Chemical Methodologies 7(2023) 483-488

Chemical Methodologies

Journal homepage: http://chemmethod.com

Original Research Article

The Effect of Genetically Modified Food on the Level of Some Steroid Hormones in Chickens: A Pilot Study

Hathama Razooki Hasan[1], Adil Turki Al-Musawi[2], Sudad Jasim Mohammed[2], Aliaa Saadoon Abdul-Razzaq Al-Faraji[2]*

[1]Department of Chemistry, College of Science, University of Baghdad, Baghdad, Iraq
[2]Market Research and Consumer Protection Center, University of Baghdad, Baghdad, Iraq

ARTICLE INFO

Article history

Submitted: 2023-03-18
Revised: 2023-04-03
Accepted: 2023-04-09
Manuscript ID: CHEMM-2303-1660
Checked for Plagiarism: Yes
Language Editor:
Dr. Fatimah Ramezani
Editor who approved publication:
Dr. Mohamed M. Rashad

DOI:10.22034/CHEMM.2023.389516.1660

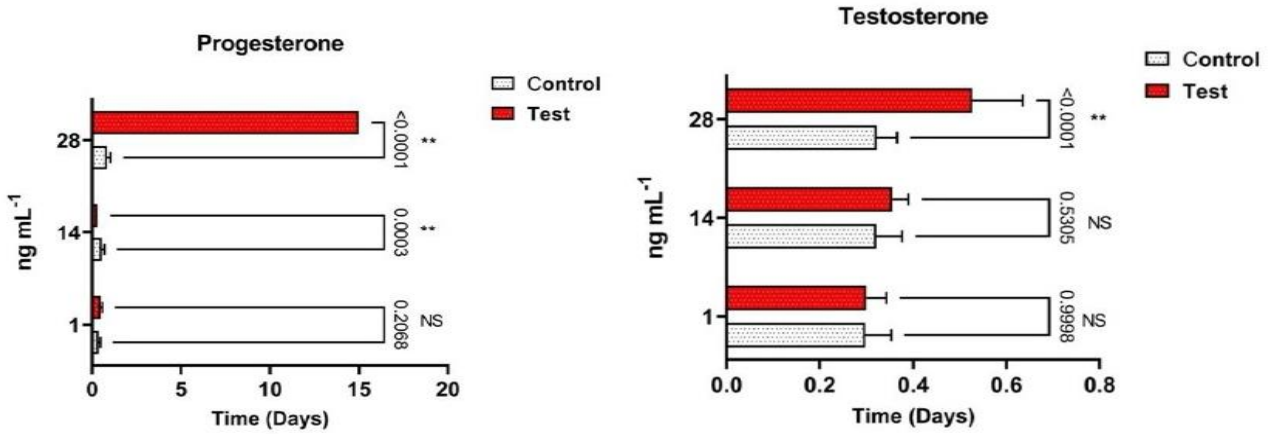
KEYWORDS

Genetic modified food
Testosterone
Progesterone
Heavy metals Pb
Cd

ABSTRACT

The advanced biological technologies, including genetic engineering, have an important role in providing the requirements for the large demands of food for human if they are used in the right direction and in accordance with the control of safety procedures and within the ethics of scientific researches, since the chicken constitutes one of the important food for mankind, samples were taken from chicken at the same weight and age, and were divided into two groups: the first being a control group that were feed with regular food for 1, 14, and 28 days and the second group was feed with genetically modified food for the same time period (for both groups and for each time point the used number of the chicken was = 15). The levels of testosterone and progesterone hormones were measured using the ELISA device and determination of heavy metal (pb and Cd). The results showed the presence of highly significant differences ($p<0.0001$) in [testosterone] after 28 days of feeding with GMF with no significant differences ($p=0.9996$ and $p=0.5305$) in those which were feed for (1 or 14) days. As for progesterone level, there was a highly significant difference ($p=0.0003$) in those after 14 days of feeding with GMF and very highly increase ($p<0.0001$) after 28 days of GMF feeding compared with those that were on a regular food with non- significant differences after1 day of GMF feeding. As for heavy metal (pb and Cd) shows highly concentration of serum in chicken Pb (1.453) and Cd (1.511).

GRAPHICAL ABSTRACT



* Corresponding author: Saadoon Abdul- Razzaq Al-Faraji
✉ E-mail: alia.sadon@yahoo.com

Introduction

Biotechnology is based on one of the important branches of life sciences, which is the molecular biology that deals with facts and genetic information from a completely new and original angle. The results of biotechnology are related to human vital issues such as, health, food, environment, dwindling natural resources, animal and agricultural production, and industrial fields, which was hoped will continue to develop services to the humanity. Therefore, there should be evaluation, monitoring, and management of potential risks related to this technology through discussion and application of biosafety vocabulary to take decisions by enacting laws and may need a long period of application in agricultural development and food security [1]. Modern biotechnology in the agricultural field has been able to move genetic materials between completely different plants and food, animals, and the kingdoms of microorganisms in ways that do not occur in nature. This is including genetically modified food, which is defined as the food resulting from manipulation of the genetic material by isolating a gene with desirable characteristics from a human, animal, plant, or microorganism, and its injection into another sex to transfer the desired trait [2-4]. Some scientists and researchers point a process of mixing where there is little control over the results that end wherever they are combined Genetic material in the host's inheritance, and accordingly, all coordination and unexpected results can occur, such as the process of transferring genetic material that can change normal function of the host's inheritance [5]. The use of biotechnology for the purpose of genetic modification of animals, plants, and microorganisms receives special attention from scientists, producers, seed companies, and food production and preparation companies. The Food and Agriculture Organization of the International [6] has recognized that biotechnology has benefits related to several factors, among which is increased in plant and animal production. Despite these advantages, many researches and studies have indicated direct and indirect effects of GMF on human health [7]. Generally the chicken is considered as one of the best source for food and the most enjoyed foods' item worldwide for the human beings. This is due to its superior taste, easy availability at reasonable price as and its good nutrient quality compared to fish and red meat. Likewise, to meet the increased demand for this type of food, more chicken farms have been established to provide the large demands for them, the farmers start to think about increasing the growth rate and to fatten chickens [8]. To achieve these aims, the breeder companies give more attention to the related nutritional requirements of these animals and they have started relaying on the GMF. Given the importance of the subjects as well as the growing interest in genetically food products at all scientific and popular levels, the idea of the current study was built [9]. Throughout the present study, we investigated the effect of one type of GMF manufactured in Iraq by FEEDCO (Iraq), used for chicken food to speed on the chicken's growth rate in order to meet their demands for this type of food. In the present study, the chicken was selected since it is considered as a first member in the food chain that end up with human being, as a sample of the study to look for the possible effect of the GMF feeding on the levels of anabolic steroid hormones, namely; testosterone and progesterone which are considered as important regulator and molecules that have wide biological effects in animals and human beings [10].

Materials and Methods

Samples

Samples of chicken have been taken from the poultry fields in Local market. They were divided into two groups according to the type of their nutrition.

Treatments

A) The first group of chicken was feed with normal food for (1, 14, and 28) days to be used as a control group and the second group was feed genetic modified food (GMF) for the same period

as the control. For each time period the number of the used chickens was 15.

Measurement of hormones concentration

Chicken blood have been collected from their wings after (1, 14, and 28) days of feed. The Serum was separated by centrifugation of the blood at 3000×g for 15 min. and the obtained serum was stored at -20 °C.

The hormone concentrations were determined using of the commercial human Uno ELISA kits (Immuno lab GmbH, Kassel, Germany), according to the manufacturer's instructions. Standard solutions six different concentrations of each of progesterone and testosterone were prepared.

The tested samples were put in the micro wells, and then the solutions of the dissolved enzyme conjugate (peroxidase), substrate (tetramethylbenzidine-TMB) and antibodies were added, and microplates were incubated for 2 hours at room temperature in the dark. The reaction was stopped by the addition of stop solution (0.5 M sulphuric acid) and the absorbance was measured on an ELISA reader at a wavelength of 450 nm. Upon plotting the calibration curve, the serum hormone concentration was determined using of the R-Biopharma Rid soft Win software. The results were expressed in ng/mL (ppb) taking the serum dilution factors into account [11].

Determination of heavy metal

Determination of heavy metal (pb and Cd) were estimated in serum of chicken using an atomic absorption spectrophotometer, determination of heavy elements was based on the reference method [12].

Statistical analysis

Statistical significance was assessed using least significant differences–LSD (T-test) where p-value<0.05 was considered significance, p=0.0001 as a highly significant.

Results and Discussion

Serum level of testosterone showed non-significant variation between the control group and the GMF feed group for 1 and 14 days of feeding, while a significant increase (p<0.0001) in this level was observed after 28 days of feeding (Figure 1).

The results in Figure 2 indicated that, there is a significant increase (p<0.0001) in progesterone level in the group of chicken which was feed GMF compared to that of the control group.

Whatever the source is, in the body they serve the same biological activity. Furthermore, these steroids regarding to their sources remain free in the blood stream and thereby, increasing their potential effects since they have limited bonding or linkage to human plasma proteins and any abnormality, or imbalance in their blood concentrations may cause a range of disorders in the body [13].

This hormone has been reported to have a predominant role in growth promoting and development of the female chicken reproductive tract [14].

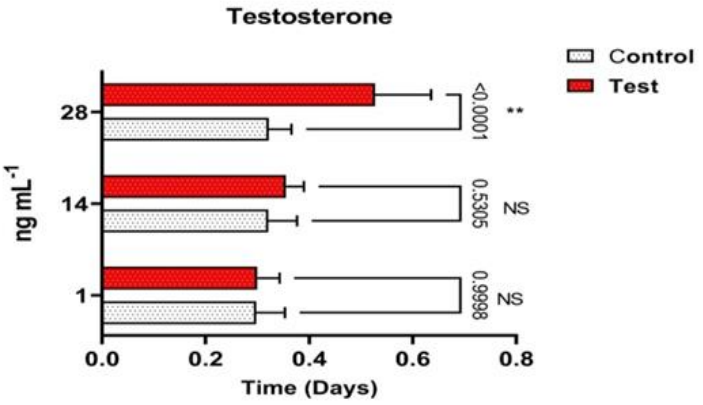


Figure 1: Testosterone concentration in chicken group with GMF feeding compared with that of control

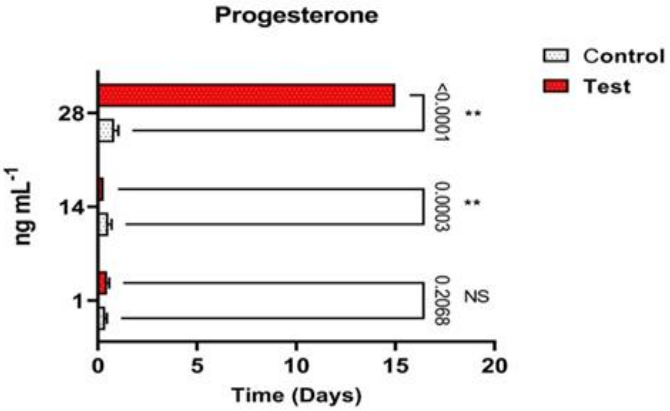


Figure 2: Progesterone concentration in the genetic modified feed compared with that of control

Progesterone regulates the female fertility and regulates the ovulation rate and oviduct development in chicken [15].

It is known that testosterone and progesterone, as well as other hormones are naturally synthesized endogenously every day in both food producing animals and in human body. In addition to that people are exposed add lesser quantiles of these hormones from consumption of animal products [15]. The hormones residues in animal and plant are the first concern of most people and this partly because exogenous steroid hormones have been reported to affect cancer risks [16].

Some studies such as Canton *et al*., [6] Zeitoun and Ahmed [17] indicated that even small differences in the hormone concentration may have adverse biological effects.

GM foods have both positive and negative impacts. And since there are no studies concerning the effect of this type of food feed on testosterone and progesterone concentration in chicken, in this study, we tried to investigate the effect of GMF feeding feed on the level of these hormones. This pilot study results recommended that harder regulations should be applied to stop the widespread misuse of GMF in chicken industry. Furthermore, an inspection of chickens for anabolic hormones levels is required prior to marketing these chickens. A conclusion which needs further studies to be confirmed and thus more researches are required in this area to examine the harmful effect of this type of food on human health.

Table 1 presents the Lead concentration was 0.366 p.p.m, in investigation of chicken samples, the percentage of Lead concentration was recorded in all serum chicken samples analyzed from 0.058-1.453 p.p.m, while the Cadmium concentration was 0.317 p.p.m, in the investigation of chicken samples, the percentage of Cadmium concentration was recorded in all serum chicken samples analyzed from 0.120-1.511 p.p.m.

Table 1: Concentration of mineral elements of serum chicken samples in (p.p.m)

Sample	Pb	Cd
1	0.058	0.120
2	0.683	0.542
3	1.453	1.511
4	0.023	0.112
5	0.196	0.180
6	0.558	0.520
7	0.981	0.750
8	1.322	1.124
9	1.180	1.166
10	0.444	0.500
LSD	0.366 *	0.317 *
* (P≤0.05)		

These result was agreement with [12] when investigating and detecting contamination with heavy elements (Pb and Cd) in some chicken meat in the local market of the city of Hilla, and this result was in agreement with Iraqi standard and the World Health Organization (WHO) because the concentration of Cd from (0.201-0.041) p.p.m which is within the permissible limits in the Iraqi standard and WHO.

Conclusion

This pilot study results recommended that harder regulations should be applied to stop the widespread misuse of GMF in chicken industry. Furthermore, an inspection of chickens for anabolic hormones levels prior to marketing these chickens should be checked, a conclusion which needs further studies to be confirmed.

Acknowledgments

The authors would like to thank all study participants of Market Research and Consumer Protection Center, University of Baghdad, Iraq. Prior to commencing this study, ethics approval was obtained from Market Research and Consumer Protection Center, University of Baghdad. (Mracpc.Un.Bagh.1486).

Disclosure Statement

No potential conflict of interest was reported by the authors.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors' Contributions

All authors contributed to data analysis, drafting, and revising of the paper and agreed to be responsible for all the aspects of this work.

ORCID

Adil Turki Al-Musawi
https://orcid.org/0000-0002-1309-4654
Sudad Jasim Mohammed
https://orcid.org/0000-0002-1750-0576
Aliaa Saadoon Abdul- Razzaq
https://orcid.org/0000-0003-4315-5611

References

[1]. Nakajima T., Tsuruoka Y., Kana M., Hayashi H., Hashimoto T., Matsushima Y., Takano I., Determination and surveillance of hydrocortisone and progesterone in livestock products by liquid chromatography-tandem mass spectrometry, *Food Additives & Contaminants. Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment*, 2015, **32**:1833 [Crossref], [Google scholar], [Publisher]

[2]. Domingo J.L.,.Toxicity Studies of Genetically Modified Plants :A Review of the published literature, *Critical Reviews in food Science and Nutrition,* 2007, **47**:721 [Crossref], [Google scholar], [Publisher]

[3]. Hegyi G., Schwabl H., Do different yolk androgens exert similar effects on the morphology or behaviour of Japanese quail hatchlings Coturnix japonica? *Journal of Avian Biology*, 2010, **41**:258 [Crossref], [Google scholar], [Publisher]

[4]. Verma C., Nanda S., Singh R.K., Singh R.B., Mishra S., A Review on Impacts of Genetical ly Modified Food on Human Health, *The Open Nutraceuticals Journal,* 2011, **4**:3 [Google scholar], [Publisher]

[5]. He S.P., Arowolo M.A., Medrano R.F., Li S.,Yu Q.F., Chen J.Y., Impact of heat stress and nutritional interventions on poultry production, *World's Poultry Science Journal*, 2018, **74**:647 [Crossref], [Google scholar], [Publisher]

[6]. Canton L., Lanusse C., Moreno L., Rational Pharmacotherapy in Infectious Diseases: Issues Related to Drug Residues in Edible Animal Tissues, *Animals,* 2021, **11**:2878 [Crossref], [Google scholar], [Publisher]

[7]. Mignon-Grasteau S., Moreri U., Narcy A., Rousseau X., Rodenburg T.B., Tixier-Boichard M., Zerjal T., Robustness to chronic heat stress in laying hens: A meta-analysis, *Poultry science,* 2015, **94**:586 [Crossref], [Google scholar], [Publisher]

[8]. Kim D.H., Lee Y.K., Lee S.D., Kim S.H., Lee S.R., Lee H.G., Lee K.W., Changes in production parameters, egg qualities, fecal volatile fatty acids, nutrient digestibility, and plasma parameters in laying hens exposed to ambient temperature, *Frontiers in Veterinary Science*, 2020, **7**:412 [Crossref], [Google scholar], [Publisher]

[9]. Jiang S., Mohammed A.A., Jacobs J.A., Cramer T.A., Cheng H.W., Effect of synbiotics on thyroid hormones, intestinal histomorphology, and heat shock protein 70 expression in broiler chickens reared under cyclic heat stress, *Poultry Science*, 2020, **99**:142 [Crossref], [Google scholar], [Publisher]

[10]. Rizzo A., Stefani A.L., Piccinno M., Roncetti M., D'Onghia G., Sciorsci R.L., Dynamics of the progesterone and cholesterol concentrations within the bovine corpus luteum cavity, *Research in veterinary science,* 2016, **109**:56 [Crossref], [Google scholar], [Publisher]

[11]. Ali I.F., Mohammed S.J., Using of ELISA Technique for Detection the Supplement Effects of Eruca Sativa Leaves in Human Males Hormones, *Diyala Journal For Pure Sciences,* 2015, **11**:11 [Google scholar], [Publisher]

[12]. Badis B., Rachid Z., Esma B., Levels of selected heavy metals in fresh meat from cattle, sheep, chicken and camel produced in Algeria, *Annual Research & Review in Biology*, 2014, 1260-1267 [Crossref], [Google scholar], [Publisher]

[13]. Ahmad S., Rehman R., Haider S., Batool Z., Ahmed F., Ahmed S.B., Perveen T., Rafiq S., Sadir S., Shahzad S., Quantitative and qualitative assessment of additives present in broiler chicken feed and meat and their implications, *The Journal of the Pakistan Medical Association,* 2018, **68**:876 [Google scholar], [Publisher]

[14]. Heifetz E.M., Rozenboim I., MorrisSoller M., Eitan Y., Hormonal levels of estradiol, testosterone, and progesterone at entry into lay of year 1980 vs. 2000 broiler breeder females under fast and slow release from feed restriction, *Physiology and Reproduction,* 2018, **97**:3728 [Crossref], [Google scholar], [Publisher]

[15]. Mishra B., Sah N., Wasti S., Genetic and Hormonal Regulation of Egg Formation in the Oviduct of Laying Hens, In *Poultry-an advanced learning*, IntechOpen, **2019**. [Crossref], [Google scholar], [Publisher]

[16]. Grgurevic N., Koracin J., Majdic G., Snoj T., Effect of dietary estrogens from bovine milk on blood hormone levels and reproductive organs in mice, *Journal of Dairy Science*, 2016, **99**:6005 [Crossref], [Google scholar], [Publisher]

[17]. Zeitoun M.M., Ahmed S.M., Effect of Cooking Method on the Residues of Natural Sex Steroid Hormones in Local and Imported Meats and Meat Products in Al-Qassim Region, *Journal of Agricultural and Veterinary Sciences. Qassim University,* 2011, **4**:83 [Google scholar]

HOW TO CITE THIS ARTICLE

Hathama Razooki Hasan, Adil Turki Al-Musawi, Sudad Jasim Mohammed, Aliaa Saadoon Abdul- Razzaq Al-Faraji. The Effect of Genetically Modified Food on the Level of Some Steroid Hormones in Chickens: A Pilot Study. *Chem. Methodol.*, 2023, 7(6) 483-488

DOI: https://doi.org/10.22034/CHEMM.2023.389516.1660

URL: http://www.chemmethod.com/article_170063.html