Rehabilitation failures of oil-covered birds:
Effects of re-feeding on the digestive tract,
the body energy stores and the immune system


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Effects of oil on birds

Oiling → Loss of feathers' waterproofness → Hypothermia → Impossibility of feeding → Depletion of body fuels → Cachexia → Rehabilitation Failure → Death

Adaptations to fasting

Optimal use of body reserves

- phase I: glycogen
- phase II: lipids, reduced metabolism, atrophy of gut
- phase III: proteins

In natural or laboratory conditions: efficient re-feeding

Le Maho et al. 1981

Le Drean-Quénec'Hdu et al. 2002

Clinical features

Care centres or dead beached birds:
- Cachexia, haemorrhagic diathesis
  Debacker et al. 1997, Balas et al. 2005
- Numerous re-feeding failures
  Allan & Ryan 1991
- Nosocomial infections
  Le Drean-Quénec'Hdu et al. 2002

Only 3-10% of birds are released in the wild after an oil spill

Immunity and energetic challenges

- in force-fasted birds: example of King penguin

Absorbance

Immunoglobulin levels

Phases

I

II

III

Bourgeon et al. 2007

- in oil-intoxicated
  Lack of data
  Briggs et al. 1996

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Questions

1. Irreversible atrophy of intestine?
2. Assimilation?
3. Deficiency of the immune system?

Context: Napoli oil Spill

20th January 2007 MRC-Napoli
South of England, 6-200 t of hydrocarbons
Ligue de Protection des Oiseaux (LPO care centre), Île Grande, France

Estimation: 5 to 10 000 oiled birds
2000 beached birds in England, 370 in France

Methods

Common Guillemot
under 600g (~40% Body Mass)
-13 euthanatized at the arrival while fasting
-7 euthanatized after 24-72h re-feeding ad libitum

Rectal temperature and blood sampling before euthanasia and dissection
- Duodenum and jejunum: morphometry
- Skin and pectoral muscle: stores (lipids and proteins)
- Blood sample: humoral immunity parameters (innate and acquired)
  / 6 non-intoxicated control

Digestive tract

Absorption of nutrients

Morphometrical measurements

Jejunum: Fasted Re-Fed

Circumference = 8 300 µm
Villi lengths = 890 µm

Circumference = 10 100 µm
Villi lengths = 980 µm

1. Irreversible atrophy of intestine?
1. Irreversible atrophy of intestine?

No!

Morphometrical restoration of the intestine

2. Assimilation?

Rectal temperature

Increase of temperature is a clue of digestive activity

2. Assimilation?

Yes!

- Digestive activity
- Assimilation and storage in organs

2. Assimilation?

Evidence of assimilation and storage in organs

3. Deficiency of the immune system?

Plasma immunoglobulin level

Deficiency of acquired immunity in oil-intoxicated birds

3. Deficiency of the immune system?

Innate humoral immunity

Deficiency in innate immunity in oil-intoxicated birds
3. Deficiency of the immune system? 
Yes!
Immuno-depression by deficiency of both the acquired & innate humoral immunity

Conclusion
1. Irreversible atrophy of intestine?
Reversibility of the fasting induced digestive atrophy
2. Assimilation?
Increase of rectal temperature and storage in the organs
3. Deficiency of the immune system?
Deficiency of acquired and innate humoral immunity

Discussion
Energetic cost of immunity
Energetic cost of toxicity
Loss of appetite, anorexia
Default of assimilation
Re-feeding Failures

Perspectives
Impact of stress?
-Corticosterone, CBG
-Oxidative stress
Improvement of:
-Immunity recovery
-Appetite & wellness of birds

Thank you
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