THE EFFECT OF BODY CONDITION SCORE AND BODYWEIGHT ON PEAK GROUND REACTION FORCES IN WALKING DOGS

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Introduction

Obesity is a common nutritional disease that is estimated to affect a quarter of the canine population [1]. It is well documented that weight may be a risk factor in the development of a number of canine orthopaedic conditions including osteoarthritis (OA) [2]. OA is a degenerative, progressive and irreversible deterioration of the joints, resulting in a decreased range of motion, pain and joint swelling [3]. Such conditions can be influenced by a combination of many factors such as diet, weight and exercise. Research has shown that a reduction in bodyweight (BW) can cause a significant decrease in lameness in dogs suffering from OA [4]. To date, force plate analysis has not been used to explore and compare the mobility of dogs with different body condition scores (BCS) and BW in a range of breeds. The aim of this study was to assess the effect of BCS and BW on peak limb ground reaction forces (GRFs) during walking.

Methodology

Figure 1. Sample Population

An example of the breeds used in the study sample (From top left a Rhodesian Ridgeback, Hungarian Visla, Black Lab x Pointer and a Standard Poodle)

A sample population of n = 17 medium and large breed dogs of varying age (mean 5.30 ± 4.16 years) and a range of BCS (mean 3.06 ± 1.14) were recruited for this study (Figure 1). The dogs were free from any predisposing musculoskeletal conditions. Dogs were body condition scored using PFMA guidelines and the study population were assigned weight categories dependent on the recommended weight range for their breed. Dogs were lead on a loose lead over an AMTI force plate (sampling at 500Hz; Figure 2) to record GRFs in the mediolateral, craniocaudal and vertical plane (Fx, Fy and Fz). Individually, dogs were walked over the force plate up to fifteen times to attempt to achieve twelve valid trials. Peak Fx, Fy and Fz GRFs (N) were calculated for all trials for all dogs. A Spearman's rank test was used to test for a correlation between BCS and average peak GRFs and a Kruskal-Wallis was used to assess for differences in GRFs between BW categories. Where significant differences were identified, post-hoc tests were carried out with the Bonferroni correction applied.

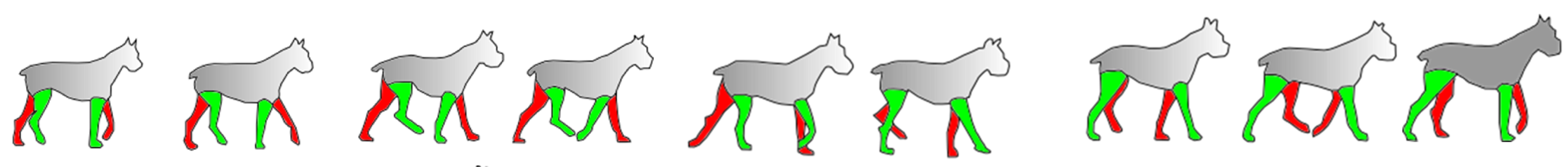

Figure 2. AMTI Force Plate

Results

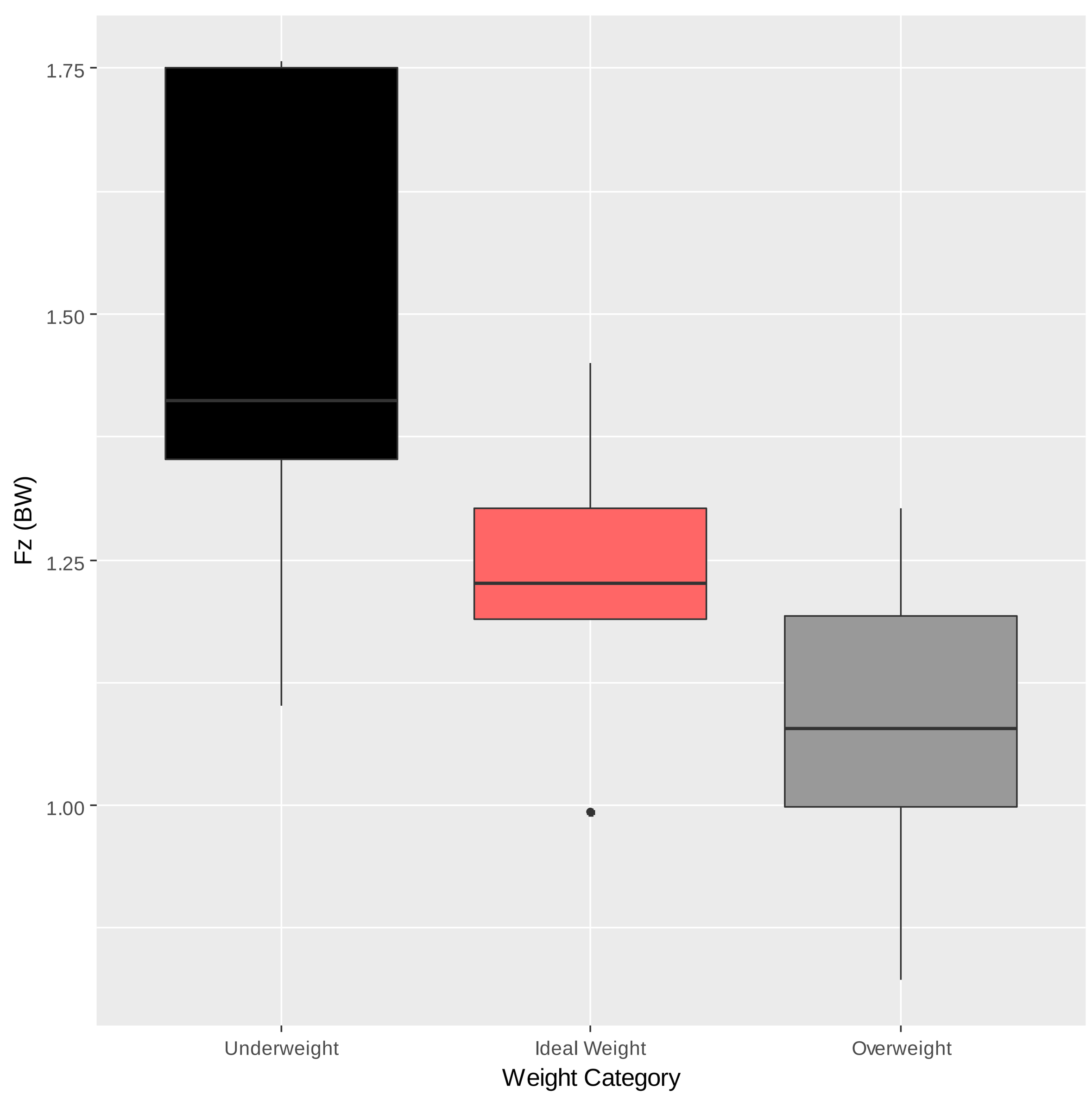

Figure 3. Mean peak GRFs for the three BW categories

Data for all dogs in the three weight categories (underweight, ideal weight and overweight) and mean peak GRF are shown for the Fz Vertical forces (BW). Circles represent outliers.

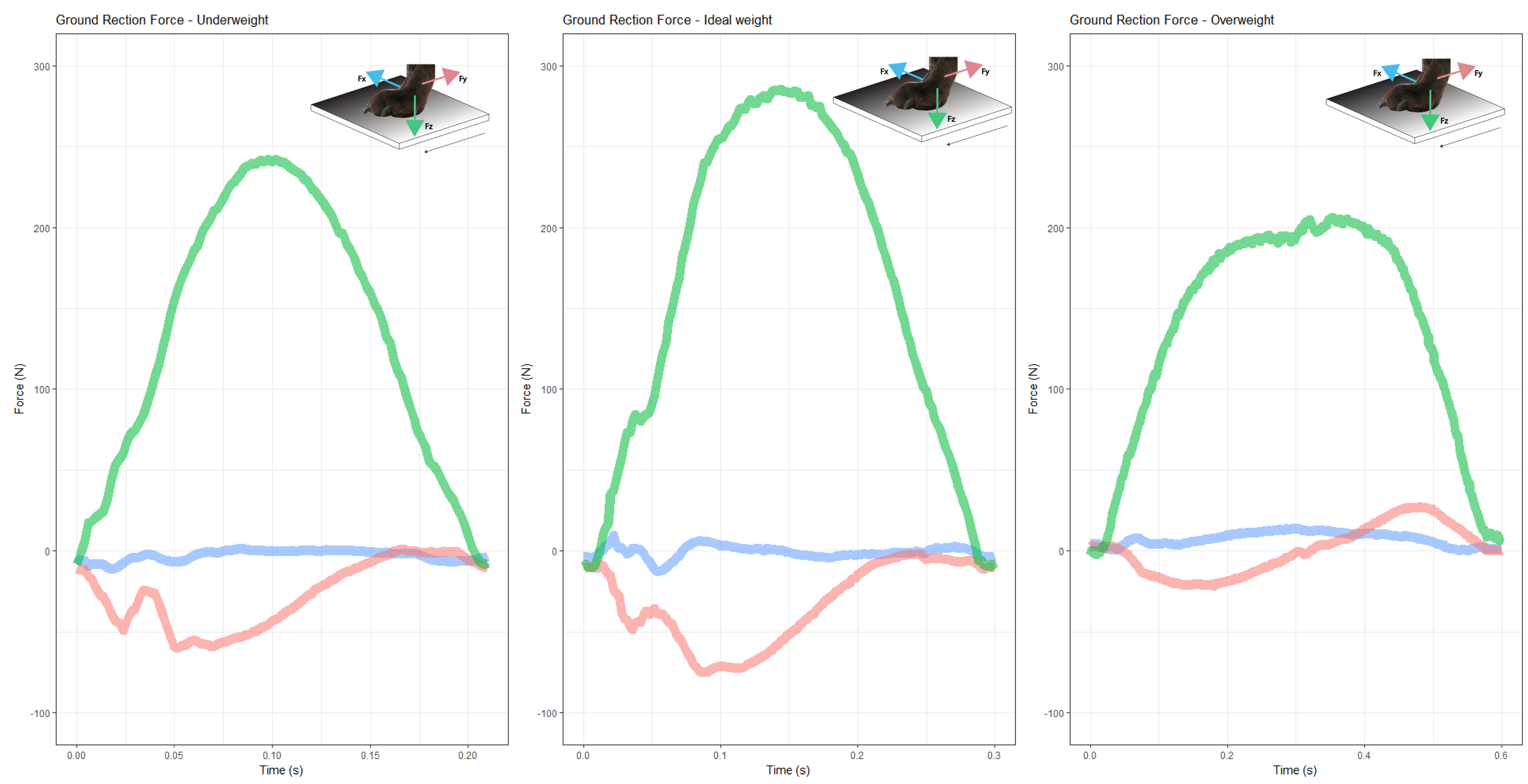

Figure 4. Example GRF from three dogs

Example kinetic data from a single trial from three individual dogs, one from each weight category showing mediolateral (Fx), craniocaudal (Fy) and vertical (Fz) GRFs (N).

There was a moderate negative correlation (R^2 = -0.57, p = 0.017) between Fx and BCS, a moderate correlation between Fy and BCS (R^2 = -0.65, p =0.004) and moderate negative correlation between Fz and BCS (R^2= -0.58, p = 0.016). There was a significant effect of weight category on Fx ($\chi^2(2)$ = 6.46, p = 0.040), Fy ($\chi^2(2)$ = 7.62, p = 0.022) and Fz ($\chi^2(2)$ = 6.61, p = 0.035). GRFs were significantly lower in the overweight group compared to the underweight (p< 0.05).

Discussion

In this study, dogs classified as overweight with a higher BCS had lower peak forelimb GRFs. This was an unexpected finding and this effect was observed in Fx, Fy and Fz. It could be concluded that weight does not negatively impact on the kinetics of overweight dogs, but may have a detrimental impact on their kinematics. The results could also be explained by the fact that the overweight dogs were possibly walking at slower velocities than the ideal weight dogs [5]. This could suggest that velocity was ultimately a confounding factor within the study and hence analysis of stance time is warranted [6]. It would be beneficial to repeat the study with a larger, homogenous sample population using an instrumented treadmill to control velocity.

References

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