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Hormonal disturbances in obese cats



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Pathophysiology of obesity

Obesity = energy imbalance → e. intake exceeds e. expenditure = positive balance

Excessive adipose tissue accumulation

Risk factors :

- ✓ Breed
- ✓ Age
- ✓ Gender & Neutering
- ✓ Sedentary lifestyle & lack of exercise
- ✓ Endocrine diseases
- ✓ Drugs
- ✓ Feeding
- ✓ Sociological factors
- ✓ Number of animals

Interaction between these factors = OBESITY

This condition is associated with important metabolic and hormone changes in the body

(Diez, 2006; Colliard, 2009; Nguyen, 2010; Zoran, 2010)

Adipocyte ≠ storage cell

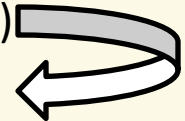
■ White adipose tissue = endocrine organ

- ✓ **Secretion of a wide variety of substances:** cytokines, growth factors, steroid hormones, eicosanoids, vasoactive factors, binding proteins,... = **Adipokines**
 - Food intake (**leptin**)
 - Metabolism and energy homeostasis (**leptin, adiponectin, resistin, IL6**)
 - Lipid and lipoprotein metabolism (**lipoprotein lipase, ASP, RBP, ...**)
 - Inflammation and Immune function (**adiponectin, TNF α , IL6, IL8, resistin, leptin, CRP, factors of complement system, ...**)
 - Vascular function (**VEGF, monobutyrin, leptin, angiotensinogen, eicosanoids, ...**)
 - Angiogenic, mitogenic, antiapoptotic effects (**leptin, IGF1, IGF-binding proteins, TNF α , VEGF, ...**)
 - Reproductive function (**leptin**)
 - (...)

Obesity

Obese state= disturbances of adipokines secretion by WAT → hormonal regulation imbalance

- **Serious endocrine variations:** ↗ Growth factors (leptin, IGF1, insulin, prolactin)



Insulin-resistance → type 2 diabetes

↘ Thyroid hormones (↘ Basal metabolism)

- **Chronic inflammation**
- **↑ Risk of several chronic diseases :**
- Osteoarthritis
 - Respiratory distress
 - Decreased heat tolerance
 - Cardiac failure
 - Kidney disease
 - Skin disorders
 - Cancer
 - Etc....

(Martin, 2006; Ferguson, 2007; Nguyen, 2010; Zoran, 2010; Hoenig, 2012; Laflamme, 2012)

Treatment

The treatment of obesity is a major challenge for the veterinary profession



- The history of weight gain, food consumption and some clinical signs may refer to a metabolic disorder (endocrine)
- The first obvious objective is to combat against body weight excess
- Diet therapy is typically based on restriction of energy allowance
- Resistance to weight loss (even if the program was well-balanced) requires, if it was not done initially, an endocrine assessment: leptin, prolactin, IGF1, insulin, cortisol, TT_4 ,...

Objectives

The aim of the retrospective study was



to investigate the endocrine profile of obesity in home-owned cats

Material and methods (1)

■ 56 client-owned, neutered cats:

- ✓ 32 females and 24 males
- ✓ mean age = 6.5 ± 3.4 years
- ✓ 83.9 % European breed & 16.1 % Purebred

■ Overweight (>15% ideal bodyweight) —→ by their veterinarians:

- BW of Females = 7.0 ± 1.5 kg
- BW of Males = 8.7 ± 2.0 kg

■ Diet:

- 58.9 % commercial therapeutic food
- 10.7 % no diet
- 30.3 % no information on food

Material and methods (2)

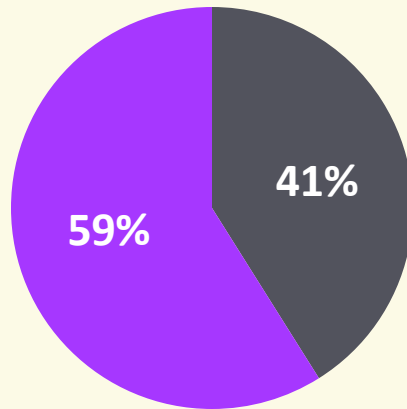
- **Blood samples (before and 1h30 after ACTH stimulation test):**
 - Leptin, Insulin-like Growth Factor (IGF1), Prolactin, Cortisol, Total Thyroxine (TT₄) and Insulin
 - Glucose (during clinical visit)
- **Hormone Assays:** commercially available kits
 - Assays: previously validated for use in cats in our laboratory
- **Statistical analysis:** non-parametric tests and Spearman's correlation (XLstat-Pro 2010, $p < 0.05$)

Results: hormonal disorders (1)

Leptin (ng/mL)

■ Normal = ≤ 10 ng/mL

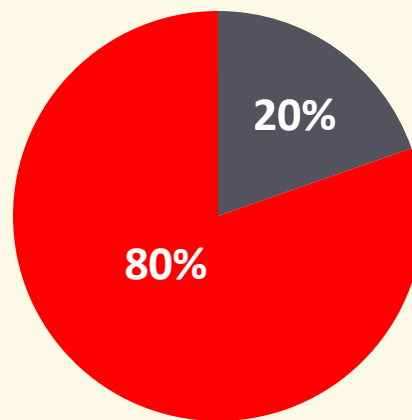
■ Hyperleptinemia = > 10 ng/mL



IGF1 (ng/mL)

■ Normal = ≤ 350 ng/mL

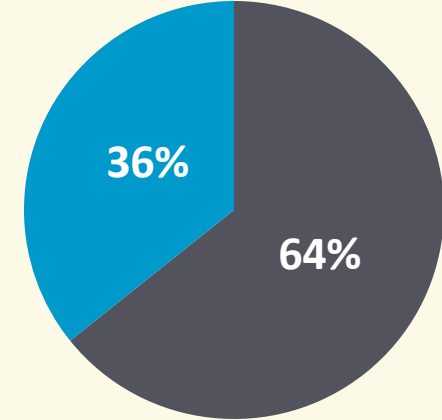
■ Hyper-IGF1 = > 350 ng/mL



Prolactin (ng/mL)

■ Normal = ≤ 10 ng/mL

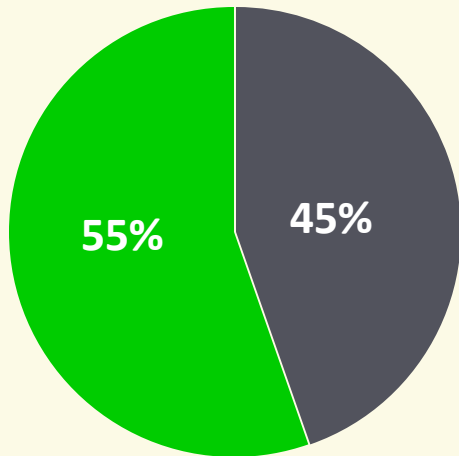
■ Hyperprolactinemia = > 10 ng/mL



Results: hormonal disorders (2)

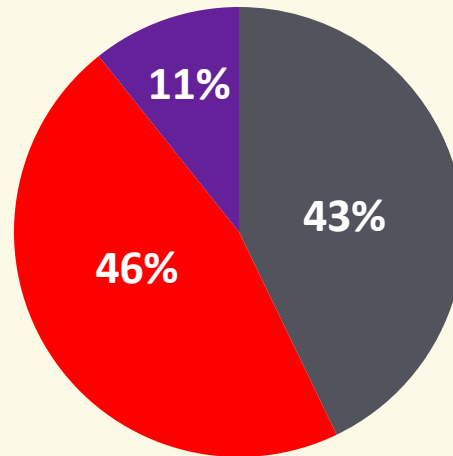
TT₄ (nmol/L)

- Normal = 2 values ≥ 17 nmol/L
- Low = 2 values < 17 nmol/L



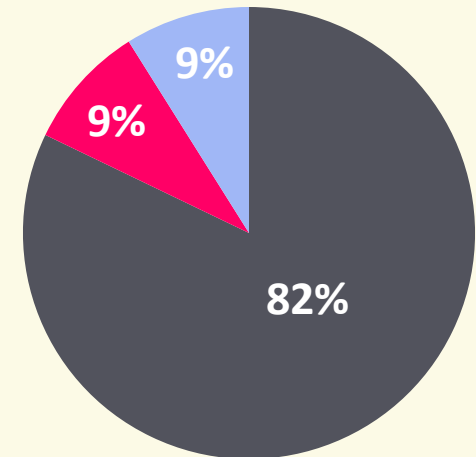
Insulin (μ UI/mL) & Glucose (mmol/L)

- Normal
- Insulin-resistant
- Diabetic



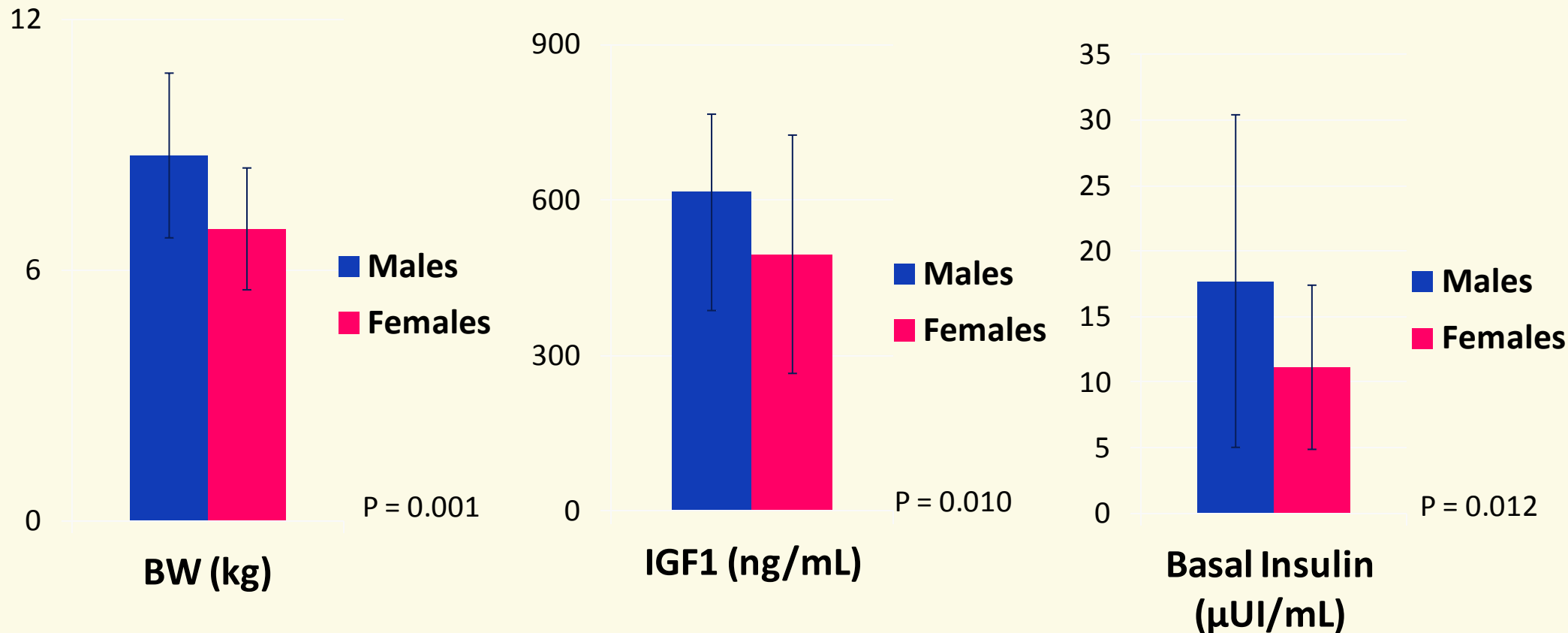
Cortisol (nmol/L)

- Normal
- Hyper-reactivity of adrenals
- Hyporeactivity of adrenals



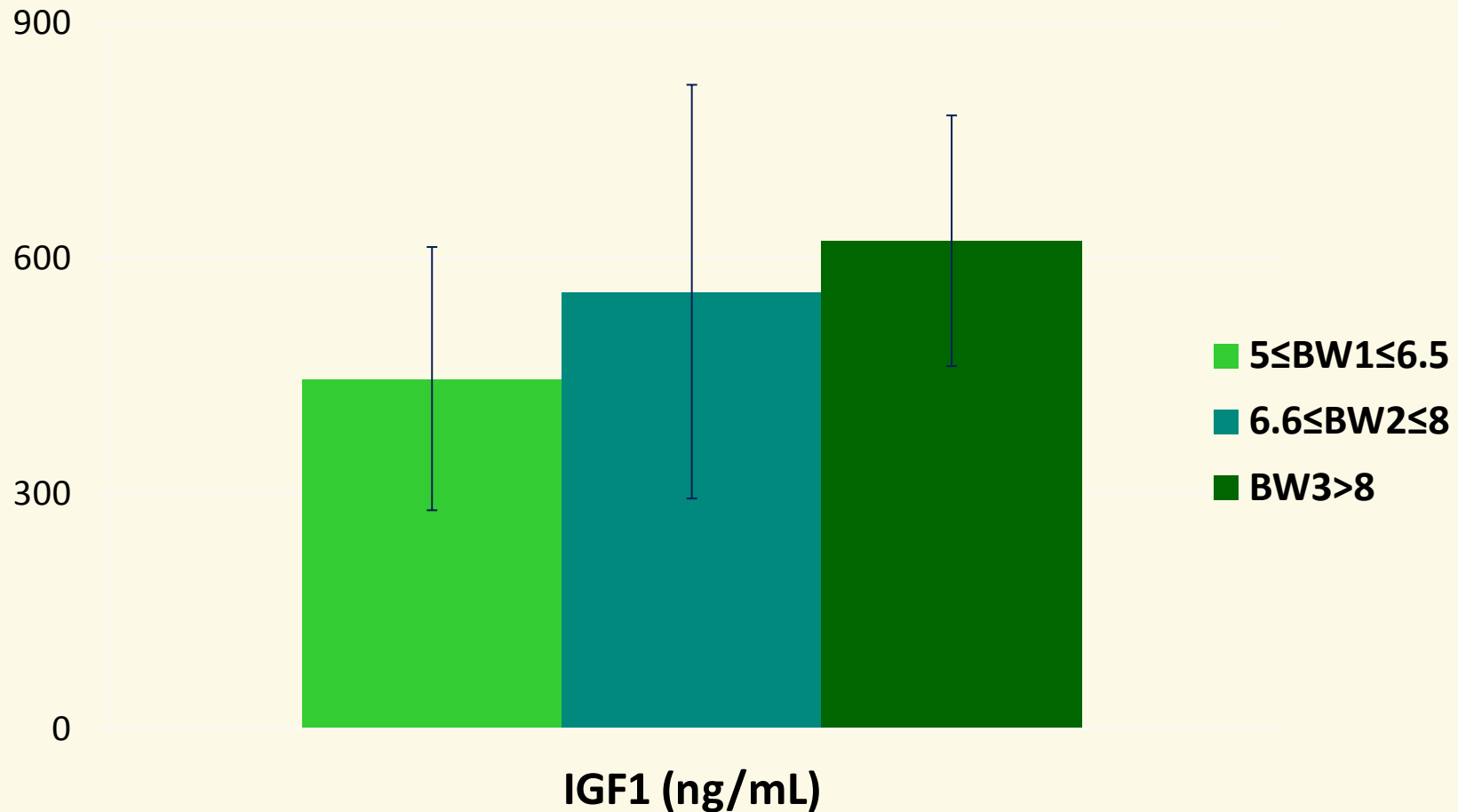
Results: differences between gender

All cats were neutered



BW, IGF1 and Insulin were higher in male than female cats

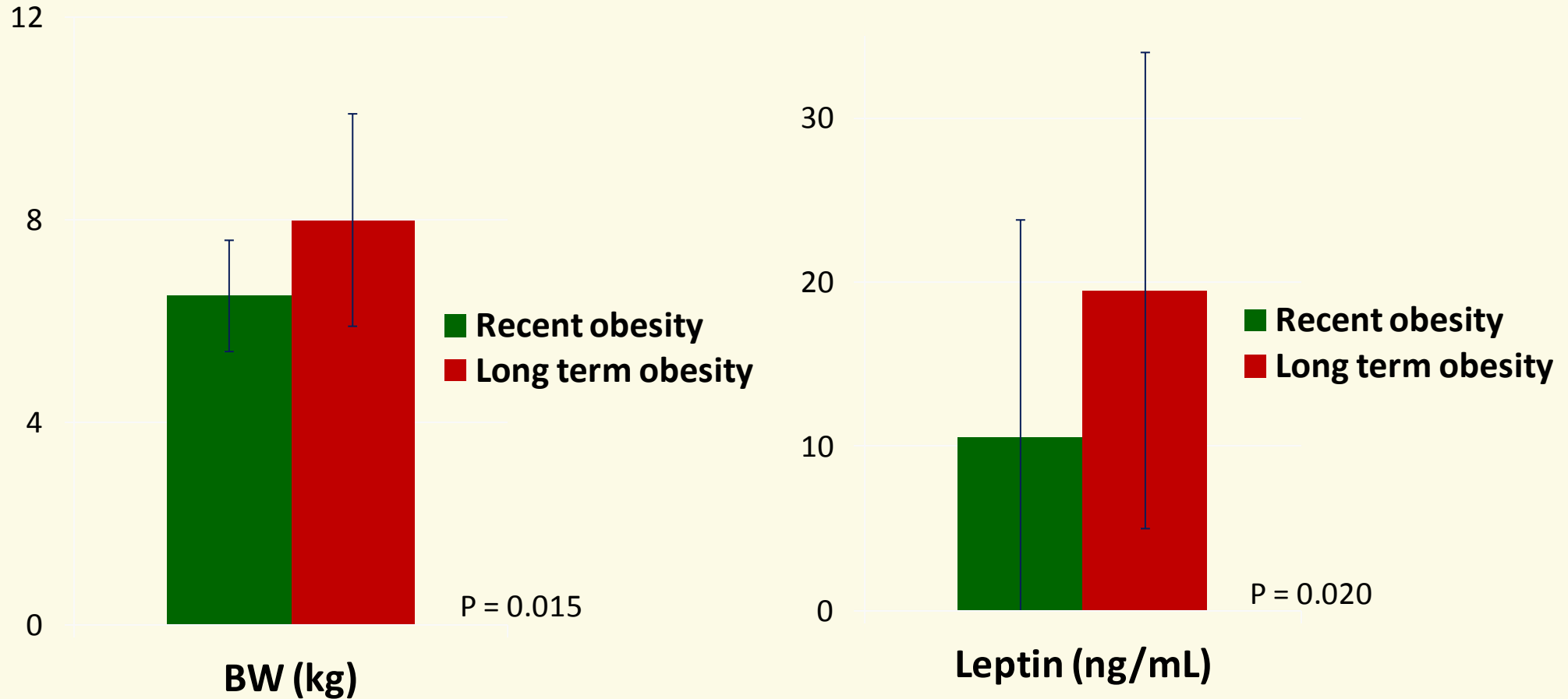
Results: IGF1 and BW



IGF1 changed according to BW ($P=0.012$)

IGF1 ($P=0.007$) and Leptin ($P=0.038$) were positively correlated with BW

Results: history of obesity



BW and Leptin were higher in cats with long term obesity (>1 year) than in cats with recent obesity (≤ 1 year)

Discussion

Obesity is associated with several hormonal changes

In this study:

- **The cats were in severe obese state:**

- ✓ hyperleptinemia, hyper-IGF1, hyperprolactinemia and
- ✓ hyperinsulinemia + hyperglycemia = insulin resistance and type 2 diabetes
- ✓ high incidence of thyroid dysfunction

- **None of the 56 cats was free from hormonal disturbances:**

- ✓ multiple hormones disorders were associated

- **58.9 % of the cats had received commercial therapeutic food for weight control:**

- ✓ energy allowance was probably not restricted enough

Conclusions

Obesity is not only a problem of surplus weight
"metabolic, hormonal and inflammatory disease in pets"



Decrease of the quality of life & longevity

An **endocrine evaluation** is crucial:

- **before** starting the nutritional therapy: to verify the presence of an endocrine disorder
- **after** 2 months: to evaluate the response of nutritional treatment
- **if there is no improvement:** to prescribe hormone therapy
→ which could facilitate weight loss



**Thank you
for listening!**

Buon appetito!

