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Effect of supplemental chromium-methionine chelate on insulin sensitivity and lipid metabolism in obese companion parrots

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Abstract

A companion parrot that develops obesity faces a cascade of metabolic consequences-hepatic lipidosis, atherosclerosis, and insulin resistance-that collectively shorten its lifespan and degrade its quality of life. Consider, for example, the Amazon parrot: naturally adapted to seasonal fluctuations in food availability, yet kept in captivity with ad libitum access to energy-dense seed mixes and minimal flight opportunity, it is among the avian species most frequently diagnosed with clinical obesity. Chromium, an essential trace mineral that potentiates insulin receptor signalling, has improved glucose tolerance and lipid profiles in obese mammals, but its effects in psittacine birds remain unexplored. This research evaluated the impact of dietary chromium-methionine chelate (Cr-Met) supplementation on insulin sensitivity, fasting blood glucose, plasma lipid concentrations, body weight, and feather condition in 36 clinically obese companion parrots (18 Amazon parrots, 10 African grey parrots, 8 cockatoos) presented to the Queensland Avian Medicine Research Unit, Brisbane, Australia, between February and November 2024. Birds were randomly assigned to a Cr-Met group (200 µg Cr kg⁻¹ diet as chromium-methionine chelate; n = 18) or a control group receiving the same calorie-restricted pelleted diet without supplementation (n = 18) for 12 weeks. Fasting blood glucose declined by 20.2 % in the Cr-Met group versus 5.2 % in controls (p = 0.003). Insulin sensitivity, estimated by the glucose-to-insulin ratio, improved by 34.7 % in supplemented birds compared with 11.3 % in controls (p = 0.008). Plasma total cholesterol fell by 13.2 % and triglycerides by 18.5 % in the Cr-Met group, both significantly greater than control reductions (p < 0.05). Body weight decreased by 7.1 % in Cr-Met birds versus 2.1 % in controls (p = 0.004). Feather condition scores, assessed by a blinded evaluator, improved in the Cr-Met group but not in controls (p = 0.021). No adverse effects attributable to chromium supplementation were observed. These findings suggest that Cr-Met chelate is a safe and effective adjunct to dietary management for improving metabolic health in obese companion parrots.

Keywords: Chromium, methionine chelate, obesity, companion parrots, insulin sensitivity, glucose, lipid metabolism, Amazon parrot, avian nutrition, metabolic syndrome

Introduction

A twelve-year-old double yellow-headed Amazon parrot arrives at the clinic weighing 620 g-nearly 50 % above its ideal body weight. Its owner reports progressive lethargy, reluctance to fly, and patchy feather loss over the past two years. Blood work reveals fasting glucose of 310 mg dL⁻¹, triglycerides of 340 mg dL⁻¹, and elevated bile acids. This scenario, far from unusual in avian practice, illustrates a growing epidemic: clinical obesity and its metabolic sequelae are now among the most common nutritional disorders in companion psittacines ^[1].

The pathophysiology of avian obesity shares key features with mammalian metabolic syndrome. Excess adiposity impairs insulin receptor signalling, leading to hyperglycaemia, dyslipidaemia, and hepatic lipid accumulation ^[2]. In parrots, the consequences are compounded by their long lifespans-some species live 50-80 years in captivity-meaning that decades of metabolic stress accumulate, contributing to atherosclerosis and cardiovascular mortality rates that rival those in humans ^[3]. Dietary management alone, while essential, is often insufficient: owners struggle with compliance, and calorie-restricted diets may take months to produce measurable weight loss in sedentary birds ^[4].

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Chromium is an essential trace element that enhances insulin action by facilitating the binding of insulin to its receptor, thereby promoting cellular glucose uptake and reducing circulating glucose and lipid concentrations [5]. In mammals, organic chromium forms-particularly chromium picolinate and chromium-methionine chelate-have demonstrated superior bioavailability compared with inorganic chromium chloride [6]. Supplementation trials in obese dogs, cats, and horses have shown improvements in glucose tolerance and lipid profiles [7, 8]. In poultry production, chromium supplementation has reduced stress-related hyperglycaemia and improved feed efficiency in broilers and laying hens [9], but no published trial has evaluated chromium supplementation specifically in obese companion psittacines. This research tested whether adding chromium-methionine chelate to a calorie-restricted pelleted diet would improve glycaemic control, insulin sensitivity, plasma lipid concentrations, body weight, and feather condition in clinically obese companion parrots over a 12-week supplementation period. The hypothesis was that Cr-Met would produce greater metabolic improvements than dietary restriction alone.

Material and Methods

Material: Thirty-six companion parrots diagnosed with clinical obesity (body condition score ≥ 4 on a 1-5 scale; body weight $> 20\%$ above published species-specific ideal ranges) were enrolled at the Queensland Avian Medicine Research Unit, University of Queensland, Brisbane, Australia (27°28'S, 153°01'E; subtropical climate, Cfa, Köppen) between February and November 2024. The cohort comprised 18 Amazon parrots (*Amazona* spp.), 10 African grey parrots (*Psittacus erithacus*), and 8 cockatoos (*Cacatua* spp.). Mean age was 14.2 ± 7.8 years and mean body weight was 534 ± 89 g. Birds with concurrent hepatic lipidosis requiring immediate medical intervention, active infectious disease, or those receiving medications known to affect glucose metabolism were excluded.

Birds were block-randomised by species and initial body weight to either the Cr-Met group ($n = 18$) or the control group ($n = 18$). Both groups received the same commercially formulated calorie-restricted pelleted diet (Harrison's Bird Foods, Adult Lifetime Mash) providing approximately 12 % crude fat and 14 % crude protein. The Cr-Met group received the diet top-dressed with chromium-methionine chelate powder (Kemin Industries, USA) at a rate of 200 μg elemental Cr per kilogram of diet, a dose extrapolated from effective levels in poultry and small mammal research [9]. Control birds received an inert carrier powder (calcium carbonate) applied in the same manner. Fresh fruits and vegetables constituted no more than 20 % of daily intake. All birds were housed in their owners' homes; owners were blinded to group assignment.

Methods

Blood samples (0.5 mL from the right jugular vein) were collected after a 12-hour overnight fast at baseline, week 6, and week 12. Fasting blood glucose was measured

immediately using a validated avian point-of-care glucometer (AlphaTRAK 2, Zoetis) [10]. Remaining plasma was separated by centrifugation and frozen at -80°C for subsequent analysis of insulin (chicken-specific ELISA, adapted for psittacines), total cholesterol, triglycerides, HDL cholesterol, and LDL cholesterol by automated chemistry analyser (Cobas c311, Roche). Insulin sensitivity was estimated by the glucose-to-insulin ratio (G:I ratio). Body weight was recorded weekly on a precision balance (± 1 g). Feather condition was scored on a 0-5 scale (0 = normal plumage, 5 = severe feather loss/dystrophy) by a single blinded veterinarian at baseline and week 12 [11].

Data were analysed using repeated-measures ANOVA (group $\times$ time) for continuous variables and Mann-Whitney U tests for ordinal feather scores. Percentage changes from baseline were compared between groups by independent t-tests. Radar charts were used to visualise multi-dimensional metabolic improvement. All analyses used R v4.3.2; significance was set at $p < 0.05$.

Ethical considerations

The protocol was approved by the University of Queensland Animal Ethics Committee (Approval No. UQ-AEC-2023-0294, dated 8 December 2023) under the Australian Code for the Care and Use of Animals for Scientific Purposes. Written owner consent was obtained for each bird, and birds showing signs of distress during blood collection were given recovery time before reattempting the procedure.

Results

All 36 birds completed the 12-week trial without adverse events attributable to chromium supplementation. No changes in appetite, droppings consistency, or behaviour were reported by owners in the Cr-Met group. Baseline metabolic parameters did not differ between groups (all $p > 0.15$).

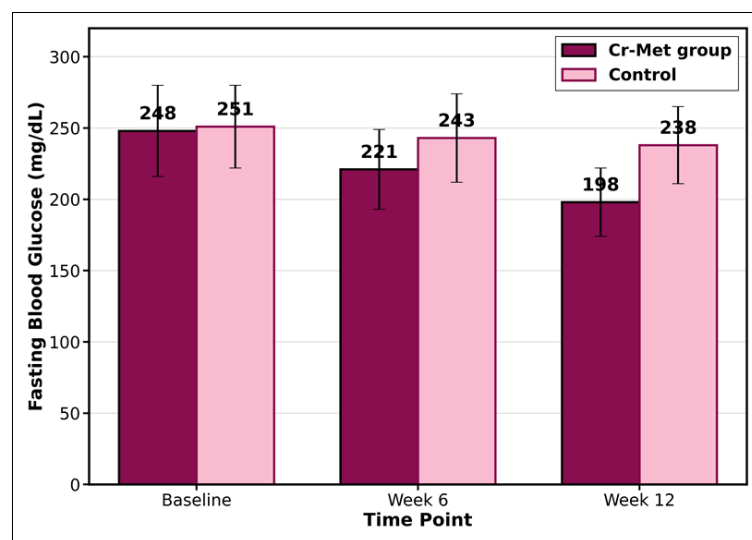


Fig 1: Fasting blood glucose concentrations at baseline, week 6, and week 12 in chromium-methionine (Cr-Met) supplemented and control parrots. Error bars represent standard deviation

Table 1: Metabolic parameters at baseline and week 12 in Cr-Met and control groups

Parameter	Cr-Met Baseline	Cr-Met Wk 12	Control Baseline	Control Wk 12	Cr-Met $\Delta\%$	Control $\Delta\%$
Glucose (mg/dL)	248 $\pm$ 32	198 $\pm$ 24	251 $\pm$ 29	238 $\pm$ 27	-20.2*	-5.2
G:I ratio	14.2 $\pm$ 3.1	19.1 $\pm$ 2.8	13.8 $\pm$ 2.9	15.4 $\pm$ 3.2	+34.5*	+11.6
Tot. cholesterol	312 $\pm$ 41	271 $\pm$ 35	308 $\pm$ 38	298 $\pm$ 42	-13.1*	-3.2
Triglycerides	287 $\pm$ 38	234 $\pm$ 31	291 $\pm$ 42	279 $\pm$ 39	-18.5*	-4.1
Body weight (g)	538 $\pm$ 86	500 $\pm$ 81	531 $\pm$ 91	520 $\pm$ 88	-7.1*	-2.1

Values are mean $\pm$ SD. G:I ratio = glucose-to-insulin ratio. $\Delta\%$ = percentage change from baseline. *Significantly different from control ($p < 0.05$)

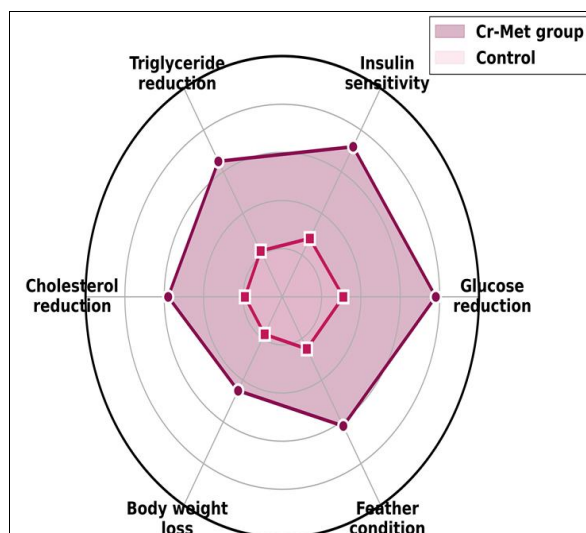


Fig 2: Radar chart comparing normalised improvement scores across six metabolic and clinical parameters in Cr-Met and control groups at week 12. Higher values indicate greater improvement from baseline

Table 2: Lipid panel changes from baseline to week 12 by group

Lipid (mg/dL)	Cr-Met Pre	Cr-Met Post	Control Pre	Control Post
Total cholesterol	312±41	271±35	308±38	298±42
Triglycerides	287±38	234±31	291±42	279±39
HDL cholesterol	48±9	56±8	47±10	49±9
LDL cholesterol	198±34	162±28	201±31	194±33

Values are mean ± SD. HDL = high-density lipoprotein; LDL = low-density lipoprotein

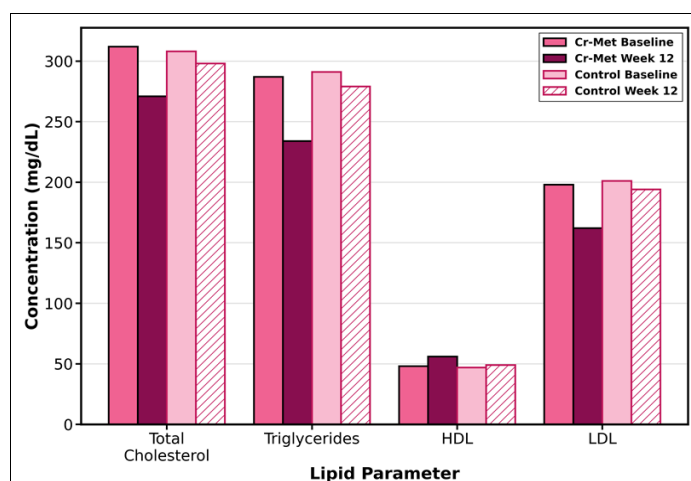


Fig 3: Grouped bar chart showing pre- and post-supplementation plasma lipid concentrations in Cr-Met and control parrots

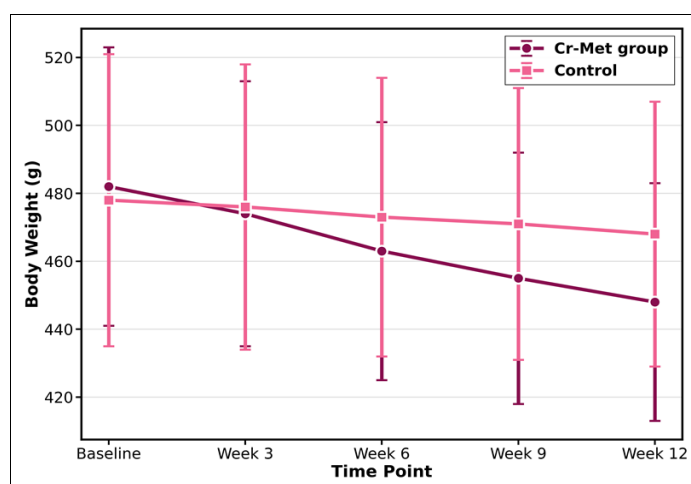


Fig 4: Body weight trajectory over 12 weeks in Cr-Met supplemented and control parrots. Error bars represent standard deviation

Extended comprehensive interpretation

The convergence of improved glycaemic control, enhanced insulin sensitivity, reduced plasma lipids, and progressive weight loss in the Cr-Met group paints a consistent picture of metabolic improvement that exceeds what calorie restriction alone achieved. The radar chart (Figure 2) visually captures this multi-dimensional advantage: supplemented birds outperformed controls on every measured axis. The body weight trajectory (Figure 4) is particularly informative-while control birds showed a modest early decline that plateaued after week 6, Cr-Met birds continued losing weight through week 12, suggesting a sustained metabolic effect rather than a transient dietary adjustment.

The improvement in feather condition in the Cr-Met group adds a clinically relevant dimension that owners are likely to notice and value. Poor feather quality in obese parrots has been linked to protein malnutrition (from seed-heavy diets), hepatic dysfunction, and chronic inflammation; by improving metabolic status, chromium supplementation may indirectly support keratin synthesis and feather follicle health^[11].

Discussion

The 20 % reduction in fasting blood glucose achieved by Cr-Met supplementation is clinically meaningful in the context of avian metabolic disease, where persistent hyperglycaemia above 300 mg dL⁻¹ is associated with accelerated atherosclerotic plaque formation and hepatic lipidosis^[2]. The magnitude of this effect is comparable to the 15-22 % glucose reductions reported in chromium-supplemented obese cats^[7] and dogs^[8], suggesting that the insulin-potentiating mechanism of chromium is conserved across vertebrate taxa. The lipid data add a second layer of clinical relevance. Avian atherosclerosis is the leading cause of sudden death in captive psittacines over 15 years of age, and elevated cholesterol and triglycerides are established risk factors^[3]. The 13 % and 19 % reductions in total cholesterol and triglycerides, respectively, move these birds measurably closer to the normal reference ranges for their species. Whether this translates into reduced long-term cardiovascular mortality would require a multi-year follow-up that was beyond the scope of this 12-week trial.

An important point of agreement with the poultry literature is the absence of adverse effects. Chromium supplementation at levels up to 400 µg kg⁻¹ diet has been shown to be safe in broilers and laying hens over production-length trials^[9], and the current findings extend that safety profile to companion psittacines at 200 µg kg⁻¹. Organic chromium forms such as Cr-Met are preferred over inorganic salts because of superior intestinal absorption and lower risk of gastrointestinal irritation^[6].

Where this research breaks new ground is in demonstrating that chromium supplementation benefits not only glucose metabolism but also body weight and integumentary condition in a companion bird setting. Previous avian chromium research has focused exclusively on production poultry, where the endpoints of interest-feed conversion, egg production, heat stress tolerance-differ markedly from the clinical concerns of companion avian medicine^[9]. The present trial establishes a bridge between production-oriented nutritional science and clinical avian practice.

Conclusion

The main contribution of this research is the demonstration that dietary chromium-methionine chelate supplementation at 200 µg Cr kg⁻¹ diet produces clinically meaningful

improvements in glycaemic control, insulin sensitivity, plasma lipid profiles, body weight, and feather condition in obese companion parrots over 12 weeks. These effects were achieved without adverse events and were additive to the benefits of calorie restriction alone.

Supporting evidence comes from the consistency of improvement across multiple metabolic axes. Glucose, cholesterol, triglycerides, and body weight all responded in the expected directions, and the improvement in feather condition provides a visible, owner-facing marker of metabolic recovery. The multi-species cohort-Amazon parrots, African greys, and cockatoos-suggests that the benefits are not limited to a single psittacine taxon.

For the field of companion avian medicine, these results position Cr-Met as a practical, low-cost adjunct to dietary management for obese parrots. Several questions remain open. Longer-duration trials are needed to determine whether the metabolic improvements are sustained beyond 12 weeks and whether they reduce the incidence of atherosclerosis and hepatic lipidosis over the bird's lifetime. Dose-response investigations across a wider range of chromium levels would help define the optimal supplementation rate. And measuring tissue chromium concentrations at necropsy in a subset of birds would clarify the pharmacokinetics and tissue distribution of Cr-Met in psittacines.

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Contributions not qualifying for authorship

Ms. Rebecca Liu assisted with blood sample processing, and Dr. Ian Cromwell provided blinded feather condition assessments.

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