Guidlines for parasitic diseases of slaughtered food animals

Acknowledgement:

We would like to acknowledge the committee of National Egyptian Guidelines for Veterinary Medical Interventions, Egyptian Health Council for adapting this guideline.
Executive Chief of the Egyptian Health Council: Prof. Dr Mohamed Mustafa Lotief.
Head of the Committee: Prof. Dr Ahmed M Byomi
The Decision of the Committee: Prof. Dr Mohamed Mohamedy Ghanem.
Scientific Group Members: Prof. Dr Nabil Yassien, Prof. Dr Ashraf Aldesoky Shamaa, Prof. Dr Amany Abbass, Prof. Dr Dalia Mansour, Dr Essam Sobhy
Editor: Prof. Dr Nabil Yassien Prof, Dr, Heba Hussien Abdelnaem

Abbreviations

NCC: Neurocysticercosis
C. bovis: *Cysticercus bovis*
C. cellulose: Cysticercus cellulosa
TB: Tuberculosis
F.H: Final host
IMH: Intermediate host
K_h: Conditionally approved after heat treatment
K_f: Conditionally approved after freezing treatment
T: Total condemnation
EMC: Encysted metacercaria
P/M: Postmortem
L.N: Lymph node

Scope:

I- Parasites directly transmissible to man	II-Parasites indirectly transmissible to man	III-Parasites not transmissible to man
Beef measle, Pork measle, *Trichinella spiralis*, *Linguatula rhinaria*, and Sarcosporidia	Hydatid cyst	• **Nematode (round worm):** Ascaris and Lung worm • **Cestodes (tape worm):** *Taenia ovis*, *Taenia hyaenha*, *Taenia hydatigena*, and *Taenia multicepes* • **Protozoa:** Babesiaisis, Anaplasmosis, and Coccidiosis • **Arthropode:** *Oestrus bovis* (warble flies) and *Oestrus ovis* • **Trematode:** Fascioliasis

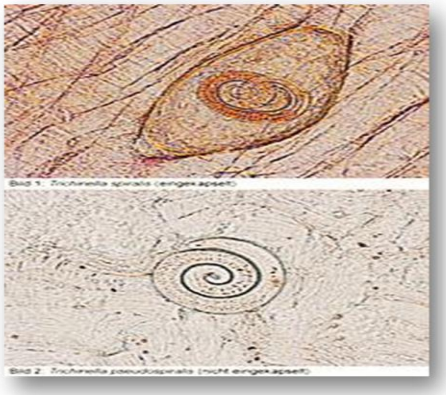
✓ To categorize parasites which directly transmissible to man ✓ To study NCC (neurocysticercosis) ✓ To differentiate between beef measle and pork measle ✓ To differentiate between tongue worm and TB ✓ To know the predilection seats for all parasites which directly transmissible to man ✓ To identify the mode of infection of all parasites which directly transmissible to man ✓ To recognize the final and intermediate host of all parasites which directly transmissible to man ✓ To be able to make judgements and control measures for all parasites which directly transmissible to man ✓ To learn how to test the viability of cysticerci ✓ To study different forms of sarcosporidia (macroscopic and microscopic) ✓ To study trichinoscopic examination of *Trichinella spiralis*	✓ To classify parasites which indirectly transmissible to man ✓ To recognize the predilection seats of parasites which indirectly transmissible to man ✓ To identify the mode of infection of parasites which indirectly transmissible to man ✓ To know the final and intermediate host of parasites which indirectly transmissible to man ✓ To learn how to make judgements and control measures for all parasites which indirectly transmissible to man	✓ To categorize parasites which not transmissible to man ✓ To identify the predilection seats of parasites which not transmissible to man ✓ To identify the mode of infection of parasites which not transmissible to man ✓ To differentiate between milk spots caused by immature ascaris or avian T.B in swine liver ✓ To know the final and intermediate host of all parasites which not transmissible to man ✓ To know the causative agent, postmortem lesion and judgement of butcher's jelly ✓ To differentiate between gide and false gide disease ✓ To learn how to make judgements and control measures for all parasites which not transmissible to man ✓ To learn forms of fasciola in different species.

I- Parasites directly transmissible to man

	1. Beef measle	2. Pork measle
Cause	*Cysticercus bovis*	*Cysticercus cellulosa*
F.H	Man	
I.M.H	Cattle and Buffalo	Mainly in Pig and Man
Judgement	More than one cyst living or dead in an area of the size of a hand palm in different cuts of carcass is considered heavy infestation and requires T. Otherwise considered light and conditionally passed after freezing, boiling	Even one cyst living or dead detected in any part of the carcass or organ makes total condemnation (T).

	steaming, or pickling.	

3- Trichinosis (the smallest nematode)



Cause: *Trichinella spiralis* larvae

Host: Pig, wild boar, rat, mice, dog, man and cat. Ruminants, horses, and birds show natural immunity while camels can infest experimentally.

Resistance: Viable in decomposed meat for 2 year

Judgement: Even one cyst live or dead requires total condemnation

Control measures

- Pig flesh is trichinella-free
- Pork should be ground in a separate grinder
- Control rodents
- Proper cooking (at least 30 min at 100°C) of swill fed to pigs

Man

- Cooking: Meat color changes from pink to grey and easily separates muscle fibers.
- Freezing (-15 ° C for 20 days thickness less than 6 inches)
- Irradiation: in countries allowing irradiation

4- Sarcosporidia

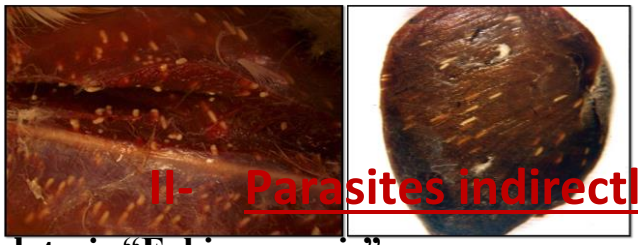
- **F.H:** Ingestion of cysts (bradyzoites)
- **I.M.H:** Ingestion of feed with oocysts
- **Predilection seats:** Larynx- Esophagus- Diaphragm- Abdominal muscle- Lumber region muscle- Skeletal muscle (heavily infested cases)
- **Judgement:**
  Localized affection condemnation of the affected part

Heavy infestation "T"

- **Types (Forms) Sarcosporidia**

Macroscopic	Microscopic
Buffalo: *Balbiana gigantea* in the esophagus Sheep: *S. gigantea* and *S. medusiformis* Pig: *S. porcifelis* Cattle: *S. hirsute*	Sheep: *S. tenella* Cattle: *S. blanchardi* and *cruzi* Pig: *S. miescheriana* Man: • *S. humnis* (bovis humnis) and *S. suihominis* (F.H) • *S. lindimann*i (I.M.H)

Oesophagus macroscopic sarcocyst " Balbaina gigantiea"

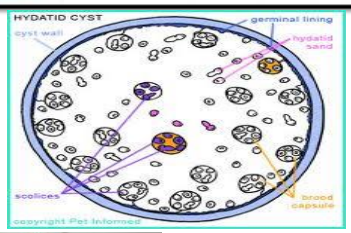


II- Parasites indirectly transmissible to man

Hydatosis "Echinococosis"

Definition: Larval or cystic stage of *Taenia echinococcus* which is found in the small intestine of carnivorous

Cause: Hydatid cyst of *Echinococcus granulosus* "dog"- Hydatid cyst of *Echinococcus mutilocularis* "fox"



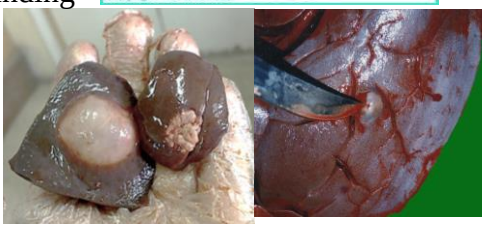
F.H: Dog and fox

I.M.H: Man, camel, cattle, sheep & pig in case of *E. granulosus*. Deer in case of *E. multilocularis*

Judgement:

Organ:

- Light infestation: Hygienic disposal of the cyst & part from surrounding tissue.
- Heavy infestation: Condemnation of organ



Carcass:

- Light infestation: Remove the affected part with hygienic disposal.The rest pass(no edema, emaciation, and muscular infestation
- Heavy infestation: Total condemnation (T)

Control measures: Carcass: Effective inspection and removal of affected part with hygienic disposal. Total condemnation of heavy-infested and emaciated carcasses with hygienic disposal. Man: Improve personal hygiene and Educational program.

III. Parasites not transmissible to man

A. Nematode

1- Ascaris (toxocara)

Cause: Ascaris suum (suis) in pig. Ascaris ovis in sheep. Neoscaris(toxocara) vitulorm in calve.

P/M: Intestinal obstruction. Flesh: Characteristics odor (toxic substance and volatile acid)-poor. Liver: The early stage is congested and chronic cases make milk spots. Lung: Edema, hemorrhage, and parasitic pneumonia.

Judgement:

1. Condemnation of affected intestine and liver
2. Boiling and roasting test must be applied for detection of any abnormal odor & taste.

2- Lungworm

Cause: Dictyocaulus viviparous in cattle. Dictyocaulus filaria in sheep. Metastrongylus elongatus in pig

P/M: Yellow or reddish brown foci (adult parasite)/surface of the lung just beneath pleura. Catarrhal bronchitis and pneumonia (exudates contain the parasites). Emaciated animal

Judgement:

Lung:

- Slight infestation: condemnation of affected part
- Heavy infestation: condemnation of lung

Carcass: If there is anemia and emaciation make T

B- Cestodes

	1- Sheep measle	**2-Camel measle**	**3-*Cysticerus tenuicollis***	**4-*Coenurus cerebralis***
Cause	*C. Ovis*	*C. cameli or dromedarri*	*C. tenuicollis* (largest)	*Multiceps multiceps* or *Coenurus cerebralis*
Adult worm	*T. ovis*	*T. hyaena*	*T. hydatigena* (marginata) largest tape worm in dog	T. *multicepes (T. coenurus)*
Habitat	Heart-Masseter-Tongue-Diaphragm	Heart- Masseter-Skeletal Ms- Liver	Liver-Mesentery & its L. node- Omentum	Brain &spinal cord
F.H	Dog	Hyaena or dog	Dog	Dog
I.M.H	Sheep and goat	Camel	Ox, sheep, goat, pig, and camel	Sheep, and goats. Rare in ox, horses, and man
Judgement	**Organ:** condemned **Carcass:** Light: remove the affected part	as c. bovis	Organ: Light: cyst. Heavy: whole organ Carcass: A	Early before emaciation remove head. With emaciation (T) **N.B:**

	Heavy: (T)			Gid=sturdy=turnsick= circling disease

C- Arthropods

	1- Oestrus bovis	2- Oestrus ovis
Cause	○ *Hypoderma bovis* (cattle) ○ *H. linatum*	○ Sheep nasal fly / False gid
Predilection seat/ host	○ Muscle of belly (butcher's jelly) ○ S/C in goat ○ Carcass unmarketable	○ Sheep ○ Camels, dogs, and man (Sometimes)
A/M and P/M	○ Swelling or eroded skin back (Larvae protruding) ○ Cattle kick the abdomen- erected tail ○ Paralysis (lower body, legs) (spinal cord) ○ Hemorrhagic edema ○ Edema and inflammation in s/c tissue around larvae (butcher's jelly)	○ Symptom of brian irritation ○ Tozzing of head ○ Sneezing ○ Loss of appetite and emacaciation
Judgement	Trimming of the affected parts	○ Condemnation of head ○ Carcass approved (no emaciation)

D- Trematode:

Fascioliasis:

Cause: *Fasciola gigantica* "Giant liver", *Fasciola hepatica*, or *Fascioloides magna*
M.O.I: EMC on grass (animal, human). Not by adult fluke

Acute	Subacute	Chronic
☛ Immature ☛ Haemorrhagic tracts ☛ Swelling, congestion, Hg. on liver capsule ☛ Soapy touch of muscle ☛ Death from liver rupture	☛ Differs from the acute type in that symptoms are more protracted	☛ Adult flukes in the bile ducts (mechanical irritation) ☛ Hard liver and atrophy ☛ The cirrhotic areas (greyish color)

Fasciola in different species:
Cattle: Bile duct: Pipe appearance/sand sound by knife. Liver tissue: Cirrhosis. Lung: Nodule (immature fluke that failed to reach bile duct and liver)
Sheep: Bile duct: Thickening & dilatation. Liver tissue: Fibrosis. Lung: Rare nodule
Pig: Immature fluke encysted in liver tissue & fail to reach bile duct.

Judgement:
<u>Organ</u>

- **Acute**: Condemnation
- **Chronic**: Light infestation: Condemnation of the affected part. Heavy infestation: Condemnation of the whole liver

Carcass:

- Examined for jaundice, emaciation & oedema "Cattle"

- Examined for edema, emaciation, and jaundice "Sheep"

References:

- **Kumar, S., Katoch, R., and Bhat, Z.F., (2014). Meat Borne Parasitic Zoonoses. In: *Veterinary Parasitology*. R. Katoch, R. Godara, A. Yadav, (Eds), Chapter 6, pp177-206. Satish Serial Publishing House, India.**
- **Bruschi, F., and Dupouy-Camet, J. (2022). Trichinellosis. In*: Helminth infections and their impact on global public health*. pp. 351-396. Cham: Springer International Publishing.**
- **Ortega Y.R., and Sterling, C.R. (2018). Foodborne Parasites. (Food Microbiology and Food Safety Series). 2nd ed., Springer.**
- **Xiao, L., Ryan, U., and Feng, Y. (2015). Biology of Foodborne Parasites; CRC Press: Boca Raton, FL, USA, Volume 1.**
- **Liu, D. (2018). Handbook of Foodborne Diseases. CRC Press, Boca Raton.**
- **Lawley, R., Curtis, L., and Davis, J. (2012). Parasites. In: *The Food Safety Hazard Guidebook*. Chapter 1.3, pp. 136-171. The Royal Society of Chemistry.**
- **Bruschi, F. (2021). Trichinella and trichinellosis. Elsevier.**
- **Campbell, W. (2012). Trichinella and trichinosis Springer Science & Business Media.**