arbor, MI, USA) used

Cortisol levels calculated using an online logistic curve-fitting program provided by the manufacturer from https://www.myassays.com/arbor-assays-detectx-cortisol-(extended-range).assay

Limitation: We tested 473 but final analysis done for only 214 pigs all from Mukono

Average : 688.5 pg/g



a	-17.25
b	-1.073
c	1347
d	98.32
MSE	34.04
R^2	0.9585
SS	476.5
SYX	6.903

Fecal parasites

Gastrointestinal parasitemia prevalence was 89.9% (473/526)

The spectrum of parasites included coccidia (79.8%), strongyles (65.4%), *Trichuris* spp (7.4%), *Strongyloides* spp (17.9%) and *Ascaris* spp (4.0%)

The highest epg/opg levels of fecal parasites (mean ± standard error) recorded with coccidia (2818.31 ± 367.150), followed by strongyles (624.90 ± 70.210), *Ascaris* (78.04 ± 32.947) and *Trichuris* (226.20 ± 203.551), *Strongyloides* (58.37 ± 15.842)

The one-way ANOVA analysis showed that there was a significant difference in the mean levels of the detected parasites ($p < 0.0001$).

- Epg findings suggested that most pigs needed to be dewormed (>250epg)
- Deworming practices (some deworm but don't evaluate the intervention)
- Housing environment probable risk factor

Salmonella

Pork borne pathogens: *E. coli* pathotypes (VTEC), *Y. enterocolitica,* ***Salmonellae****, Campylobacter, Listeria monocytogenes*

*Salmonella f*ecal shedding may increase due to stress as seen in pigs transported in poor conditions

Wakiso - 0/240 (0.0%)
Mukono - 17/271 (6.3%)

***Salmonella* sources and spread**
Infected pigs or contaminated feces (One farm all 6 pigs sampled tested positive)
Vermin
Contaminated feed and water
Poor sanitary conditions
Seasonality

Detected by ISO 6579-1: 2017
Levels not enumerated

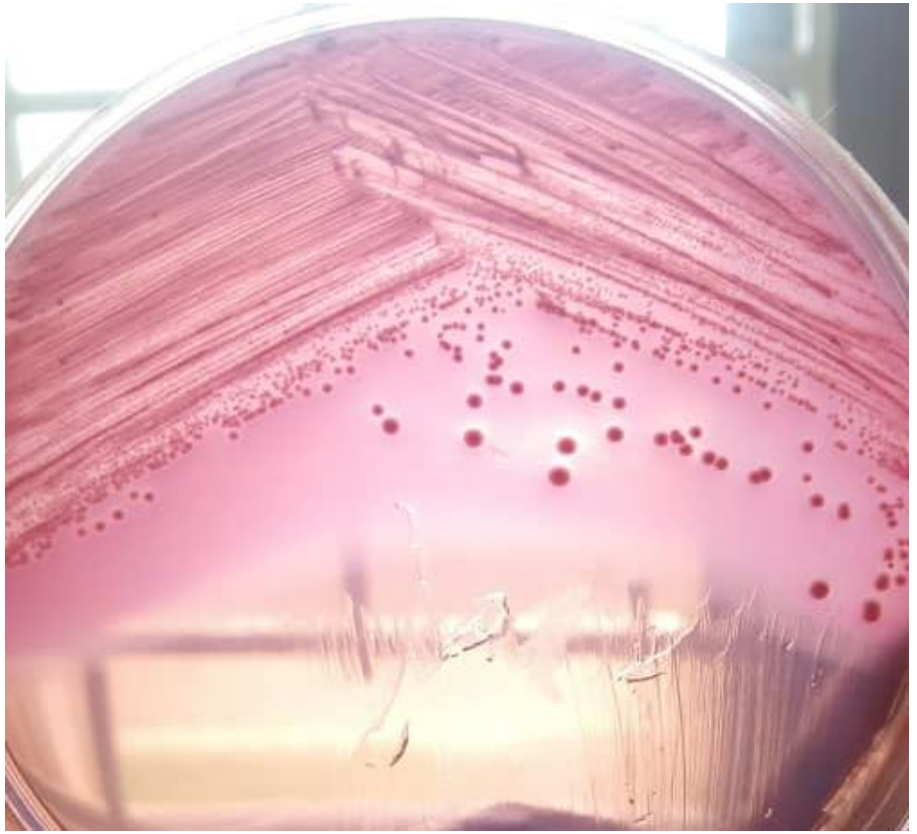
AMR using *E. coli* as an indicator bug

Qualitative and quantitative analyses for cefotaxime, colistin and high-level tetracycline resistance done

The prevalence of high-level tetracycline resistance was the highest (**82.1%**; 418/509), followed by cefotaxime (**79.2%**; 403/509) and colistin resistance (**62.9%;** 320/509)

The highest CFU level of resistant *E. coli* (mean ± standard error) was recorded with tetracycline (2135898.44 ± 383251.44), followed by cefotaxime (2344380.92 ± 389848.90) and colistin (226.20 ± 203.551)

One-way ANOVA analysis showed that there was a significant difference in the mean levels of the detected resistance phenotypes ($p < 0.0001$)



Screening of fecal samples for ARB using Mac conkey spiked with Antibiotics (tetracycline, ceftriaxone, colistin)

Poor biosecurity could drive AMR burden

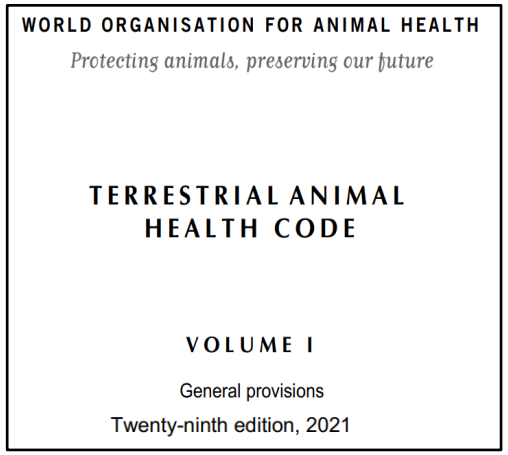
Results

2. Use the data from objective 1 to create linkages between the on-farm welfare scores and occurrence of food safety risks in pigs

100 intensive farms
Wakiso = 50,
Mukono = 50

Score based Questionnaire with reference to the EU tool and OIE welfare assessment guidelines

0 intensive farms
Wakiso = 40,
Mukono = 49



WORLD ORGANISATION FOR ANIMAL HEALTH

Protecting animals, preserving our future

TERRESTRIAL ANIMAL HEALTH CODE

VOLUME I

General provisions

Twenty-ninth edition, 2021

Article 7.1.4.

Guiding principles for the use of measures to assess animal welfare

1) For the OIE *animal welfare* standards to be applicable globally, they should emphasise favourable outcomes for the *animals*, although, in some circumstances, it may be necessary to recommend specific conditions of the *animals*' environment and management. Outcomes are generally measured by assessing the extent to which *animals* experience the "five freedoms" described in Article 7.1.2.

2) For each principle listed in Article 7.1.5., the most relevant criteria (or measurables), ideally comprising animal-based measures, should be included in the standard. Any given animal-based measure may be linked to more than one principle.

3) Recommendations should, whenever possible, define explicit targets or thresholds that should be met for animal-based measures. Such target values should be based on relevant science and experience of experts.

4) In addition to animal-based measures, resource-based measures and management-based measures may be used and should be defined on the basis of science and expert experience showing that a welfare outcome is clearly linked to a resource or to a management procedure.

5) Users of the standard should select the most appropriate animal-based measures for their farming system or environment, from among those listed in the standard. Outcomes can be measured by an assessment of individuals or animal groups, or a representative sample of those, using data from *establishments*, transport or *slaughterhouses/abattoirs*. *Competent Authorities* should collect all data relevant for the users to set target and threshold values.

6) Whatever the basis of the measure, if outcomes are unsatisfactory, users should consider what changes to resources or management are necessary to improve outcomes.

Animal welfare matrix

	Welfare criteria	Measures
Good feeding	1. Absence of prolonged hunger	Body Condition Score
	2. Absence of prolonged thirst	Water supply
Good housing	3. Comfort and resting	Bursitis, absence of manure on the body
	4. Thermal comfort	Shivering, panting, huddling
	5. Ease of movement	Space allowance
Good health	6. Absence of injuries	Lameness, wounds on the body, tail biting
	7. Absence of disease	Mortality, coughing, sneezing, pumping, twisted snouts, rectal prolapse, scouring, skin condition, ruptures, hernias
	8. Absence of pain induced by management procedures	Castration, tail docking
Appropriate behaviour	9. Expression of social behaviours	Social behaviour
	10. Expression of other behaviours	Exploratory behaviour
	11. Good human-animal relationship	Fear of humans
	12. Positive emotional state	Qualitative Behaviour Assessment (QBA)

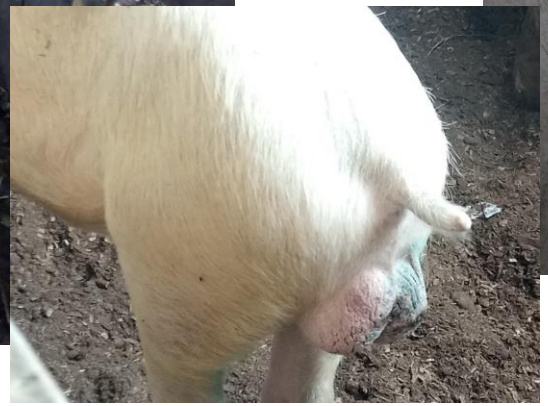
Animal welfare situation

Welfare principle	Measures	Indicators / observations made	District	Pigs observed (N)	Frequency (Percent)	Performance	Performance indicator index
Good housing	Comfort around resting	Evidence of Bursae	Mukono	345	29 (8.4)	1	Mukono = 0.8 (5/6); Wakiso = 0.2 (1/6)
			Wakiso	499	56 (11.2)	0	
		Evidence of shoulder sores, an open wound or lesion	Mukono	149	10 (6.7)	1	
			Wakiso	200	59 (29.5)	0	
		Pigs with more than 30-50% of their body surface soiled with manure	Mukono	738	120 (16.2)	1	
			Wakiso	976	165 (16.9)	0	
	Thermal comfort	Evidence of panting	Mukono	360	12 (3.3)	0	
			Wakiso	1120	13 (1.2)	1	
		Evidence of huddling	Mukono	363	28 (7.7)	1	
			Wakiso	973	92 (9.5)	0	
		Evidence of shivering	Mukono	155	4 (2.5)	1	
			Wakiso	354	29 (8.2)	0	
Good health	Absence of injuries, disease	Lameness	Mukono	835	28 (3.3)	0	Mukono = 0.3 (2/7); Wakiso = 0.9 (6/7)
			Wakiso	1081	7 (0.6)	1	
		Body wounds	Mukono	581	24 (4.1)	1	
			Wakiso	501	78 (15.6)	0	
		Coughing	Mukono	130	11 (8.5)	1	
			Wakiso	1080	31 (2.9)	0	
		Sneezing	Mukono	112	4 (3.6)	0	
			Wakiso	1086	4 (0.4)	1	
		Pumping	Mukono	580	3 (0.5)	1	
			Wakiso	1012	5 (0.5)	1	
		Rectal prolapse	Mukono	677	12 (1.8)	0	
			Wakiso	1090	0 (0.0)	1	
		Skin condition	Mukono	619	53 (8.6)	0	
			Wakiso	1041	50 (4.8)	1	

Animal welfare situation

Welfare principle	Measures	Indicators / observations made	District	Pigs observed (N)	Frequency (Percent)	Performance	Performance indicator index
Good feeding	Absence of prolonged hunger	Evidence of poor body condition score	Mukono	524	140 (26.7)	0	Mukono = 0 (0/1); Wakiso = 1 (1/1)
			Wakiso	600	120 (20.0)	1	
Appropriate behaviour	Expression of social behaviour	Evidence of negative social behaviour	Mukono	351	14 (4.0)	1	Mukono = 0.3 (1/3); Wakiso = 0.7 (2/3)
			Wakiso	515	93 (18.1)	0	
	Expression of other behaviours	Evidence of expression exploratory behaviour	Mukono	294	240 (81.6)	0	
			Wakiso	489	437 (89.4)	1	
	Good human-animal relationship	Evidence of fear of humans	Mukono	431	230 (53.4)	0	
			Wakiso	469	160 (34.1)	1	
Average performance index							Mukono = 0.4; Wakiso = 0.7

Welfare conditions in field



Linkages_AW & FS

Indicators linked with pork safety and animal welfare

- Hemograms
- Cortisol
- Antimicrobial resistant *E. coli*
- *Salmonella*

Fecal parasites eliminated as an indicator
The spectrum of parasites included coccidia (79.8%), strongyles (65.4%), *Trichuris* spp (7.4%), *Strongyloides* spp (17.9%) and *Ascaris* spp (4.0%)

None of the above has a zoonotic link through consumption of pork

Parasites of interest – ingestion of raw or undercooked pork
Trichinella spiralis
Taenia solium
Toxoplasma gondii

Best detected by serology, molecular techniques

Not detected but examination of sera could unmask them

Linkage 1_AW & FS (Hypoproteinemia)

HYPOPROTEINEMIA

Nutrition

Parasitic disease

Mukono pigs had higher parasitemia

Mukono pigs had more poor body condition scores

SOLUTIONS (WELFARE ISSUES)

- Housing
- Deworming programmes
- Feeding (to reverse microbiome dysbiosis)

FOOD SAFETY THREAT MECHANISMS

Hypoproteinemia

Production of immunoglobulins

Effect on immunity causing infection susceptible hosts
(Higher prevalence of Salmonella and Antibiotic resistant bacteria in Mukono pigs)

Linkage 2_AW & FS (Cortisol)

CORTISOL

SOLUTIONS (WELFARE ISSUES)

- Feeding

FOOD SAFETY THREATS MECHANISMS

Released from Adre
Due to stressful con
(heat, overcrowd
hunger, thirst), hum
restraint and handli
groups

microorganisms

MDPI

Review

Bacterial Stress Responses as Potential Targets in Overcoming Antibiotic Resistance

Jirapat Dawan [1] and Juhee Ahn [1,2,*]

essful conditions

Cortisol

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Obolski and Hadany *BMC Medicine* 2012, **10**:89
http://www.biomedcentral.com/1741-7015/10/89

BMC Medicine

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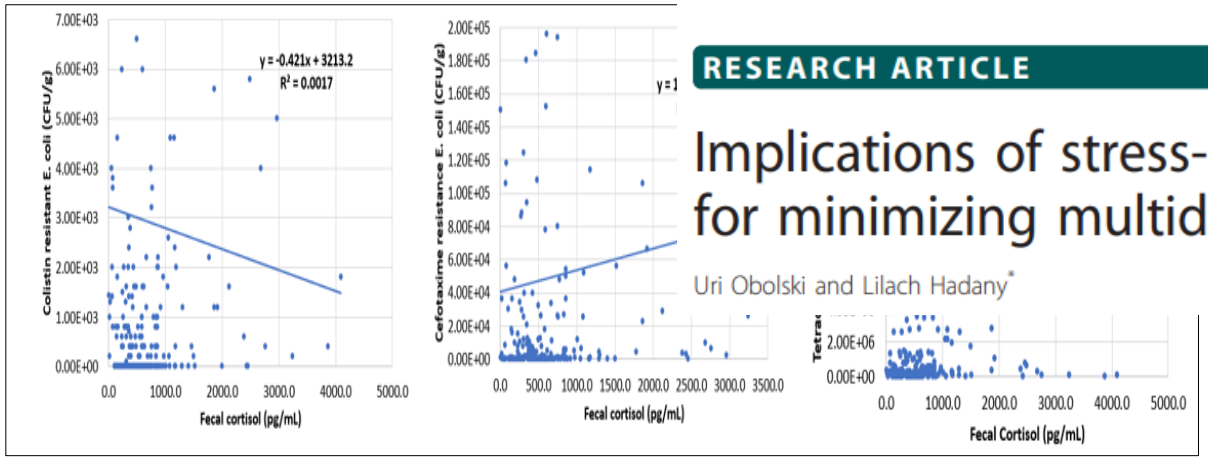

RESEARCH ARTICLE Open Access

Implications of stress-induced genetic variation for minimizing multidrug resistance in bacteria

Uri Obolski and Lilach Hadany*

Linkage 4_AW & FS (Salmonella)

SALMONELLA IN HERDS

Age

Animal husbandry (housing sanitation and hygiene, diet, herd health management)

Seasonality

Environmental stress

↓

Only found in Mukono pigs, had slightly more stress-related leukogram cases (35.7% vs 34.8%), average welfare farm performance lower

SOLUTIONS (WELFARE ISSUES)

- Stress management
- Animal husbandry practices (to capture good biosecurity)

FOOD SAFETY THREAT MECHANISMS

Stress

↓

Effect on immunity causing infection susceptible hosts

↓

Fecal shedding of Salmonella

Conclusion

Linkages were established between fecal shedding of zoonotic pork borne pathogens such as *Salmonella* and drug resistant *E. coli* and animal welfare

As we think about boosting pig farming in Uganda, its potential contribution to the prevalence of zoonotic agents in pork can be associated with animal welfare issues that need to be corrected

It is also important that national food safety plans and guidelines incorporate animal welfare in their strategies for promoting safe animal source meat such as pork

Take home messages for the targets of change

1. Farmers

Awareness on animal welfare (best herd health management practices)

2. Extension workers

Capacity for veterinary services (diagnostics, herd health monitoring)

Farmer sensitization in herd health monitoring

3. Researchers

Baseline stress studies, cortisol detection protocols

More research on bacterial stress responses as potential targets for AMR

3. Policy makers

Integration of AW as a core in national food safety plans, guidelines

Acknowledgement


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MAAIF
Ministry of Agriculture Animal Industry and Fisheries

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

THE UNIVERSITY of EDINBURGH


SRUC