How nutrition can influence breeding performances in cat?

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What does it mean « good breeding performances » ?
Good breeding performances if.....

**Good ovocyte quality**
- High number of ovocytes

**No embryonic death**

**No foetal death**

**No dystocia**

**Healthy female**
- Good body condition
  - Good milk (quality + quantity)

**A lot of healthy kittens**
- with a healthy mother

**Good semen quality**
- Good mobility
- High concentration
- Normal morphology

**No neonatal death**

**Good birth weight**

**Optimal growth**

**Healthy kittens**
How food can influence breeding performances?
How food can influence breeding performances?

**Ingredients**

<table>
<thead>
<tr>
<th>Intentionally introduced substances</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nutrients</strong></td>
</tr>
<tr>
<td>Fat/Proteins/Carbohydrates/Vitamins/Minerals</td>
</tr>
<tr>
<td><strong>Food additive</strong></td>
</tr>
<tr>
<td>Preservative, flavors</td>
</tr>
</tbody>
</table>

**Unintentionally introduced substances**

<table>
<thead>
<tr>
<th>Biological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mycotoxins, viruses, parasites, bacteria</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pesticide residues, vet drugs containants, environmental contaminants...</td>
</tr>
</tbody>
</table>

**Diet**

**Nutrient profiles**

**Quantity**

**Storage**

<table>
<thead>
<tr>
<th>Temperature</th>
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<table>
<thead>
<tr>
<th>Humidity</th>
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<table>
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<tr>
<th>Packaging</th>
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</table>

<table>
<thead>
<tr>
<th>Time</th>
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</table>

<table>
<thead>
<tr>
<th>Cleanliness</th>
</tr>
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<table>
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<tr>
<th>Insects rodents</th>
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</thead>
</table>

**Animal**

**Digestion**

**Absorption**

**Nutritional needs**

**Maintenance**

**Reproduction**

- Oestrus
- Gestation
- Lactation
- Growth
- Semen quality
Link between food and breeding performances

Quality | Food | Quantity
---|---|---
Decrease | No effect | Improve

Breeding performances
Raw meat diets ➔ nutritional concerns and safety risk

Nutritional concerns

60 %
Major nutritional imbalances
95 homemade raw meat diets analyzed

Safety risks

21 – 48 %
Contaminated by Salmonella sp

Campylobacter spp
Toxoplasma gondii

Link between food and breeding performances

Food

Quality

Quantity

Decrease  No effect  Improve

Breeding performances
Modification of the diet can influence breeding performances

<table>
<thead>
<tr>
<th>Year</th>
<th>Queens</th>
<th>Kittens</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979</td>
<td>65</td>
<td>423</td>
</tr>
<tr>
<td>1980</td>
<td>72</td>
<td>510</td>
</tr>
<tr>
<td>1981</td>
<td>72</td>
<td>557</td>
</tr>
<tr>
<td>1982</td>
<td>73</td>
<td>924</td>
</tr>
</tbody>
</table>

Diet modification

- **Litter size**
  - 1979: 4.5
  - 1980: 4.3
  - 1981: 5.4
  - 1982: 5.5

- **Stillborn + dead < 7 days**
  - 1979: 20.6%
  - 1980: 14.2%
  - 1981: 6.7%
  - 1982: 5.3%

- **Dead > 7 days**
  - 1979: 2.4%
  - 1980: 3.2%
  - 1981: 3.4%
  - 1982: 3.5%

High quality and high fat diet improved reproduction

Link between food and breeding performances

Food

Quality

Quantity

Decrease

No effect

Improve

Breeding performances
Consequences of overfeeding before and during gestation
A scale to evaluate body condition score

**WEIGHT MANAGEMENT PROGRAMME**

**BODY CONDITION SCORE CAT**

**TOO THIN**
- Ribs, spine and pelvic bones easily visible on short-haired cats
- Very narrow waist
- No palpable fat on the rib cage
- Severe abdominal tuck

**IDEAL**
- Ribs not visible but are easily palpable
- Obvious waist
- Minimal amount of abdominal fat

**OVERWEIGHT**
- Ribs not visible but palpable
- Obvious waist
- Small amount of abdominal fat
- Slight abdominal tuck

**OVERWEIGHT**
- Ribs difficult to palpate under the fat
- Waist barely visible
- No abdominal tuck
- Slight tuck of abdomen with moderate abdominal fat

**OBSESE**
- Ribs not palpable under a thick layer of fat
- Waist absent
- Obvious abdominal distension
- Extensive abdominal fat deposits
Leptin: a peptide hormone secreted by adipocytes


Plasma leptin concentration (ng/ml)

Body fat mass (kg)
Obesity induces modifications in hormonal secretions

Hypothalamus → GnRH → Pituitary gland

FSH + LH

Progesteron Estrogen

Leptin
Leptin decrease ovary contractility

Leptin receptors

1-Ovary
2-Oviduct
3-Uterine horn
4-Follicule

Ovarian contractions → Ovulation

Reduction of frequency
Reduction of tension

Overweight cat at mating = poor fertility
Obesity induces an inflammation of placenta in human

Obesity decreases fertility in human

Brannian JD et al. Baseline non-fasting serum leptin concentration to body mass index ratio is predictive of IVF outcomes. Human reproduction, 2001, 16, 9 : 1819-1826
New study done in dog on BCS and reproduction

n=41 bitches (n=34 pregnant)

Low birth weight (25% lowest weights)

Body condition score + Leptinemia

n=179 puppies

Perinatal mortality (0-2 days)
Prevalence of low birth weights
22.5%

Perinatal mortality
25.1%

Low birth weight puppies (%)

Mortality (0-2 days) (%)
Overweight cat during gestation = poor fertility

Poor fertility
Low birth weight kittens
Neonatal mortality
Overweight queens accumulate fat in the uterus.

Uterus has a muscle: myometra.
In overweight women, a diminution of myometral contraction is observed.

Overweight is frequent in pure breed cats

Assessment of body condition score before the mating

Only healthy queens in a good body condition score should be used for breeding
How to feed the cat during pregnancy?
In Carnivores, there are two strategies to produce milk
Optimal weight of pregnant bitch

G gross = weight (just before delivery) – Weight (pre-mating) = 15 – 25%
G net = weight (post-delivery) – weight (post mating) = 5 – 10%
Optimal weight of pregnant queen

Wichert D et al. Cats during gestation and lactation fed with canned food ad libitum: energy and protein intake, development of body weight and body composition. JAPAN 2011
Dogs and cats two strategies during pregnancy

Bodyweight (% weight at mating)

Days after mating
In Carnivores, there are two strategies to produce milk.

**Energy comes only from food**
- Few energy reserve

**Energy comes from body fat deposit & food**
- More energy reserve
Is it possible to modulate milk composition with nutrition during gestation?
Four different factors influence the composition of domestic cat milk

- Diet
- Stage of lactation
- Litter size
- Teat location

Four different factors influence the composition of domestic cat milk:

- Diet
- Stage of lactation
- Litter size
- Teat location
Diet and number of weeks of lactation have an impact on the composition of cat milk

% of fat in the milk

Number of weeks of lactation

High fat diet

Low fat diet
Use specific diet dedicated for gestation and/or lactation

388,5 g of fat / 1000 Kcal

549,2 g of fat / 1000 Kcal
Do we need to give supplements of the queen during gestation?
Eclampsia

Clinical signs in case of eclampsia

- Muscle tremors, fasciculations
- Generalized seizures
- Muscle cramping or pain
- Behavior changes
- Poor activity

Low blood Calcium concentration
Extracellular calcium ($\text{Ca}^{2+}$)

Soft tissue calcium

Parathyroid hormone (PTH)
Extracellular calcium (Ca\(^{2+}\))

Parathyroid hormone (PTH)

Ca\(^{2+}\)

Extracellular calcium (Ca\(^{2+}\))

Ca\(^{2+}\)

Lactation
Risk factors of eclampsia

1- Calcium supplementation during gestation

\[ \text{Parathyroid hormone (PTH)} \]

\[ \text{Soft tissue calcium} \]

\[ \text{Extracellular calcium (Ca}^{2+} \) \]

\[ \text{Ca}^{2+} \]
**Risk factors of eclampsia**

1- Calcium supplementation during gestation

2- Low quality diet

3- High quantity of legumes (phytates)

**Parathyroid hormone (PTH)**

**Extracellular calcium (Ca^{2+})**

**Soft tissue calcium**
Prevention of eclampsia

High quality balanced diet

No calcium supplementation during gestation
Good breeding performances if.....

Nutrition

Environment
Stress
Genetic
Behavior
Management of reproduction
Breed
Infectious disease
Age
How to optimize breeding performances

Optimal kennel management + Optimal nutrition = Best results