How nutrition can influence breeding performances in dog?

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

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

- 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 puppies with a healthy mother

- No neonatal death
- Good birth weight
- Optimal growth
- Healthy puppy

A lot of healthy puppies with a healthy mother
How food can influence breeding performances?
How food can influence breeding performances?

Ingredients

- Intentionally introduced substances
  - Nutrients
    - Fat/Proteins/Carbohydrates/Vitamins/Minerals
  - Food additive
    - Preservative, flavors

- Unintentionally introduced substances
  - Biological: Mycotoxins, viruses, parasites, bacteria
  - Chemical: Pesticide residues, vet drugs containants, environmental contaminants...

Diet

Nutrient profiles
Quantity

Storage

- Temperature
- Humidity
- Packaging
- Time
- Cleanliness
- Insects rodents

Animal

- Digestion
- Absorption
- Nutritional needs
  - Maintenance
  - Reproduction
    - Oestrus
    - Gestation
    - Lactation
    - Growth
    - Semen quality

Formulation
Process

Ingestion
Link between food and breeding performances

- Quality
- Food
- Quantity

- Decrease
- No effect
- Improve

Breeding performances
Link between food and breeding performances

- **Quality**
  - Decrease
  - No effect
  - Improve

- **Quantity**

- **Breeding performances**
Case report of primary anoestrus

- 2 years old
- No sign of heat since birth
- No induction of oestrus after treatment by the vet
- Feed with BARF
  - Cattle bone and meat of the head and neck
  - Since birth

Case report of primary anoestrus

Case report of primary anoestrus

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

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

Breeding performances
Supplementation of bitches with tyrosine has no effect on bitches sexual behaviour.

Tyrosine (Amino acid) → Hypothalamus → Pituitary gland → Ovaries
- Tyrosine 100 mg/kg/day day 3 to 9 of heat
- No effect on:
  - Visual signs of heat
  - Copulation behaviour
  - Oestradiol concentration

Diagram:
- GnRH → FSH, LH → Ovaries → Oestrogen, Progesteron → Sexual behavior
Link between food and breeding performances

Food

Quality

Quantity

Decrease

No effect

Improve

Breeding performances
Consequences of an excess of food ingestion

Excess of food ingestion

Overweight
Obesity
BODY CONDITION SCORE - MEDIUM DOG

TOO THIN

1. Ribs, lumbar vertebrae, pelvic bones and all bony prominences evident from a distance
   - No discernible body fat
   - Obvious loss of muscle mass

2. Ribs, lumbar vertebrae, and pelvic bones easily visible
   - No palpable fat
   - Some bony prominences visible from a distance
   - Minimal loss of muscle mass

3. Ribs easily palpable and may be visible with no palpable fat
   - Tails of lumbar vertebrae visible, pelvic bones becoming prominent
   - Obvious waist and abdominal tuck

IDEAL

4. Ribs easily palpable with minimal fat covering
   - Waist easily noted when viewed from above
   - Abdominal tuck evident

OVERWEIGHT

6. Ribs palpable with slight excess of fat covering
   - Waist is discernible when viewed from above but is not prominent
   - Abdominal tuck apparent

5. Ribs palpable without excess fat covering
   - Waist observed behind ribs when viewed from above
   - Abdomen tucked up when viewed from side

TOO HEAVY

7. Ribs palpable with difficulty, heavy fat cover
   - Noticeable fat deposits over lumbar area and base of tail
   - Waist absent or barely visible
   - Abdominal tuck may be absent

8. Ribs not palpable under very heavy fat cover or palpable only with significant pressure
   - Heavy fat deposits over lumbar area and base of tail
   - Waist absent
   - No abdominal tuck
   - Obvious abdominal distension may be present

9. Massive fat deposits over thorax, spine, and base of tail
   - Waist and abdominal tuck absent
   - Fat deposits on neck and limbs
   - Obvious abdominal distension
Leptin: a peptide hormone secreted by adipocytes
Leptin concentration is correlated to BCS and fat level

Leptin $\leftrightarrow$ body condition score

Leptin $\leftrightarrow$ body fat level


Obesity induces modifications in hormonal secretions
Obesity induces an inflammation of placenta in human

Obesity

General and local inflammation

Hormonal dysregulation

Infertility
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)*

**Mating** (W0)  
**Gestation** (W4)  
**Whelping** (PP)  
→ **Birth**

**Body condition score + Leptinemia**

- *n=179 puppies*

- **Low birth weight**  
  (25% lowest weights)

- **Perinatal mortality**  
  (0-2 days)
BCS influence prevalence of low birth weight and mortality

**Prevalence of low birth weights**

- **22.5%**

**Perinatal mortality**

- **25.1%**

### Prevalence of low birth weights (%)

- **Low birth weight puppies (%):**
  - **W0:** 25%
  - **W4:** 30%
  - **PP:** 20%

### Perinatal mortality (0-2 days) (%)

- **Mortality:**
  - **W0:** 5%
  - **W4:** 20%
  - **PP:** 10%
Overweight bitches accumulate fat in the uterus

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

Overweight is frequent in pure breed dogs

**Holland (Winner show)**
1379 dogs*
19%

**UK (Crufts)**
960 dogs**
26%

**France and Belgium (world dog show)**
482 dogs***
23%

**Such, ZR., German, AJ. (2015) Best in show but not best shape: a photographic assessment of show dog body condition. Veterinary Record 177, 125.
***Unpublished results
Only healthy dogs in a good body condition score should be used for breeding
How to feed the dog during pregnancy?
Foetal growth occurs at the end of pregnancy
Energy needs of the bitch increase from the 6th week of gestation
In the same time, food intake capacity is decreasing

- Uterus compresses the stomach
- Behavioural changes
Necessity to use a palatable food with a high energy level

Avoid unlimited food distribution during gestation!

- Foetal growth
- ↓ Ingestion capacity
- Behavioural changes
- High energy food
- Palatable

Good practice
Optimal weight of pregnant bitches

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

Link between food and breeding performances

Food

Quality

Quantity

Decrease

No effect

Improve

Breeding performances

Food Quantity

Quality

Quantity

Decrease

No effect

Improve

Breeding performances
Cleft lip and palate
Cleft palates: a main concern in dogs

Prevalence (1-2) 4.2 – 17.6 %

2- Elwood JM. et al. New Zealand Veterinary Journal, 1997 (45) 6 : 254-256
Cleft palate affects many dogs breeds
.... But mainly brachycephalic breeds
Cleft palate: gestion and treatment
In Humans, supplementation with folic acid decreases the risk of cleft palate

Review of 5 trials = 6105 women

Authors’ conclusions—Folic acid, alone or in combination with vitamins and minerals, prevents NTDs but does not have a clear effect on other birth defects.

400 μg of folic acid / day/ woman

5 mg of folic acid / day/ woman
A low folate concentration is frequent in dogs.

**From 1990 to 2002**

- 9960 dogs from 40 breeds

**Low folate concentration**

- 14%

45 reproductive bitches presented for a heat follow up

- 11%

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** Grellet A et al. A high folic acid diet increases folate serum concentration in pregnant bitches. EVSSAR congress 2014. Wroclaw, Poland
Folic acid during early gestation reduces the incidence of cleft palate

**Boston terrier**

- 242 puppies

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<th>Control</th>
<th>Supplemented</th>
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<tr>
<td>Frequency of cleft palate</td>
<td>17.6%</td>
<td>4.2%</td>
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**French Bulldogs**

- 544 puppies

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<th>Control</th>
<th>Supplemented</th>
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<tbody>
<tr>
<td>Frequency of cleft palate</td>
<td>9.6%</td>
<td>5.1%</td>
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</table>

Elwood JM. et al. New Zealand Veterinary Journal, 1997 (45) 6 : 254-256

Del Carro et al. EVSSAR congress 2014. Wroclaw, Poland
Two ways to increase serum folic acid level

Two ways to increase folic acid level

Grellet A et al. A high folic acid diet increases folate serum concentration in pregnant bitches. EVSSAR congress 2014. Wroclaw, Poland
Folic acid and cleft palate... BUT don’t forget the other causes

→ Collaboration with vets

→ Selection of dogs by breeders
Link between food and breeding performances

Quality

Food

Quantity

Decrease
No effect
Improve

Breeding performances
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 (Ca$^{2+}$)

Parathyroid hormone (PTH)

Soft tissue calcium

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

Parathyroid hormone (PTH)

Ca\(^{2+}\)

Ca\(^{2+}\)

Ca\(^{2+}\)

Lactation
**Risk factors of eclampsia**

1- Calcium supplementation during gestation

- Extracellular calcium (Ca$^{2+}$)
- Soft tissue calcium
- Parathyroid hormone (PTH)

Calcium supplementation during gestation reduces the risk of eclampsia by maintaining stable extracellular calcium levels.
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\(^{2+}\))

Low

Soft tissue calcium
Prevention of eclampsia

High quality balanced diet

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

Nutrition

Environment
Genetic
Stress
Behavior
Management of reproduction
Breed
Infectious disease
Age
The two main causes of infertility

50%
How to optimize breeding performances

Optimal kennel management + Optimal nutrition = Best results