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Abbreviations:

CRY1: Crytochrome 1; *DRD4*: Dopamine
Receptor 4; *F-KER*: Feather Keratin;
GSR: Glutathione-Disulfide Reductase;
LDHA: Lactate Dehydrogenase; *LRP8*:
Low-Density Lipoprotein Receptor-
Related Protein 8; *MSTN*: Myostatin;
mtDNA; mitochondrial DNA

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Case Report

Consistent Race Performance in Racing Pigeons: A Case Report Confirming a Favorable Genetic Profile

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Abstract

A recent multivariate analysis showed that racing pigeons had a better race performance based on *DRD4* and *F-KER* genotypes that were independently statistically significant and those racing pigeons with both *DRD4 CCCT* and *F-KER TT* had the lowest race coefficient, i.e. the best race performance. This result indicated that 50% birds with this genotype were consistently in the top 10% in the race results. To date, this is the first multigene genotype reported relating to race performance. In 2023, a consistently performing racing pigeon scored in or around the top 10% in all races of a 5 race series ranging from 100 mile to 350 miles. Retrospectively, this bird was shown to have indeed *DRD4 CCCT* and *F-KER TT*. Another bird while distantly family related, showed top performance only in the final long distance race but lacked consistency throughout the race series; this bird not have the consistency genotype profile. We pose the hypothesis that birds with both *DRD4 CCCT* and *F-KER TT* are more likely to score consistently in the Top 10% in a race series than birds without. This would need to be confirmed in a larger study in particular including Ace Champion birds with consistent top 10% race performance.

Introduction

In the quest to identify genotypes relating to race performance in racing pigeons multiple studies reported about the effect of variability in a single gene [1-12]. Most frequently reported genes are *LDHA*, *DRD4*, *F-KER*, and more recently *CRY1*. *LDHA* codes for lactate dehydrogenase which is an enzyme involved muscular energy metabolism under high performance [2]. *DRD4* codes for Dopamine Receptor D4 which is involved in orientation, cognition, perseverance and smartness [13,14]. *F-KER* codes for feather keratin which is an important component the structure of feathers [9,11]. *MSTN* codes for myostatin which is related to muscle mass [3,4]. *LRP8* codes for low-density lipoprotein receptors, which play a role in signal induction, learning, memory, cognition and navigation [1]. *GSR* codes for glutathione-disulfide reductase which is highly expressed in the wattle and visual pigment cell layer of the eye; and it thought to be related to spatial memory, navigation and possibly in magnetoreception [12]. *CRY1* codes for crytochromes related to magnetoreceptor molecules located in the retina of pigeon eye [5]. Variability in these genes could potentially impact race performance. The first genotype profile based on a multivariate analysis involving genotype analyses of *LDHA*, *DRD4*, *F-KER*, and *MSTN* was reported by Kolvenbag et al. [7].

In 2022, we reported our prospective study with a data set based on 124 pigeons with 636 total race observations. This study evaluated multivariate analyses involving genotypes for *LDHA*, *DRD4*, *F-KER*, and *MSTN*, as well as gender, color and mtDNA. In our reports the most impactful profile was for birds with the genotype *DRD4 CCCT* and *F-KER TT*, showing that 50% birds with this genotype were consistently in the top 10% in the race results. With this information one could attempt to breed more pigeons with this genotype in order to compete in a consistent manner in the races, in particular in the One Loft Races. To-date only few matings were specifically established to generate offspring with the desired genotype. One of these offsprings notably performed in a consistent manner. The current case report presents the race records along with the genotype for a consistent performer and for context for a bird that had its best result in the longest race only.

Materials and Methods

The two birds reported here were entered in the One Loft Race called Texas Dash for Cash with a 5 race series ranging from 150 miles to 350 miles (see Table 1). The two birds were IF23 PHX8555 "Steeler" and IF23 KOLV1778 "Trashy", where the latter was produced from parents with the aim to deliver the desired genotype of *DRD4 CCCT* and *F-KER TT*. The sire was *DRD4 CCCT* and *F-KER TG* and the dam was *DRD4 CCCC* and *F-KER TT*. Genotype analysis was performed by Feanix Biotechnologies 39 Glendale Ave STE 102, Asheville, NC 28803.

Table 1: Race performance.

Race Distance	Number of Birds in the Race	IF23 PHX8555 "Steeler"		IF23 KOLV1778 "Trashy"	
		Place	Top %	Place	Top %
150 miles	380	120	32%	36	9%
200 miles	374	78	21%	40	11%
250 miles	340	53	16%	45	13%
300 miles	345	235	68%	19	6%
350 miles	304	10	3%	21	7%

Results

Race results (Table 1) shows that IF23 KOLV1778 "Trashy" had a consistent race performance over the 5 races finishing in the Top 6%-13% in each of these 5 races. On the other hand, IF23 PHX8555 "Steeler" placed in the top 3% in the final race, but finished in the other races between top 16% and 68% of the participating birds. Genetic analysis (Table 2) showed that IF23

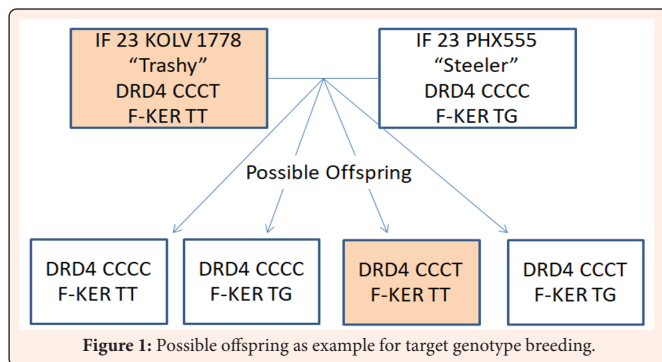
KOLV1778 “Trashy” indeed had the desired genotype of *DRD4 CCCT* and *F-KER TT*, while IF23 PHX8555 “Steeler” did not and had *DRD4 CCCC* and *F-KER TG*.

Table 2: Genotypes. Abbreviations: *CRY1*: Crytochrome 1, *DRD4*: Dopamine Receptor 4, *F-KER*: Feather Keratin, *GSR*: Glutathione-Disulfide Reductase, *LDHA*: Lactate Dehydrogenase, *LRP8*: Low-Density Lipoprotein Receptor-Related Protein 8, *MSTN*: Myostatin.

	IF23 PHX8555 “Steeler”	IF23 KOLV1778 “Trashy”
DRD4 954	CC	CC
DRD4 456	CC	CT
F-KER	TG	TT
LDHA	BB	BB
MSTN	CC	CC
CRY1	AG/TT	AG/AG
LRP8	HH	HQ
GSR	TT	TT

Discussion

While there are limitations with a retrospective analysis of genotype relating to race performance, in our report such analysis was used to test the hypothesis generated from our large prospective study [7]. It is very encouraging to see that our results indicate that pigeons in our family of birds with the genotype *DRD4 CCCT* and *F-KER TT* seem to be very likely consistent Top10% race performers over all distances including the final longest distance of around 325-400 miles. While we have not been able yet to determine a profile for top racers who just perform in the final race only, we believe that this report provides a confirmation of our hypothesis relating the *DRD4 CCCT* and *F-KER TT* genotype with consistent race performance over all races. The challenge in recreating this desired profile is to find mates with the right genetic profile. It turns out that the two birds presented in this paper are good mates to create this profile in 1 out of 4 of their offspring (Figure 1).



Our previous studies have not shown a clear role for *LDHA* or *MSTN* in predicting a better performance. More recently identified genes including *CRY1*, *LRP8* and *GSR* have not yet been studied in our family of birds whether or not they could contribute in a multivariate analysis to a genotype profile predicting top race performance. However, it is an interesting observation that the consistent performing bird showed *CRY1 AG/AG* and the non-consistent bird showed *CRY1 AG/TT*, which completely contradicts the *CRY1* hypothesis that the *CRY1 AG/TT* individuals achieved significantly higher ($p < 0.05$) mean values of ace points than birds with *CRY1 AG/AG* [5]. We recognize the small sample size of this case report and encourage the conduct of more and larger prospective studies to further confirm our findings and to determine a superior profile including multiple genetic factors [7].

Conclusion

The genotype of *DRD4 CCCT* and *F-KER TT* in racing pigeons may be associated with consistent top 10% race performance in racing pigeons.

Author Contributions

GK: Conceptualization; Data curation; Investigation; Methodology; Project administration; Resources; Writing-original draft manuscript

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Ethics Statement

Study was conducted by an independent scientist without institutional relationship. No human subjects were involved in this study. Ethics review was not available. Study was conducted following high standard and generally accepted practice to breed and race racing pigeons.

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