brief communication

Plumage colour effecting behaviour

Behavioural differences in two PMEL17 genotypes have been observed.

Feather pecking is one of the causal factors of cannibalism in domestic birds and is therefore a large welfare problem[1]. A relationship between plumage damage (interpreted to be equivalent to feather pecking) and feather pigmentation have been presented previously[2]. Black birds homozygous on the wild type (wt) allele of PMEL17, a gene controlling the expression of eumelanin, showed more feather damage then white birds homozygous on a mutated allele of the same gene. Here we confirm by real time observation of pecking behaviours that the preference to peck at black birds is present in the flock. Furthermore, we also revealed that black wt birds are behaving differently then white birds with mutated alleles.

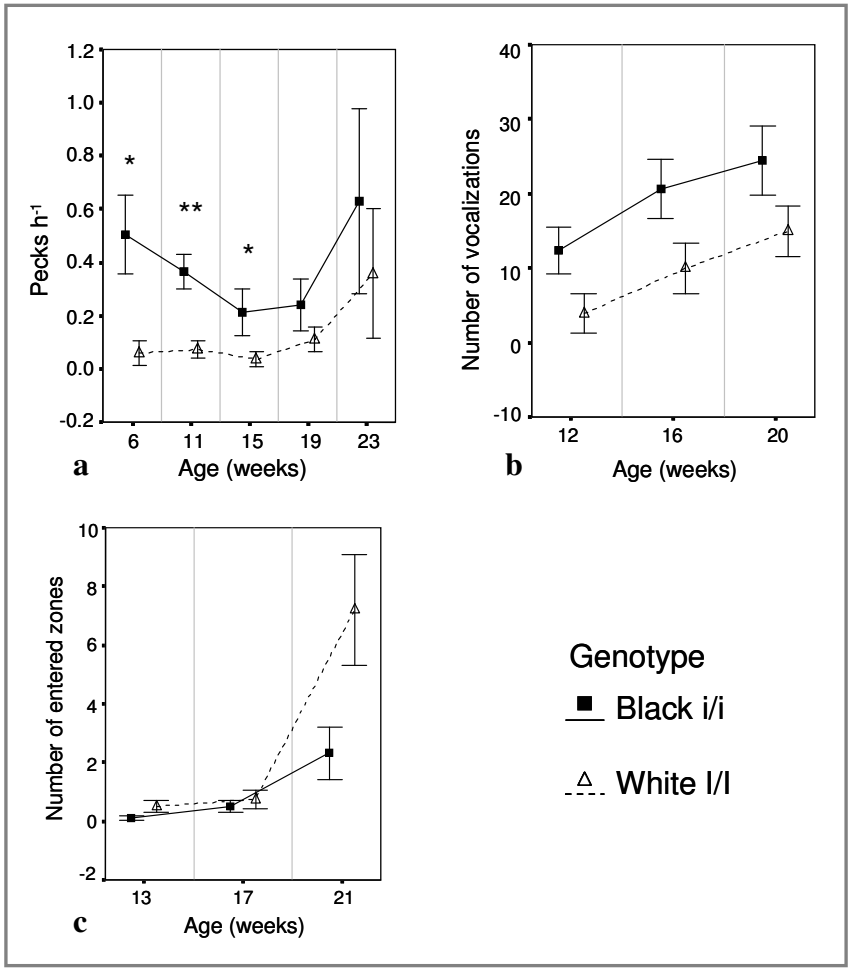

Figure 1. Behavioural differences between PMEL17 genotypes. **a,** Black wt PMEL17 birds were more severe pecked then white mutated PMEL17 birds, especially between 6-15 weeks of age. **b,** In an open-field arena black birds vocalized more. **c,** At 21 weeks of age white birds are more active then black birds in an fear for human based anxiety test.

Within a large-scale project investigating the chicken genome an inter-cross between Red jungle fowl (*Gallus gallus*) and a line of White leghorn (*G. gallus domesticus*) has been utilized[3]. An extensive quantitative trait loci analysis on the second generation of this cross revealed a QTL that explained 14.9 % of the variation seen in plumage damage[2]. Furthermore, this QTL showed to be perfectly aligned with the PMEL17 gene. In the present study a fifth generation of the same cross was used to confirm and investigate the mechanisms behind earlier results.

By observing behaviour in small groups differing in sex and PMEL17 genotype composition we were able to confirm that, at least female, black wt birds received more severe pecking then white birds carrying mutated alleles (fig 1a).

The mechanism of how PMEL17 effect victimization is unexplored territory, and as a first step to investigate it a series of behavioural test were conducted.

A feather preference test, where feathers of black and white colour were presented to a test bird, showed that immobile black feathers were not enough to trigger the black preference that was observed in the flock. This indicates that feather mobility is important for the ap-

pearance of the black pecking preference and would suggest behaviour as a key player in this phenomenon. For example, if wt black birds would tend not to withdraw from the flock when victimized they would most certainly receive more pecks. Additionally, other tests of this study strengthen the idea of a of a behavioural mechanism.

In an open-field arena black birds vocalized more than white birds (fig 1b), suggesting that the wt PMEL17 phenotype is more prominent to get in contact with flock mates in a stressful situation. Another behavioural difference was seen in an anxiety test, where white birds at the entry of sexual maturation suddenly were more active than black birds (fig 1c). Increased activity at the start of puberty is common in female chicken and relates to the activity pattern hens perform before laying their eggs[4].

These findings indicate that PMEL17 have a direct or indirect effect on the social reinstatement and prelaying behaviours of this cross. The question if the observed difference is genetically or environmentally derived is always appropriate, especially when one of the genotypes have been more victimized than the other. But the specificity of the behaviours and the lack of any logical criticism based on behavioural evidence are apparent here. For example, why become more socially motivated if close contact to pen mates causes pain? Why become more anxious if you have inhabited the genotype that experience less pain?

Furthermore, in males there was no difference between genotypes neither in receiving feather pecks nor in feather damage. But when comparing aggression on group level it appeared that flocks with more white birds showed more aggression than flocks with less white birds ($F_{1,7} = 12.13$, $p = 0.01$). This indicates that the social stability of a flock is influenced by the PMEL17 gene and that males display behavioural differences independently of the feather pecking behaviour.

Earlier studies have shown correlations between pigmentation and behaviour, but non have suggested a possible neural mechanism[5,6]. New findings that PMEL17 is expressed in the human brain and in neural tissue of the developing murine embryo, together with old knowledge claiming the kinship of melanin to cathecolamines, suggest a very possible neural mechanism[7,8,]. By using the behavioural differences of the two PMEL17 genotypes of chickens as a basis for further research we could eventually obtain a closer understanding of this relationship and put a piece in the puzzle in the mysteries of domestication and the brain.

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