Sex Chromatin in New Hampshire Cocks

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Abstract

Sex chromatin (SC) is defined as inactive X chromosome in the female somatic cells, it condensed as heterochromatic at interphase of the nucleus and appears like nuclear satellite projection, and only female cells contain SC in mammals.

Different ages of cocks: immature (8,16 weeks old), growing (24 weeks old) and production age (32,48 weeks old) , were studied to detect the sex chromatin (SC) with it's various shapes :Sessile nodule(SS), Drum stick(DS), Tear drop(TD) and Club shape(CS) in the blood lymphocytes of blood smears prepared from WBCs of 45 New Hampshire(NH) strain cocks. Also SC measurements were detected which include: vertical (V) and horizontal (H) axes, SC area (SCA), nuclear area (NA), and the ratio(R) between these two areas. .

Results show that SC is present in the male chicken blood lymphocytes in all ages. There is no significant difference in the incidence of the SC or its various measurements between ages, but the vertical axis was recorded a significant ($P<0.05$) decrease at 16 week old as compared with other ages. Also there is a non significant increase in the incidence of DS shape with ages; this indicated that simple, easy and cheap test could be helpful to detect some physiological parameters in the poultry species and other mammals.

Key words: sex chromtin, Barr body, birds, blood lymphocyte

Introduction :

In birds males carry ZZ and females ZW sex chromosomes, and it has been proposed that there is no dosage compensation in the expression of sex-linked genes[1]. However, recent data suggest the opposite, indicating that male and female birds might demonstrate similar levels of expression of Z- linked genes. If they do, the equalization between the sexes is probably not achieved by inactivation of one of the male Z chromosomes [2]. Other possible mechanisms include the transcription of Z- linked genes being up regulated in females or down regulated in males, or equalization at the translation stage in either sex. A recently identified hypermethylated region on the Z chromosome, with similarities to the X inactivation center on the mammalian X chromosome, might play a part in this process or have a role in avian sex determination. In the species (including humans) in which sex is determined by the presence of the Y or W chromosome rather than the diploidy of the X or Z, a **Barr body** is the inactive X chromosome in a female cell, or the inactive Z in a male [3], rendered inactive in a process called Lyonization. The Lyon hypothesis states that in cells with multiple X chromosomes, all but one is inactivated during mammalian embryogenesis [4]. This happens early in embryonic development at random in mammals, [5] except in marsupials and in some extra-embryonic tissues of some placental mammals, in which the father's X chromosome is always deactivated [6]. Barr bodies are named

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after their discoverer, Murray Barr [7]. In men and women with more than one X chromosome, the number of Barr bodies visible at interphase is always one less than the total number of X chromosomes. For example, men with a 47, XXY karyotype have a single Barr body, whereas women with a 47, XXX karyotype have two Barr bodies. The Barr body chromosome is generally considered to be inert, but in fact a small number of genes remain active and expressed in some species. These genes are generally those which are present on the other sex chromosome (Y or W) [8]. The condensed, inactive X-chromosome found in the nuclei of somatic cells of most female mammals. SC was first detected in blood lymphocytes of chicken by Al-Janabi *et al*. [9], since there was no observations of SC in any type of leucocytes in chicken but in other cells like duodenum, jejunum and liver [10] .Few attempts was made to attribute the presence of SC in blood lymphocytes of chicken [11] they use SC as a useful marker for prediction production of egg in younger ages. In cocks researches try to correlate SC presence in blood lymphocytes with seminal fluid analysis in these birds [12]. The present study try to find age related SC parameters in NH strain of cocks brought up in Iraq, it would complete the all previous studies in order to find a clue for many questions about SC significance in birds.

Materials and Methods :

Blood smears from 45 phenotypically normal cocks of NH strain were studied ranging in age from 8 to 48 weeks. The birds were reared in the Native chicken Breeding Station / IPA Agricultural Research Center (Abu-Gharaib, Baghdad). They were kept in individual cages with controlled environment. .

The preparation of peripheral blood smear were studied according to the method of Coles (13) using Wright's stain. .

Statistical analysis: Values reported are means ± SEM .All data were normally distributed and underwent equal variance testing. Statistical significance of difference was determined by SPSS program at 11.5 versions for windows. Average comparison between the groups was made using Student's *t*-test .$P<0.05$ was considered as statitistically significant.

Table1: Sex chromatin percentage in the lymphocytes of different ages of NH strain of cocks.

Age/wks	SC%	DS%	SS%	TD%	CS%
8	3.17±0.89[a]	1.31±0.07[a]	0.07±0.10[a]	0.89±0.30[a]	0.89±0.30[a]
16	3.69±0.65[a]	1.81±0.06[a]	0.60±0.08[a]	0.68±0.09[a]	0.60±0.08[a]
24	3.78±0.24[a]	1.81±0.06[a]	0.92±0.13[a]	0.13±0.04[a]	0.92±0.13[a]
32	3.92±0.99[a]	2.40±0.23[a]	0.16±0.07[a]	0.20±0.12[a]	0.16±0.07[a]
48	3.65±0.62[a]	2.30±0.24[a]	1.07±0.07[a]	0.14±0.11[a]	0.14±0.11[a]

Values are Mean ± SM
Different letters indicate significance ($P<0.05$)

Table2: Changes in sex chromatin dimensions, nuclear area (NA), sex chromatin area (SCA) and their ratios R1,R2 (NA/SCA and SCA/NA)respectively in the blood lymphocytes of the NH strain of cocks.

Age/ wks	V.axis (mμ)	H.axis (mμ)	SCA (mμ)	NA (mμ)	R1	R2
8	1.13±0.13[a]	1.34±0.20[a]	1.44±1.97[a]	34.39±0.91[a]	23.88±1.30[a]	4.18±1.11[a]
16	1.06±0.16[b]	1.13±0.15[a]	0.94±1.17[a]	31.40±0.65[a]	33.40±1.42[a]	2.99±2.04[a]
24	2.00±0.33[a]	1.25±0.36[a]	1.96±1.66[a]	35.32±0.63[a]	18.02±3.02[a]	5.54±2.31[a]
32	1.83±0.40[a]	2.00±0.09[a]	2.87±1.79[a]	28.26±0.19[a]	9.84±1.97[a]	10.15±4.01[a]
48	1.83±0.40[a]	1.50±0.19[a]	2.17±1.24[a]	31.40±0.65	14.74±1.40[a]	6.91±1.19[a]

Values are Mean ± SM
Different letters indicate significance ($P<0.05$)

Results:

The present study rerecorded that SC was present in the blood lymphocytes of the male in chicken species in its four shapes: DS, SS, TD, and CS. Table 1 gives the measurements of SC in different ages (from 8 to 48 wks). The results showed no significant difference in the incidence of SC or its various shapes between ages. The incidence of DS% increasing with advance ages but statistically not significant. Table 2 gives the measurements of SC in different ages, the results also showed no significant difference in all parameters, the only parameter shows significance ($P<0.05$) is the vertical axis in age 8 and 16 weeks as compared with other ages, also the table showed a non significant changes at 24, 32 weeks old of the V. and H. axes, NA and SCA as compared with other ages group.

Discussion :

It was find that sex chromatin was present in the nuclei of male blood lymphocytes of poultry species, this referred to the pattern of sex chromosomes in the chicken (1).

Four shapes were detected: DS, TD, SS, and CS (table1). Our results found clearly that SC pattern accompanied with some physiological characteristics such as age, as shown in table 1 the incidence of DS shape record a non significant increase with advanced ages, this may be referred to the action of hormones specially sex hormone (testosterone), (11) and the SC or its nuclei may respond differently to extra cellular environmental factors like sex hormones (14). Somatic association and heteropycnotic occur in the tissue of the mouse which is in some way dependent on the sex hormones (Graffian follicle cells and epithelium of lactating mammary glands). In other tissue nuclei of this animal the sex chromosomes are neither heteropycnotic nor do they show somatic association (15).

These observation helped explain that the interphase nucleus of the female chicken which is hetyerogametic and male nucleus which is homogametic are contained a SC like body structure. Study is continued with many studies on SC in chicken (male and female) to indicate the significance of SC incidence and measurements for the breeders.

References:

1. Ellegren, H. D. 2002. Dosage compensation: do birds do it as well? Trends Genet. 18(1):25- 8.
2. Marshall Graves, J.A.and Shetty S. 2001.Sex From W to Z: Evolution of Vertebrate Sex Chromosomes and Sex Determining Genes. Journal of Exp.Zool. 290: p.p.449-462
3. Harrison, K. B. 1989. X-chromosome inactivation in the human cytotrophoblast Cytogenetics. 52:37-41.
4. Lyon, M.F. 1961. Gene action in the X chromosome of the mouse (*Mus musculus*), Nature.190: 372-373.
5. Brown, C.J. and Robinson, W.P. 1997. Xist Expresion & X-chromosome inactivation in human preimplantation embryos. Am.J.Hum.Genet. 61:5-8.
6. Lee, J.T. 2003. X chromosome inactivation: a multi-disciplinary approach. J.sem.db. 14:311-312.
7. Barr, M.L.and Bertram, E.G. 1947. A morphological distinction between neurons of the male and female and the behavior of the nuclear satellite during accelerated nucleoprotein synthesis. Nature. 163: 676- 677.

8. Lyon, M.F. 2003. Lyon hypothesis and the line hypothesis. Sem.edb. 14(6): 316- 318.
9. Al Janabi, A.S.; Al Kareem, M.K. and Al Athary, A.K. 1999. Studies on sex chromatin in poultry. I-Identification of SC in chicken blood lymphocytes. Iraqi J.Agric. Special issue). 4(5): 59-63.
10. Moor, K.L. and Hay, J.K. 1961.Anatomical Record. 139: 315.
11. Abd Al Kareem, M.K. 1999. Sex chromatin picture in some strains of chicken in Iraq. M. Sc. Thesis, Baghdad Univ., Iraq.
12. Abd Al Kareem M.K.; Al-janabi A.S. and Al-Athary A.K. 2001. Sex chromatin and seminal fluid characteristics in Cocks. Iraq J. Agric. 6(1):147-152.
13. Coles, E.H. 1986 .Veterinary clinical pathology.4th Edition.W.Saunders Company. Philadelphia.
14. Harold, P. and Hans, G. 1960. The sex chromatin and heterochromatic bodies in human Diploid and polyploidy nuclei. The J.of Biophysical and Biochemical Cytology. 8:345 -364.
15. Ohno, S.; Kovacs, E. and Kinosita, R.1958. On the X-chromosome of mouse carcinoma cells.Exp. Cell Research.16: 462.

الصبغين الجنسي في سلالة النيوهمشاير في الديكة

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الخلاصة:

يعرف الصبغين الجنسي بأنه احد كروموسومي X الذي فقد فعاليته في نواة الطور البيني للخلايا الجسمية في إناث اللبائن ويظهر كبروز متغاير الصبغين ملاصق لغشاء نواة الخلية .

استخدمت في الدراسة أعمار مختلفة من الدجاج من سلالة النيوهمشاير : أعمار صغيرة (8و16 أسبوع), عمر النمو (24 أسبوع) وعمر البلوغ الجنسي (32و48 أسبوع). تمت دراسة صفات الصبغين الجنسي وأشكاله المختلفة : عصا الطبال, بروز بدون ساق, دمعة العين والشكل الهراوي .تم العثور على هذه الأشكال في خلايا الدم البيضاء اللمفاوية من 45 ذكر من السلالة. تمت دراسة قياسات وأبعاد الصبغين الجنسي أيضا والتي تتضمن: أبعاد الصبغين الجنسي العمودي والأفقي ,مساحة الصبغين الجنسي ومساحة النواة الحاوية عليه والنسبة بينهما.

أظهرت نتائج الدراسة وجود الصبغين الجنسي في انويه خلايا الدم اللمفاوية في ذكور الدجاج وفي جميع الأعمار بنسب متفاوتة. سجلت الدراسة عدم وجود أهمية معنوية في النسبة المئوية للصبغين الجنسي وأشكاله المختلفة أو أبعاده المختلفة بين مختلف الأعمار ,فقط البعد العمودي سجل انخفاضا معنويا ($P<0.05$) في عمر 16 أسبوعا مقارنة مع بقية الأعمار أيضا سجل ارتفاعا غير معنوي في نسبة تواجد شكل عصا الطبال مع تقدم العمر وهذا يشير انه من خلال فحص بسيط وسهل وغير مكلف يساعد على تحديد بعض الخواص الفسلجية المهمة في الدجاج واللبائن الأخرى.