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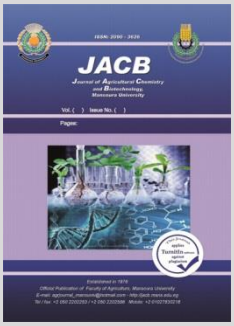
Using Cutting Enzymes to Investigate Genetic Variation in Two Local Chicken Breeds, Fayumi and Dandarawi

El-Sayed, M. A.[1*] ; Heba A. E. M. Assi[2] and S. M. A. El-Hamamsy[3]

[1]Animal Genetic Resources Department, National Gene Bank, Agricultural Research Center, Giza, Egypt,
[2]Animal Production Research Institute, Agricultural Research Center, Giza, Egypt,
[3]Biochemistry Department, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt.



ABSTRACT

The aim of this study was to compare the genetic variation in two local chicken breeds, Fayumi and Dandarawi. Two hundred individuals (100, Fayumi and 100, Dandarawi) were tested. Live body weights were collected and recorded for each bird separately within genotype from zero to 16 weeks of age. Two genes for the Growth Hormone GH and the Growth Hormone Receptor GHR were used in 12 birds at random for each of the two chicken breeds. After *MspI* and *HindIII* digestion, four allele's privet patterns were found for the GH and GHR genes, allele C, T and allele A, B, respectively. For GH, there were 17 and 7 for the Fayoumi and Dandarawi breeds, respectively. While in GHR resulted were 25 and 15 bands with the Fayoumi and Dandarawi breeds, respectively. The frequency of TT (GH) and AA (GHR) in Fayumi chicken was 0.28 and 0.55, respectively. Also, in Dandarawi chicken, the frequency of these alleles was 0.21 and 0.56, respectively. There was no homozygous genotype CT for GH detected in both studied breeds. The Polymorphic Information Content PIC values of 0.49, 0.65, and 0.49, 0.57 for Fayumi and Dandarawi chicken breeds, respectively, for two genes GH and GHR. Some possible genes for improving body weight in various indigenous chicken breeds had already been identified and exploited for selection and breeding reasons.

Keywords: Growth Hormone GH gene, Growth Hormone Receptor GHR gene, cutting enzyme, native chicken breeds, Fayumi and Dandarawi.

INTRODUCTION

Fayoumi chickens breed are a sturdy and energetic of poultry whose origins are unknown. Several theories have been presented in reference to this situation; the first is that it was transported to Egypt from a location in Turkey known as "Biga" during the reign of Mohamed Ali Pasha. The second is that it is a descendant of the Silver Campine breed, which was imported into Egypt during Napoleon's reign. (Hossari, 1958). Abdel Warith (1993) Although Fayoumi is more phenotypically similar to the Silver Campine than any other breed; its genetic contents may differ. Because barring is a sex-linked feature in the Fayoumi breed, but autosomal in the Silver Campine breed. Also, the web site of Iowa State University, Lamont (1997) discovered that Fayoumi genetics is extremely distinct from other chicken. She confirmed that Fayoumi birds are far more virus-resistant than other birds. http://www. iastate.edu/general/Iastater/....chicken.html

Dandarawi chickens are a local Egyptian chicken breed found in the Dandrah/Assuit it region in Upper Egypt. Males have a black body with a white hackle and saddle, with some white on the wings and body. Females have a lone comb and are wheaten-looking, reddish-brown or grey in color through a little backward facing crest. Males weigh 1.3-1.5 kilograms, while females weigh 1.1-1.2 kilograms. They are disease resistant and can withstand temperatures of up to 40 degrees Celsius. (El-Itriby *et al.,* 1963). Dandarawi chickens breed has a strong resemblance to the advantageous breed. The down color of freshly hatched chicks varies from yellow to creamy white, with variable degrees of black striping on the back. Males have a Ply-black pattern of black and white coloring, while females have salmon plumage with white breasts.

White beak and shanks. In the male, the comb is cupped, while in the female, it is solitary and tiny. Adult birds have a beard, crest, and muffs, and most have five toes. The (GH) axis and the transforming growth factor-b subfamily are the most important groups of genes involved in a wide range of physiological processes such as development and reproduction. The gene for chicken growth hormone (cGH) is recognized as one of the most significant candidate genes that might affect chicken performance qualities because to its crucial function in development and metabolism. (Vasilatos-Younken *et al.*, 2000). In chickens and ducks, the cGH gene has four exons and five introns, totaling 4.1 kb and 5.2 kb, respectively. (Kansaku *et al.*, 2008). The GHR gene is regarded to be one of the most plausible candidate genes for reproductive, egg production, and egg shell quality traits in chickens because of its considerable effects on live body weight. (Attarchi *et al.*, 2017). On chromosome 1, the chicken growth hormone gene (cGH) is a 4098-bp with 5 exons and 4 introns. (Lechniak *et al.*, 1999). The presence of GHR/GH binding protein in the livers of normal and sex-linked dwarfism birds revealed that this mutant mRNA was being translated. The (cGHR) is comparable to the mammalian GHR except for two overall sequence homologies and the lack of the human GHR exon 3homologue (Enayati and Ghodrat, 2009).

* **Corresponding author.**
E-mail address: m.a.el_sayed@outlook.com
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RFLPs or sequencing were used to investigate polymorphism in the cGH gene. The alleles found in the introns of the White Leghorn's cGH gene were associated to egg production features, resistance to Marek's disease, and avian leukosis, according to the researchers (Yan *et al.*, 2003). The use of PCR-RFLP in a variety of Chinese native hen populations was also explored, with the hypothesis that an allele present in intron1 might be linked to laying performance. (Stephen *et al.*, 2001). A PCR-RFLP analysis of cGH revealed that the A allele at the cGH1 locus plays a role in increased egg making in Kadaknath chicken (Thakur *et al.*, 2009). As a result, the goal of this study was to detect polymorphisms in intron I of the cGH gene using the RFLP method and analyse the correlations between these polymorphisms and growth features in Kadaknath, Kadaknath cross, and Synthetic colored dual type birds.

The purpose of this study was to find genetic polymorphisms in the GH and GHR loci in two local chicken breeds, Fayumi and Dandarawi, using the cutting enzymes. As a consequence, using the applicant gene to identify desirable economic features may result in increased efficacy in chick breeding operations, allowing for increased output and real exhibitions.

MATERIALS AND METHODS

Experimental population

The birds were maintained in batteries, in single bird cage and an individual body weight weights were recorded for each bird separately within genotype at 0, 2, 4, 6, 8, 10, 12, 14 and 16 weeks of age. Live body weights were collected and recorded for each bird separately within genotype from zero to 16 weeks of age.

Samples collections and DNA extraction

Two hundred individuals (100 Fayumi and 100 Dandarawi) were tested, with 24 blood samples (12 Fayumi and 12 Dandarawi) randomly obtained from the Faculty of Agriculture, Al-Azhar University, Egypt, for each of the two chicken breeds. Ibrahim *et al.*, (2021) had described how to isolate DNA previously. To evaluate the quality and amount of the isolated DNA, a spectrophotometer and agarose gel electrophoresis were utilized. Using the TE buffer, genomic DNA samples were adjusted to a final concentration of 50ng/l and stored at Egypt's National Gene Bank.

Primer design:

Two genes for the Growth Hormone GH and the Growth Hormone Receptor GHR were used in 12 birds at random for each of the two chicken breeds. It was recommended by Ip *et al.*, (2001) and Feng *et al.*, (1998) to use a set of primer sequences for the GH and GHR gene, which used RFLP analysis and restriction enzyme to digested PCR produced in our study, the sequences as indicated in Table (1).

Table 1. For each gene, the primer sequence and other specific information are provided.

Genes	Primer sequences (5'-3')	TM*	Enzyme	Recognition site	Region	Reference
GH	F: ATCCCCAGGCAAACATCCTC R: CCTCGACATCCAGCTCACAT	59.3	MspI	5'…C/CGG…3' 5'…GGC/C…3'	Intron I	Ip *et al.* (2001)
GHR	F: GGCTCTCCATGGGTATTAGGA R: GCTGGTGAACCAATCTCGGTT	59.3	HindIII	5'…A/AGCTT…3' 5'…TTCGA/A…3'	Intron II	Feng *et al.* (1998)

TM*: annealing temperatures

PCR Reaction

The PCR reaction mixture contained approximately 80 ng of genomic DNA, 10pmol of each primer and 25µL of master mix in a total volume of 50µL. The following cycles were applied: denaturation at 95ºC for 5 min, followed by 35 cycles at 95ºC for 60s, primer annealing at 59.3ºC for 30s, and PCR products synthesis at 72ºC for 60 s, and then final synthesis at 72ºC for 10 min.

Restriction endonuclease digestion

For the PCR-RFLP assays, 12µ of each PCR products from GH and GHR were digested with 1µ of *MspI* and *HindIII* restriction endonuclease at 37°C for three days, respectively. Digested products were separated by elechtrophoresis on two percent agarose gel in 1×TBE (Tris-Boric Acid-EDTA) buffer at 120 V for 1 h. The 100bp Plus DNA ladder (TRAN, BM311) was used in each gel as molecular size standard. The gels were stained using ethidium bromide then the fragments were imagined using a gel documentation system.

Statistical analysis

With two local chicken breeds, the distribution of genotypic and allelic frequencies was counted. The effect of those genotypes on body weights was calculated using the analysis of variance (IBM SPSS Statistics 21.0). All resulting gels were visualized, scored, and analyzed with Alphaimages2200 software (Version 4.0.1).

RESULTS AND DISCUSSION

The results from enzymes digestions

Figures 1 and 2 show the electrophoresis summary of the genes examined. After *MspI* digestion intron 1 of the Growth Hormone GH gene, double private allele patterns were discovered, with allele C including 794 and 585bp DNA fragments and allele T containing two DNA fragments of 418 and 257bp. As a result, this gene produces two genotypes: TT (418 and 257bp) and CT (418 and 257bp) (794, 585, 418 and 257bp). The results reveled that two allele C and T in exon I of the GH gene, but only CT genotypes and TT genotypes in two local chicken breeds, Fayumi and Dandarawi. The results agreed with Rashidi *et al.*, (2012) that the fragment of PRLR5 was discovered by digestion with *BamHI* restriction enzyme found in two bands of 195 and 55bp. Including 195bp and 55bp fragment for A allele, while uncut fragment 250bp for allele B because of the lack site for a *BamHI* restriction enzyme activity. Also, Tamzil *et al.*, (2021) investigated that the fragments were not truncated by the *TasI* enzyme (483bp) were TT genotypes, while the truncated fragments (380 and 103bp) were CC genotypes and combined fragments (heterozygous) (483, 380 and 103bp) were CT genotypes. Figure 1 showed a total of 17 Fayoumi bands in lines 1, 2, 4, 6, 8, 9, and 10 and a total of 7 Dandarawi bands in lines 5, 7, and 11 with GH gene.

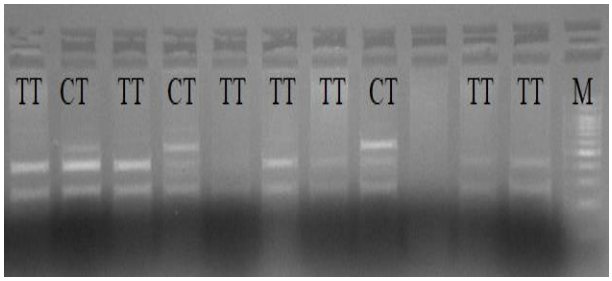

Figure 1. The fragments result from *MspI* enzymes digestions of GH gene for chicken. In lane 1, 2, 5, 6, 7, 9, and 11: genotype TT; Lane 4, 8, and 10: genotype CT; Lane M: Molecular weight marker.

The electrophoresis outlines of the studied genes are shown in Figure 2. For intron 1 of GHR gene, two private allele's patterns were found after *HindIII* digestion, allele A containing 410 and 313bp DNA fragments and 3 DNA fragments of 313, 252 and 155bp for allele B. Thus, this gene consequently result in three genotypes, AA (410 and 313bp), BB (313, 252 and 155bp) and AB (410, 313, 252 and 155bp). For exon 2 of GHR, this study has obtained two allele A and B; but just AA genotypes and BB genotypes were identified in two native chicken breeds. LI *et al*., (2008) investigated that the following DNA restriction fragments were obtained for GHR-*Hind III* polymorphism: 428bp / 290bp for the A1A1 genotype and 258bp /170bp / 290bp for the A2A2 genotype. While, Kadlec *et al.*, (2011) reported that 2 from 3 genotypes were found (AA and AC) the CC homozygous genotype was not found and the *Hinf I* PCR-RFLP investigation exposed fragments of 622, 378, 244 and 191, and 378, 244, and 191bp. In GHR resulted were 25 and 15 bands with the Fayoumi and Dandarawi breeds, respectively in lines 1, 2, 4, 6, 8, 9, and 10 and in lines 3, 5, 7, 11, and 12 as shown in Figure 1.

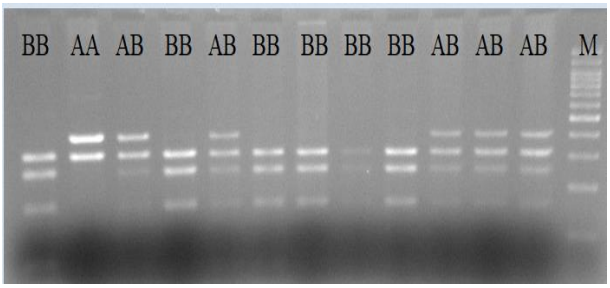

Figure 2. The fragments result from *HindIII* enzymes digestions of GH gene for chicken. In Lane 1, 2, 3, 8, and 10: genotype AB; Lane 4, 5, 6, 7, 9, and 12: genotype BB; Lane 11: genotype AA; Lane M: Molecular weight marker.

The relationship between genotype and traits

Investigation of the relationship between genotypic patterns in these genes by the studied traits in local chicken breeds Fayumi and Dandarawi including (BW at day one, 4, 6, 8, 10, 12, 14 and 16 weeks of age), Means relationship analysis results demonstrated significant differences between not the same genotypes of Growth Hormone gene in BW (at from day one to 16 week of ages) and genotypes of GHR gene in the BW trait as shown in Table 2 and 3.

Table 2. Mean ± Genotypes of the GH and GHR Genes influence the Standard Error of Body Weights characteristic in the Fayumi chicken breed.

Trait	GH		GHR		
	CT	TT	AA	AB	BB
BW0	32.41±0.50	33.17±0. 55a	32.59±0.70b	31.91±0.52	33.83±0.66a
BW2	84.24±3.40	97.03±3.54a	86.05±4.10	88.43±5.09b	97.21±3.86a
BW4	155.85±4.26	166.37±5.04a	157.14±5.86b	155.52±4.32	170.33±6.61a
BW6	238.79±6.64	269.83±10.18a	237.45±9.36	239.22±6.04b	284.88±13.23a
BW8	353.03±10.12	409.97±16.44a	351.91±15.47	362.26±6.66b	428.25±22.48a
BW10	491.74±13.81	544.80±16.43a	481.68±20.71	510.70±9.62b	560.17±21.94a
BW12	587.29±17.61	733.34±19.93a	563.82±24.64	661.70±15.02b	750.50±26.70a
BW14	688.41±22.49	905.83±22.17a	651.00±30.39	777.74±13.50b	954.17±26.19a
BW16	820.88±20.87	1070.11±21.89a	770.95±26.75	935.43±6.02b	1120.33±26.09a

Table 3. Mean ± Standard Error of Body weights trait for Dandarawi chicken breed by Genotypes of GH and GHR Genes

Trait	GH		GHR		
	CT	TT	AA	AB	BB
BW0	33.16±0.50	33.32±0.45	32.41±0.61	33.52±0.62b	33.71±0.51a
BW2	100.31±3.45	102.79±3.59a	100.31±3.85b	95.97±4.68	107.44±4.18a
BW4	164.71±4.24	186.13±4.56a	162.86±5.05	171.52±5.02b	190.09±5.78a
BW6	266.02±7.42	310.60±8.96a	258.66±9.03	280.93±8.36b	321.21±11.23a
BW8	412.62±11.36	468.04±14.41a	398.10±13.67	430.38±12.34b	486.47±18.22a
BW10	556.27±11.10	659.55±14.53a	546.79±15.54	587.59±11.31b	680.41±17.58a
BW12	721.16±15.60	869.98±16.19a	694.17±19.21	786.34±16.19b	894.29±19.19a
BW14	881.29±17.15	1102.26±24.35a	843.14±19.30	964.62±15.66b	1148.21±29.72a
BW16	1010.38±13.26	1331.06±20.07a	969.72±16.00	1128.07±10.82b	1387.97±20.08a

Anh *et al.*, (2015) investigated that the linked of cGH gene was found in BW trait at four and six WKs; and ADG at two to four and zero to six WKs and chicken with AG and GG genotypes presented higher BW and ADG ($p<0.05$) compared to that of the AA genotype. Also, Bassam *et al.*, (2018) discuss that the GH gene (AA, AB, BB) of weekly egg making of chickens from 1 to 14 and the significant effect was presented in the third week only ($p<0.05$) and the wild genotype AA had the maximum average of 5.92 tracked with the AB and BB genotypes (5.12 and 4.58) respectively. The Fayumi chicken breed has BB genotypes (in the GHR gene) and TT genotypes, according to the results of association

analysis between the fragments extracted from cutting enzymes and the researched attributes, as well as the means comparison study between genotypes (in the GH gene) as shown in Table 2. Also, in the chickens with BB genotypes (in GHR gene) and TT genotypes (in GH gene) with the Dandarawi chicken breed could be employed as good parents for the following generation to help these breeds gain weight as shown in Table 3. Kazemi *et al.,* (2018) showed that the mean of the AC, BC, and CC genotypes were greater than the other genotypes for BW related variables, and the BB genotype had the lowest record, which could be linked to the effective C allele. The selected chicken Growth Hormone cGH genotypes AG or GG recommend pairing KM females with male PS to produce the PSKM hybrid, which has a greater potential to improve into Thai broilers and has a healthier growth act by Anh *et al.,* (2015). Suggestion study of (GH) gene polymorphisms and its significance has been set in several studies due to finding significant relations among SNPs and not the same characters in chickens counting body and drumstick weight at six week Ghelghachi *et al.,* (2013), sexual maturity, egg number and body weight Aminafshar *et al.,* (2012), body weight at four, six, eight and ten weeks of age as well as daily heaviness increase Anh *et al.,* (2015), and also physiological characteristics in broiler chickens, such as triglyceride levels and total serum protein Al-khatib *et al.,* (2016). On Z chromosome, the chicken Growth Hormone Receptor gene has 10 exons and 9 introns, according to Hull *et al.,* (1999). In addition, chickens with the BB and TT genotypes were more competent than those with the AA, AB, and CT genotypes (in the GH and GHR genes) to be considered as the parents of the following generation if the breeding goal is to produce bodies with higher weight as shown in (Tables 2 and 3). While, Tamzil *et al.,* (2021) reported that the BW of Super Kampung chickens containing of CC genotype was weightier than those containing of CT and TT genotypes ($p>0.05$), The CC genotype has the highest body weight. Therefore, in Super Kampung chickens, the effective marker GH containing of CC genotype. Also, Anh *et al.,* (2015) investigation that the body weight of 408 chickens was noted only at hatching; and at two, four, six, eight and ten weeks of age. Finally, the heavier juvenile BW was related with GHR Hind III+ genotype Feng *et al.,* (1998) and a trend of relationship was create with age in first egg ($P \leq 0.14$) and housing BW ($P \leq 0.058$).

Frequencies distribution

The distribution of genotypic frequencies and frequencies of alleles of each fragment in the two local chicken breeds tested are showed in Table 4 and 5. The distribution of alleles and genotypes frequencies of all fragment tended to be the same in both Fayumi and Dandarawi chicken breed. Particularly, in Fayumi chicken, the frequency of TT (GH gene) and AA (GHR) was 0.28 and 0.55, respectively. Also, in Dandarawi chicken, the frequency of these alleles was 0.21 and 0.56, respectively. There was no homozygous genotype CT of GH detected in both studied breeds.

Under our study, the alleles associate with BW had low frequencies in the both Fayumi and Dandarawi chicken breeds. Previously, polymorphism of fragments at intron one of GH gene and its link with BW traits was implemented. However, in our study in indigenous Fayumi and Dandarawi chicken the result was different, with the PCR fragment, two alleles (A allele, B allele) and three haplotypes (AA, AB, BB) were found. Anh *et al.,* (2015) investigation that a total of four Thai broiler lines in all four chicken populations, allele G is more common than allele A for the cGH gene. Khaerunnisa *et al.,* (2017) reported that in all chicken populations the GG, AA genotypes and the G, A alleles were predominant and higher with Growth Hormones and Growth Hormones Receptor gene respectively. Also, Tamzil *et al.,* (2021) investigation that the frequency of the CC genotype is the highest compared to the CT and TT genotypes in all of the analysed Super Kampung chicken populations, which is due to the high frequency of C alleles in the entire Super Kampung chicken population.

Table 4. Number of hens, allelic frequencies, genotypic frequencies and Polymorphic Information Content of Fayumi chicken breed.

Breeds	Number of hens	Allelic frequencies		Genotypic frequencies			PIC*
		Allele 1	Allele 2	11	12	22	
GH	60	C:0.11	T:0.89	(0)	0.45(27)	0.55(33)	0.49
GHR	69	A:0.32	B:0.68	0.28(19)	0.29(20)	0.43(30)	0.65

PIC*: Polymorphism information content

Table 5. Number of hens, allelic frequencies, genotypic frequencies and Polymorphic Information Content of Dandarawi chicken breed.

Breeds	Number of hens	Allelic frequencies		Genotypic frequencies			PIC*
		Allele 1	Allele 2	11	12	22	
GH	80	C:0.25	T:0.75	(0)	0.44(35)	0.56(45)	0.49
GHR	92	A:0.63	B:0.37	0.21(19)	0.22(20)	0.58(53)	0.57

PIC*: Polymorphism information content

The frequencies of C genotype in Fayoumi and Dandarawi chicken breeds were 0.11 and 0.25, respectively. And, the frequencies of A genotype in Fayoumi and Dandarawi chicken breeds were 0.32 and 0.63, respectively. Also, the frequencies of T genotype in Fayoumi and Dandarawi chicken breeds were 0.89 and 0.75, respectively. Finally, the frequencies of B genotype in Fayoumi and Dandarawi chicken breeds were 0.68 and 0.37, respectively. Therefore, breeding programs need to be done to select chickens carrying the desired genotypes for enhancing BW of indigenous chickens. Also, in growth hormone gene, the positive result of T allele on body weight related traits was determined genotypes had the highest performances in Fayoumi and Dandarawi chicken breeds. Also, in growth hormone receptor gene, the positive result of A allele on body weight related traits was resolute genotypes had the highest performances in Fayoumi and Dandarawi chicken breeds. There was a trend toward an increase in the frequency of the Hind III + allele, according to Feng *et al.,* (1998). LI *et al.,* (2008) investigated that the frequency of restriction enzyme for IGF-1 was (0.53, C1)/ (0.47, C2) in population, for GHR intron two it was (A1, 0.06) and (A2, 0.94), respectively, while with GHR-intron five it was (B1, 0.20) and (B2, 0.80). Also, Kadlec *et al.,* (2011) reported that the genotypic frequencies were (AA from 0.83 to 0.86) and for AC (from 0.14 to 0.17), while, in the broilers, the frequency of allele of A from 0.915 to 0.93 was upper than that of C that from 0.07 to 0.085. Anh *et al.,* (2015) investigation that the observations of PSxKM and PSxSN populations, however, the AA genotype was counted at a frequency of 0.05, when compared to the three other lines,

the AA genotype had the lowest frequency (0.01) in the PSxSP population. Finally, El-sayed *et al.,* (2011) reported that in Fayoumi and Dandarawi chicken breeds the frequency of specific alleles ranged from 0.05 to 0.50.

The Polymorphic Information Content (PIC) is a useful metric for assessing the quality of genetic markers. Among two genes GH and GHR PIC were 0.49 and 0.65 respectively for Fayumi chicken breed. While, the GH and GHR PIC were 0.49 and 0.57 respectively for Dandarawi chicken breed as shown in Table 4 and 5. Botstein *et al.,* (1980), classification the PIC to highly informative markers that have PIC values >0.50, the reasonably informative markers that have PIC value between 0.25-0.50 and the slightly informative markers have PIC value <0.25. In the present study the GH gene had reasonably informative PIC values agree with Roushdy *et al.,* (2013) who reported that in Dokki-4, Golden Montazah and Silver Montazah strains, two markers had reasonably informative PIC values of (MCW43, 0.271) and (ADL171, 0.46), respectively. Also, the dissection had done by Roushdy et al., (2012) showed that PIC values ranged from 0.3 to 0.79 and from 0.49 to 0.73 with Gimiza and Inshas strains. While, the GHR had the greatly informative markers have PIC values agree with Ibrahim *et al.,* (2021) who investigation that the majority of the markers were highly informative (PIC ≥ 0.50) for gray quail strain (GJQS).

CONCLUSION

The molecular genetic structure of indigenous breeds and strains in Egypt was assessed using GH and GHR. The results clearly demonstrated the genetic diversity of these chickens and would serve future improvements to these breeds and/or understanding different genome arrangements and knowledge interests. Consequently, using genes may increase the efficiency with which desirable economic features are detected, which is important for improving productivity and reproduction in chicken breeding strategies.

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إستخدام إنزيمات القطع لدراسة التباين الوراثي في سلالتين من الدجاج المحلي الفيومي والدندراوي

محمد احمد السيد[١]، هبه عبد الوهاب محمود عاصي[٢] وسام محمد امين الحمامصى[٣]

[١] قسم الموارد الوراثية الحيوانية ـ البنك القومي للجينات- مركز البحوث الزراعية ـ الجيزة مصر

[٢]معهد بحوث الانتاج الحيواني- مركز البحوث الزراعية ـ الجيزة مصر

[٣] قسم الكيمياء الحيوية الزراعية ـ كلية الزراعة ـ جامعة الأزهر

الغرض من هذه الدراسة مقارنة التباين الوراثي في سلالتين محليتين من الدجاج الفيومي والدندراوي، حيث تم اختبار مائتي طائر (١٠٠، الفيومي و ١٠٠، الدندراوي). تم جمع بيانات أوزان الجسم الحي لكل طائر على حدة ضمن التركيب الوراثي من عمر يوم إلى ١٦ أسبوعًا ، واستخدم جينين هما جين هرمون النمو GH وجين مستقبلات هرمون النمو GHR في ١٢ طائرًا بشكل عشوائي لكل من سلالتي الدجاج. ، تم الحصول على أربعة اليلات وذلك بعد هضم الناتج بكلا من الانزيمات التالية *MspI* و *HindIII* علي النحو التالي:اليل C و T واليل A و B على التوالي. ومن اهم النتائج كان مجموع الحزم ١٧ و ٧ مع السلالتين الفيومي والدندراوي على التوالي بالنسبة لـ GH. بينما نتج ٢٥ حزمة من GHR و ١٥ حزمة مع السلالتين الفيومي والدندراوي على التوالي. لوحظ تكرار لاليل TTوAA لجين (GH)و (GHR) بنسبة ٠,٢٨ و ٠,٥٥ على التوالي في الدجاج الفيومي . بينما في دجاج الدندراوي كان تكرار هذين الأليلين ٠,٢١ و ٠,٥٦ على التوالي . وعلي الجانب الاخرلم يتم الحصول علي الاليلات المتباينة CT في كلا السلالتين المدروستين . فمن خلال الجينينGHR و GH وجد ان PIC يساوي ٠,٤٩ و ٠,٦٥ على التوالي لسلالة دجاج الفيومي. بينما كان PIC لكل من GHR و GHهو 0.49 و ٠,٥٧ على التوالي لسلالة الدجاج الدندراوي. تم بالفعل تحديد بعض الجينات الممكن استخدامها لتحسين وزن الجسم في سلالات الدجاج المحلية المختلفة.

الكلمات الدالة: جين هرمون النموGH و جين مستقبلات هرمون النموGHR والسلالات المحلية الفيومي والدندراوي.