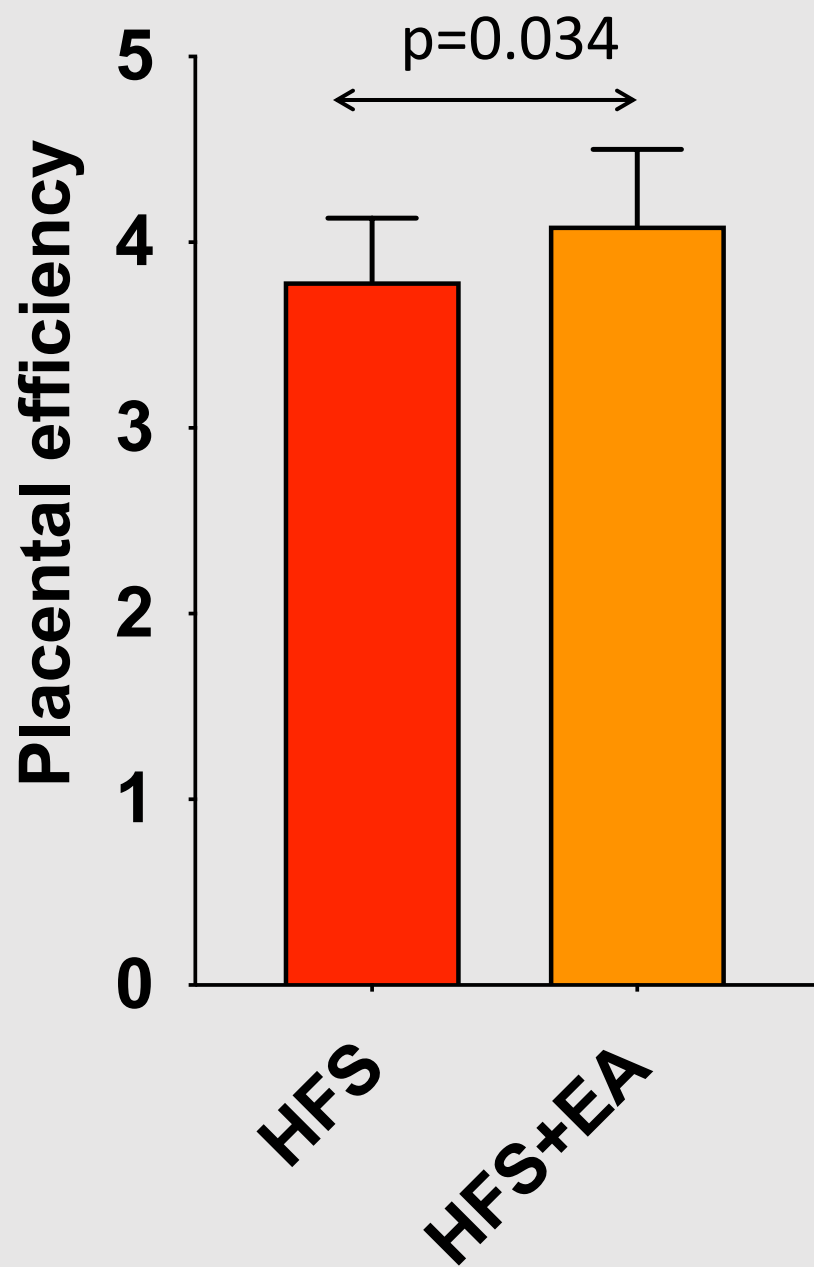


Low-frequency electroacupuncture normalizes fetal growth in a rat model of maternal obesity

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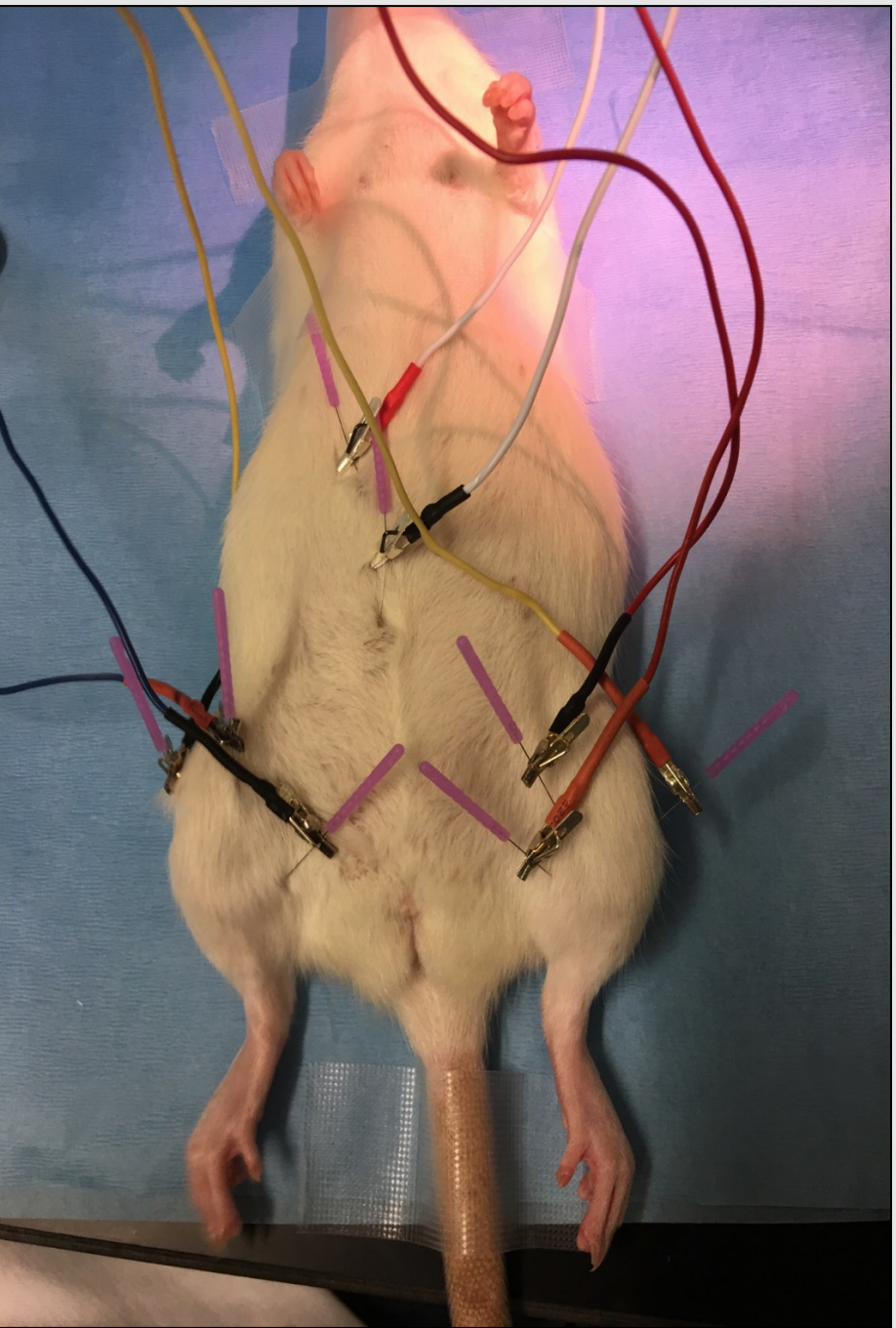
BACKGROUND

- Percutaneous electrical stimulation of skeletal muscle, commonly known clinically as electroacupuncture (EA), modulates autonomic function via somatovisceral reflexes¹
- Both obesity and pregnancy are states of relative insulin resistance, and each associated with elevated sympathetic tone^{2,3}
- We previously showed that repetitive low-frequency EA during pregnancy enhanced whole-body insulin sensitivity (measured by hyperinsulinaemic-euglycaemic clamp procedure) in a high fat/sucrose (HFS) diet-induced rat model of maternal obesity⁴
- Interestingly, placental efficiency (PE), defined as fetal weight (FW) ÷ placental weight (PW), was increased in EA-treated vs. untreated HFS diet-exposed dams (4.09±0.41 g vs. 3.79±0.34)
- Objective:** to establish the fetoplacental growth characteristics of this model, relative to healthy rat pregnancies (which prior study lacked by design), and to further explore the effects of EA



METHODS

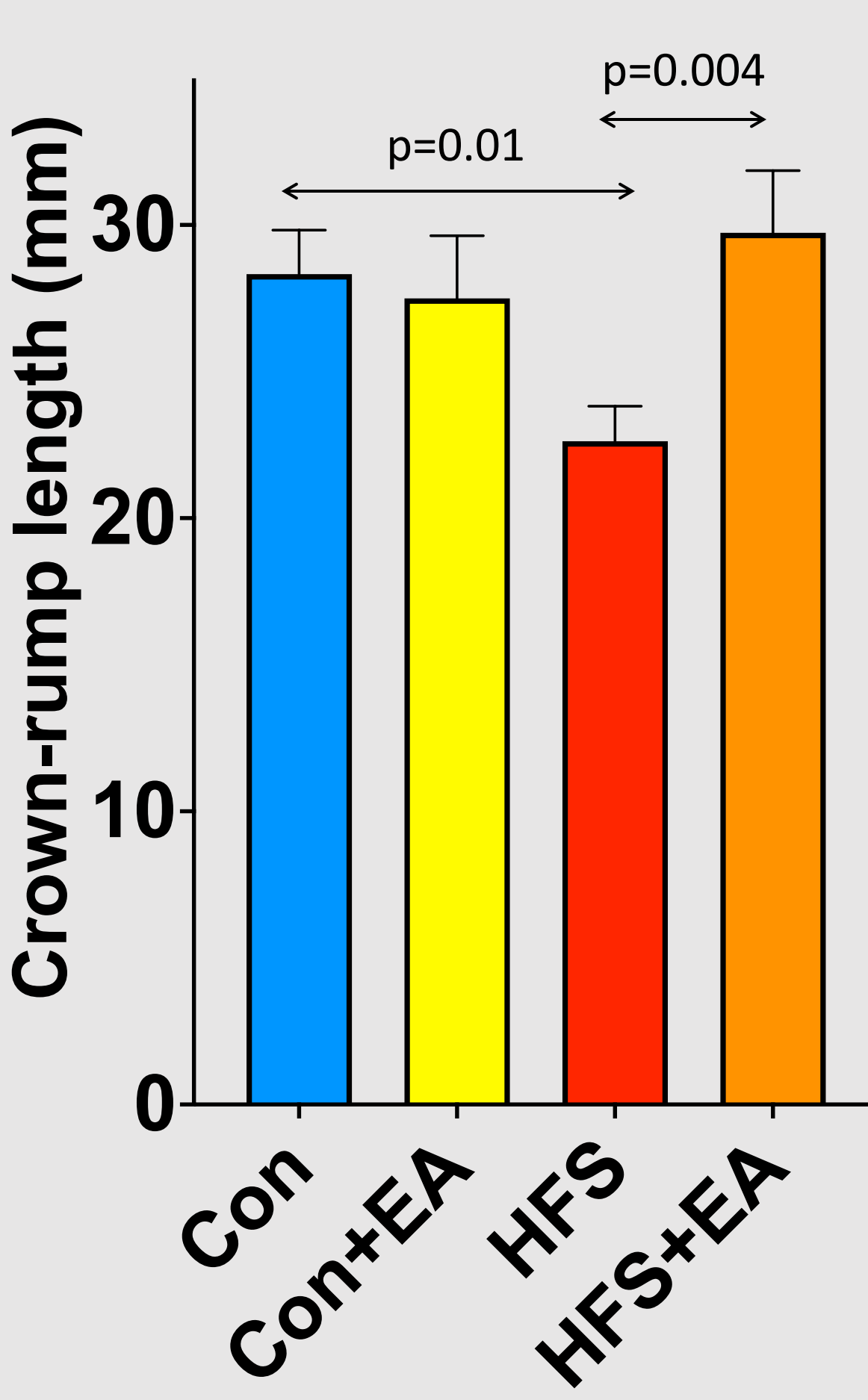
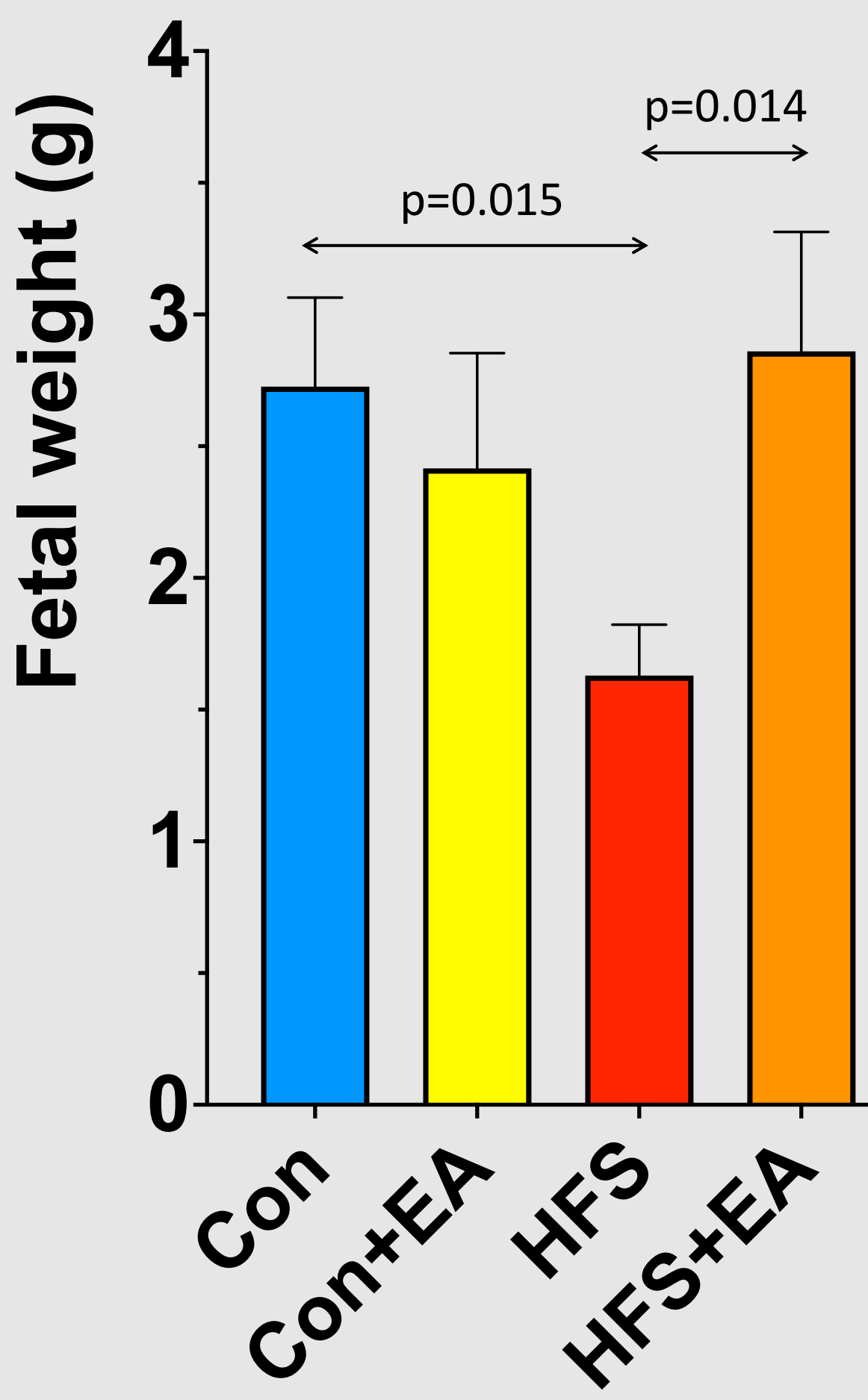
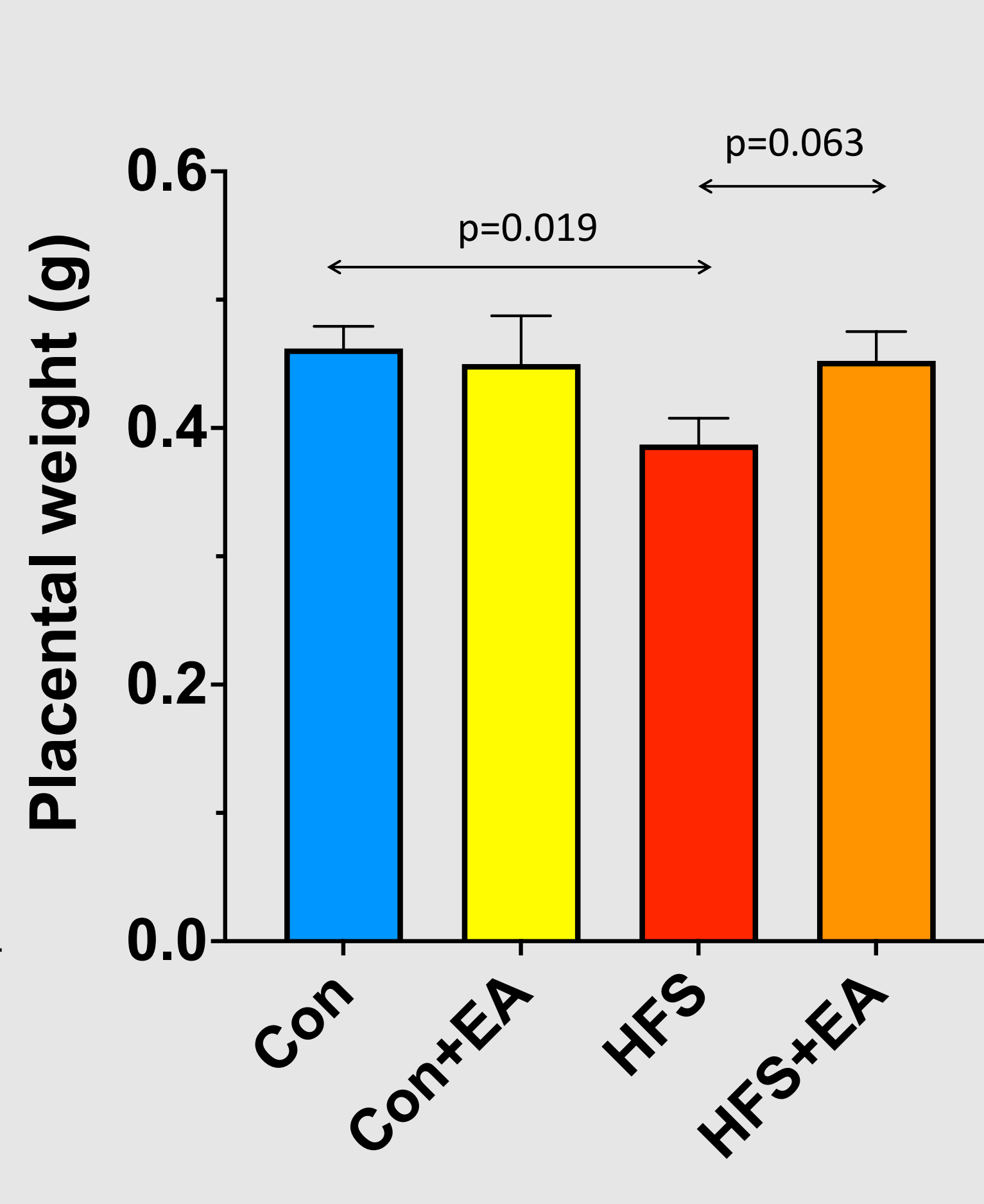
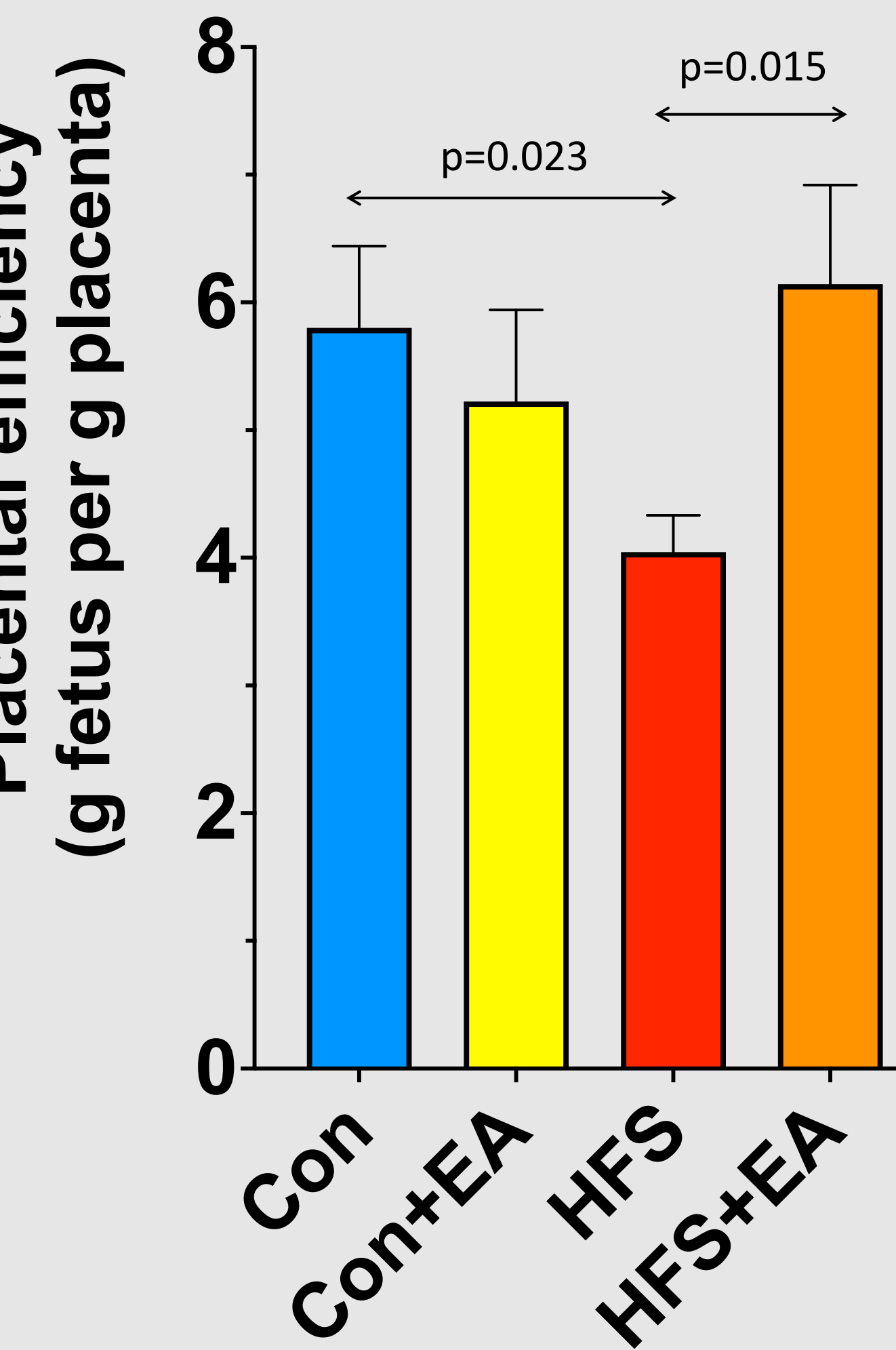
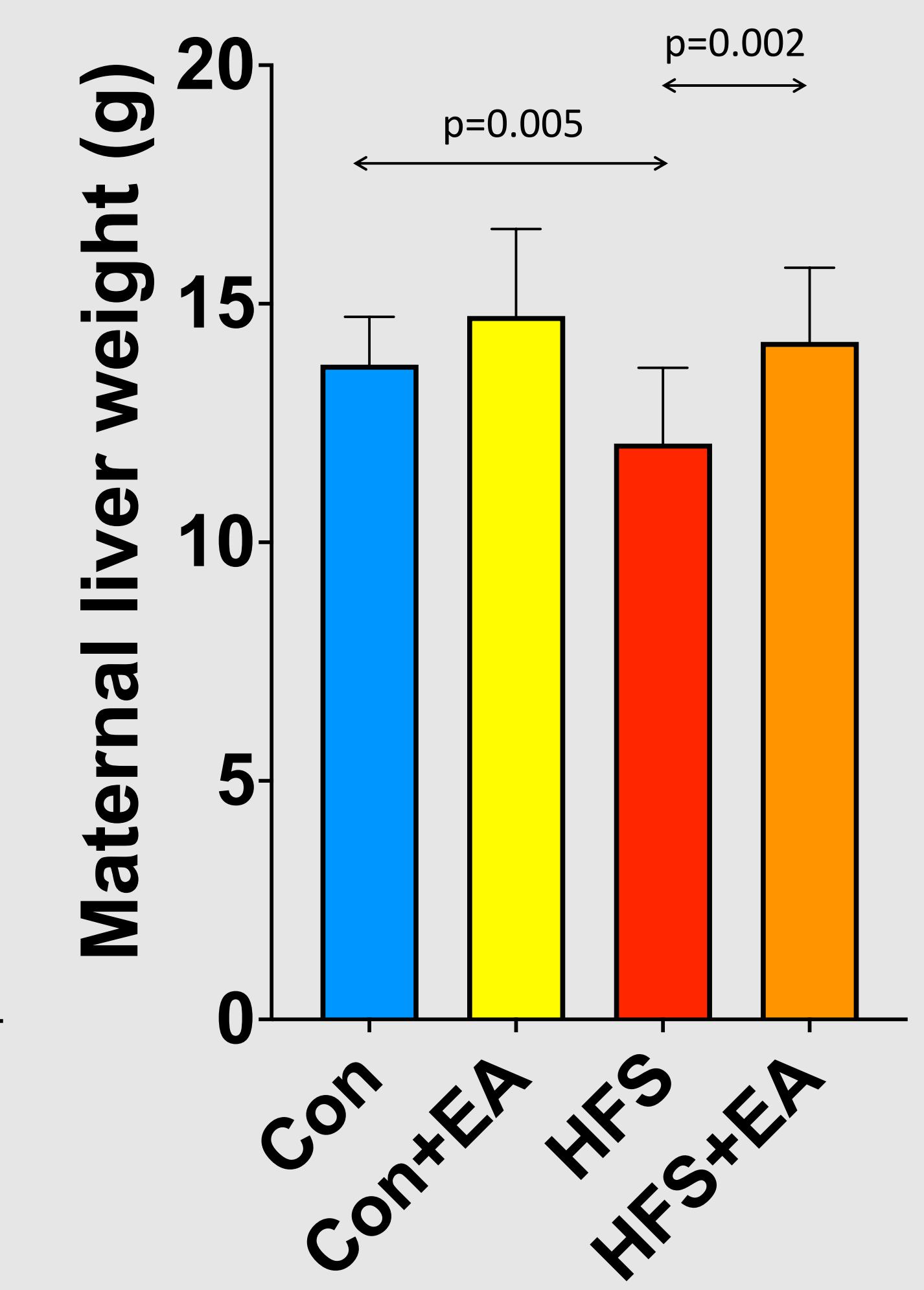
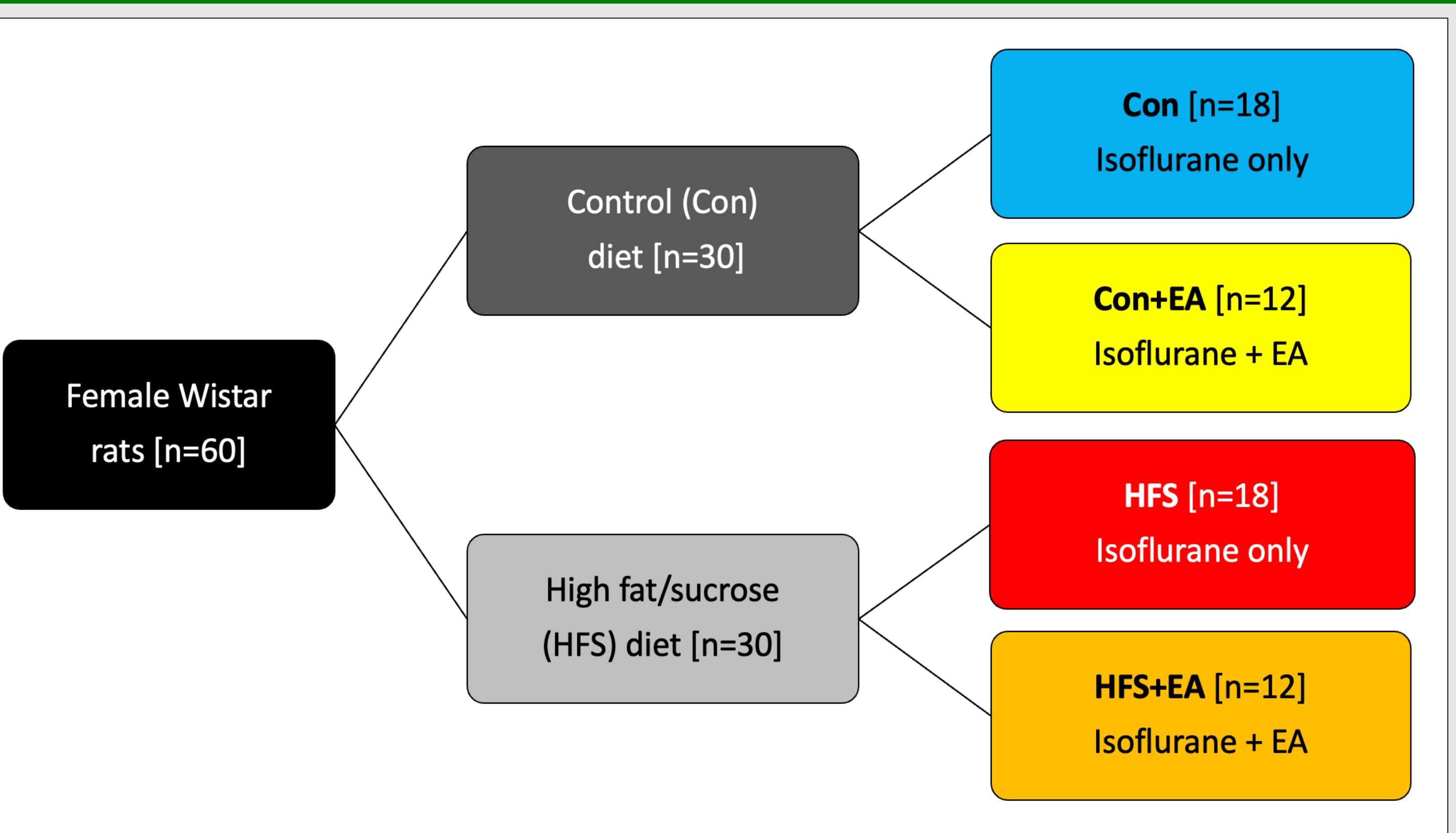
- Design:** Preclinical animal study (2x2 parallel design) to test impact/interaction of HFS diet and EA
- Subjects:** 60 female Wistar rats, 81d old, weighing 231±3.6g
- Dietary allocation:** Control (Con) or HFS (TestDiet 58V8: providing 45% energy from fat; containing 20% sucrose) administered for 65±4d prior to mating 1:3 with males
- EA treatment:** 30 min per day; 12 sessions; 3/15Hz alternating frequency (q3sec); 10mA intensity; under isoflurane anaesthesia (induction 5%, maintenance 2-3%)
- Randomization (four groups):** Con (n=18); Con+EA (n=12); HFS (n=18) and HFS+EA (n=12) → Con/HFS groups received equivalent handling and isoflurane anesthesia without EA and groups numbers inflated based on interim data analysis to achieve sufficient power to detect FW differences by diet⁵
- Pregnancy diagnosis:** palpation/ultrasound in mid-gestation
- Primary outcomes:** FW/PW/PE and crown rump length (CRL) (averaged per pregnancy) at necropsy on embryonic day 19±1 (performed blind to treatment group)
- Secondary outcomes:** Major organ and fat depot weights
- Statistical analysis:** One-way ANOVA with *post hoc* LSD tests



Muscle	Innervation
Rectus abdominis	T6 to L1
Tibialis anterior	L4
Soleus	L5
Gastrocnemius medius	L5

RESULTS

- At mating (prior to allocation to EA subgroups), as expected, pre-gestational weight gain was 66% greater in HFS vs. Con diet-exposed rats (98±4.4 vs. 59±4.4g, p<0.001)
- Pregnancy rate was 77% *overall* (72-83% per group) with the following final numbers for each group: Con (n=13); Con+EA (n=9); HFS (n=15); and HFS+EA (n=9)
- At necropsy, weights of all internal (parametrial/retroperitoneal/mesenteric) fat depots were increased by HFS diet and unaffected by EA (data not shown)
- Litter size and resorption rate did not differ across the four groups (p>0.05; Kruskal Wallis test)
- There were no significant differences between Con and Con+EA groups (all p>0.05)



CONCLUSIONS

- Electroacupuncture normalised fetal growth, enhanced placental efficiency and reversed attenuations of maternal liver weight in this high fat/sucrose diet-induced rat model of maternal obesity (that is characterised by uteroplacental insufficiency)
- Electroacupuncture had no effects (positive or negative) on healthy rat pregnancies
- If these effects are reproducible and electroacupuncture is shown to be safe, it may have a potential role in prevention or treatment of placental-fetal growth restriction

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