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ENHANCING BREEDER POULTRY HEALTH: EXPLORING THE EFFECT OF OREGANO (*Origanum vulgare*) MEAL SUPPLEMENTATION ON SEMINAL BIOCHEMISTRY AND SPERMATOLOGICAL CHARACTERISTICS

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ABSTRACT

This experiment investigated the effect of oregano meal (ORM) supplementation on seminal biochemistry and spermatological characteristics of breeder chickens. Following a completely randomised design, 24-week-old Yoruba chickens (n = 48) were assigned to four equal groups of three replications per group, and fed graded levels of ORM (1.50, 3.00, and 4.50 g kg^{-1} diets, respectively) for 56 days on ad libitum. By the end of experimental feeding, semen collection was performed to evaluate specific seminal biochemicals and spermatological characteristics. Data obtained were analysed in one-way analysis of variance. Results showed highest ($p < 0.05$) sperm concentrations in birds fed 3.00 and 4.50 g ORM, while control had least concentrations. Sperm motility was highest ($p < 0.05$) in birds fed 3.00 g ORM and lowest in the control. Birds fed 1.50 g ORM had higher ($p < 0.05$) live sperms, normally-shaped sperms, and seminal potassium levels than other groups. Seminal levels of sodium and fructose of birds fed 3.00 and 4.50 g were higher ($p < 0.05$) than control and those fed 1.50 g ORM. Highest ($p < 0.05$) levels of seminal magnesium were recorded by birds fed 3.00 and 4.50 g ORM while those fed 1.50 g ORM had lowest levels. The study concluded that 1.50 g ORM kg^{-1} diet influences seminal biochemistry and spermatological characteristics for good semen quality in Yoruba breeder chickens.

Key words: dietary treatment, heavy-ecotype, nutraceutical, reproductive health, seminogram

INTRODUCTION

Food security in Nigeria is currently facing a lot of challenges. Improving indigenous poultry has shown to be a significant strategy in achieving sustainable food security in developing countries. Increasing the production of these birds with modern reproductive technologies that guarantee massive production outputs such as artificial insemination (AI) should be well relatable among poultry producers and experts. Successful AI requires quality grade of inseminating semen. This quality refers to physical and chemical attributes of the ejaculate that promote efficient use in AI. Semen quality of food-producing animals is very vital to achieving food security in Nigeria, and as such, influenced by many factors including but not limited to nutrition and dietary factors. The use of natural feed additives in poultry production has been topical in research due to the many benefits and limited risks, yet oregano meals (ORMs) have not been versely explored as a dietary protocol for improved semen quality of indigenous poultry. Oregano (*Origanum vulgare*) is a natural botanical without risks to one health. The nutritional and pharmacological profile of oregano could benefit semen quality grade of the Nigerian chickens. Such improvement should increase availability of food from these native chickens and ultimately promote dietary and nutritional adequacy among the consuming populace.

Oregano (*Origanum vulgare*) is a culinary herb with a rich history in traditional medicine due to its numerous health benefits. The ORM is derived from dried parts of the plant, and a source of essential oils, flavonoids, and phenolic compounds (Gutiérrez-Grijalva *et al.,* 2018). These bioactive components are believed to contribute to the herb's antimicrobial, antioxidant, and anti-inflammatory properties. Studies suggest that ORM supplementation positively influences sperm concentration, liveability and progressive motility, crucial factors for successful fertilization (Soliman *et al.,* 2016; Maty *et al.,* 2021). The ORM is rich in antioxidants, which play a vital role in neutralising harmful free radicals in the seminal fluid, thereby reducing oxidative stress to protect sperm cells from damage, maintaining their morphology and functionality.

Dietary inclusion of ORM has been linked to improved seminal fluid composition, promoting a balanced environment in the reproductive tract to foster good semen quality (Valsa *et al.,* 2012). Incorporating ORM in the diet of heavy-ecotype roosters holds immense promise for the poultry industry in Nigeria. Its positive effects on seminal biochemistry and spermatological characteristics underline the potential as a natural supplement (nutraceutical) for enhanced semen quality and reproductive health in local breeder chickens.

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MATERIALS AND METHODS

The experiment was carried out in the Poultry Unit of Department of Animal Science Teaching & Research Farm, University of Nigeria (UNN), Nsukka (located at 5° 22' N and 7° 24' E, 540 m asl). The study area has a tropical climate with mean daily temperature range of 26-32.8°C and relative humidity of 56.01-103.83 mmHg (Yakubu *et al.,* 2022). The experimental procedure conformed to ethical guidelines of the Institutional Animal Care & Use Committee, Faculty of Veterinary Medicine, UNN, Nsukka. The test ingredient was custom-made oregano meal (ORM) from the Department of Animal Health & Production, UNN, Nsukka. It was incorporated into standard breeder diet for local roosters (Table 1) at 1.50, 3.00, and 4.50 g kg^{-1} diet, such that each inclusion level constituted a dietary treatment. The test inclusion levels were borne out of literature evidence that 3.00 g ORM kg^{-1} diet promotes healthy performance of Yoruba laying hens (Dim *et al.,* 2022). Hence, this present study explored higher and lower levels than the 3.00 g ORM to ascertain optimal level that supports good semen quality in the Yoruba rooster chickens. Table 2 shows the proximate compositions of the experimental diets and ORM as determined by methods of the Association of Official Analytical Chemists, AOAC (2005).

The study followed a completely randomised design (CRD) in arranging 48 apparently healthy Yoruba breeder chickens (24-week-old, weighing approximately 2.00 kg) into four dietary treatment groups that received different levels of ORM supplementation (1.50, 3.00, and 4.50 g per kg diet), including a control diet without ORM. Each group had three replicates with four birds per replicate. The birds were sourced from a deep-litter system in the experimental farm, and acclimatised for two weeks in their new environment before the start of the experiment. Prior to the study, the experimental pens were sanitised using sodium hypochlorite (PZ Cussons Ltd.), followed by thorough rinsing with tap water. These pens were constructed with dimensions of 3 m × 2 m × 1.2 m, allowing adequate space for bird movement. The floors were made of smooth concrete, and covered with coarse wood shavings as bedding material to a 10-cm height. Plastic balls were tied at strategic areas in the pen to promote natural behaviour and reduce feather-pecking. Adequate ventilation was maintained through adjustable blinds that allowed airflow while protecting the birds from direct sunlight. The birds were fed once daily in the morning with experimental diets while drinking water was provided *ad libitum*. A calm approach was adopted during the feeding to prevent fear or stress responses in the birds. Routine vaccinations against Newcastle disease and infectious bursal disease were administered by a veterinary doctor following the schedule for breeder chickens by the National Veterinary Research Institute, Vom, Nigeria. At the end of experimental feeding, semen collections from the birds were performed according to the study groups. Careful handling techniques were used during semen collection to minimise stress. Each bird in a replicate was gently restrained to a comfortable position before the abdominal massage technique was carried out as described by Burrows and Quinn (1937) to stimulate ejaculation. The ejaculated semen is collected into triplicate vials (sterilised in boiling distilled water), labelled according to the treatment groups, and placed in flask containing ice blocks prior to the seminogram. The semen volume was ascertained with a graduated test tube (ml), while the seminal levels of sodium, potassium, magnesium, calcium, and fructose were determined by atomic absorption spectrometry (Nerdy, 2018). Sperm concentration was assessed by the method of Peters *et al*. (2005), while sperm liveability, progressive motility, and normal morphology were evaluated and scored according to standard procedures described by Sayed *et al.* (2017). Data were analysed in one-way analysis of variance for a CRD to determine significant variations among treatment means using IBM SPSS Statistics version 22.0 (IBM Corporation, USA). Post-hoc tests were conducted using Duncan's new multiple range test for multiple comparisons at 95% level of statistical significance. This experiment conformed to ethical standards and guidelines by the Institutional Animal Care & Use Committee, Faculty of Veterinary Medicine, UNN, Nsukka; prioritising animal welfare and scientific rigour.

Table 1: Ingredients and nutrient compositions of breeder diet

Ingredients (%)	
Maize	50.00
Soybean meal	20.00
Fish meal	9.00
Wheat bran	16.00
Bone meal	2.00
Vitamin and mineral premix*	1.00
Salt	1.00
DL-methionine	0.50
Lysine	0.50
Calculated nutrients	
Crude protein	23.85
Crude fiber	3.77
Metabolisable energy (kCal kg^{-1})	2960

Table 2: Proximate compositions of experimental diets and oregano meal (ORM)

Nutrients (%)	Control	1.50 g ORM	3.00 g ORM	4.50 g ORM	ORM
Crude protein	24.20	24.44	24.68	24.92	16.06
Crude fiber	3.70	3.81	3.92	4.03	7.31
Ether extract	3.01	3.03	3.06	3.08	1.92
Ash	5.05	5.09	5.15	5.22	4.98
Nitrogen-free extract	64.04	63.63	63.19	62.75	69.83

RESULTS AND DISCUSSION

The seminogram of Yoruba breeder chickens fed graded levels of ORM supplementation for 56 days is shown in Table 3. The experimental birds scored seminal and spermatological values that were within range of optimal quality for breeding purposes (Isidahomen *et al.*, 2014; Adeoye *et al.,* 2017; Luvanga and Kashoma*,* 2022; Abiola *et al.,* 2023).

The result shows that sperm concentration was highest ($p < 0.05$) in the birds fed 3.00 and 4.50 g ORM and lowest in the control. Birds fed 3.00 g ORM had highest ($p < 0.05$) sperm motility, while control group recorded the lowest. The percentages of live and normally-shaped sperms in the birds fed 1.50 g ORM were higher ($p < 0.05$) than those of other groups including control. The chickens that fed 3.00 and 4.50 g ORM diets recorded higher ($p < 0.05$) seminal levels of sodium and fructose than those fed other dietary treatments. Seminal potassium was highest ($p < 0.05$) in the birds that fed 1.50 g ORM and lowest in those fed control, 3.00 g, and 4.50 g ORM diets. The chickens that fed 3.00 and 4.50 g ORM recorded higher ($p < 0.05$) levels of seminal magnesium than control birds, while the lowest levels were scored by those fed 1.50 g ORM per kg diet.

Seminal Biochemistry

Oregano has been shown to improve gut health and digestive efficiency by promoting beneficial gut microbiota, such as *Lactobacillus* and *Bifidobacterium*. These beneficial bacteria can enhance the fermentation of carbohydrates, leading to increased production of short-chain fatty acids and possibly fructose, thereby elevating fructose levels in seminal fluid. The bioactive compounds in oregano may enhance the absorption of carbohydrates and sugar, leading to higher fructose availability for metabolism and subsequent secretion into seminal fluid. Oregano supplementation may stimulate metabolic pathways involved in carbohydrate metabolism. This stimulation could enhance the synthesis of fructose from glucose or other precursors, leading to increased fructose levels in semen. The body maintains sodium levels within a narrow range through homeostatic mechanisms. Even with dietary changes, the physiological systems may effectively regulate sodium concentration in seminal fluid, preventing significant deviations from baseline levels observed in the control group. Oregano leaf meal may not contain sufficient sodium or may alter the bioavailability of sodium from other dietary sources. If the sodium content in the oregano is low or if its presence does not enhance sodium absorption, it would not significantly impact seminal sodium levels. At both low and high supplementation levels, the birds' bodies might activate compensatory mechanisms to maintain sodium balance. For instance, if sodium intake increases due to oregano supplementation, renal excretion may also increase to prevent hypernatremia, keeping seminal sodium levels stable. At high inclusion levels of oregano, any potential effects on sodium may be masked by other dietary components or interactions. If the oregano alters overall nutrient absorption or metabolism significantly, it could neutralise any direct effects on sodium levels, leading to no significant difference compared to control. At low levels of oregano supplementation, the bioactive compounds in oregano may enhance nutrient absorption, including potassium. However, at higher inclusion levels, the effects may plateau or become saturated, leading to no further significant increase in potassium levels. The body has mechanisms to maintain electrolyte balance, including potassium. At low oregano levels, any increase in potassium absorption might be more pronounced. Conversely, at high levels, the body may regulate potassium excretion more aggressively through renal mechanisms, preventing significant changes in seminal potassium. When oregano is included at low levels, it may stimulate metabolic pathways that increase potassium availability. However, at higher levels, the body might activate compensatory mechanisms to maintain homeostasis, thus stabilising potassium levels despite increased dietary intake. Oregano is known for its antioxidant properties; at low doses, it may reduce oxidative stress and promote better cellular function, enhancing potassium retention. At high doses, the antioxidant effects could lead to a different physiological response that does not further elevate potassium levels. The significant decline in seminal magnesium levels at the lowest level of oregano leaf meal supplementation and the instanta-

Table 3: Seminogram of Yoruba roosters fed levels of oregano meal (ORM) supplementation

	Control	1.50 g ORM	3.00 g ORM	4.50 g ORM	SEM
Seminal biochemicals					
pH	7.45	7.50	7.60	7.65	0.13
Fructose (%)	1.65^{b}	1.86^{b}	2.77^{a}	2.85^{a}	0.99
Sodium (mEq L^{-1})	138.62^{b}	140.13^{b}	150.92^{a}	165.70^{b}	20.21
Potassium (mEq L^{-1})	4.49^{b}	5.76^{a}	4.55^{b}	4.60^{b}	0.01
Calcium (mg dL^{-1})	6.50	6.95	7.11	7.13	1.70
Magnesium (mg dL^{-1})	4.88^{b}	3.97^{c}	4.04^{c}	6.78^{a}	0.05
Volume (ml)	0.30	0.34	0.31	0.33	1.02
Sperm characteristics					
PM (%)	69.82^{c}	76.29^{b}	83.08^{a}	75.15^{b}	11.06
SC ($\times 10^{9}$/ml)	3.50^{c}	4.27^{b}	4.61^{a}	4.95^{a}	0.27
LS (%)	69.66^{b}	75.59^{a}	70.73^{b}	68.56^{b}	19.34
NS (%)	73.00^{b}	76.22^{a}	71.37^{b}	70.11^{b}	9.93

SEM - standard error of the mean, PM - progressive motility; SC - sperm concentration, LS - live spermatozoa, NS - normally-shaped spermatozoa. Mean values in a row having different superscripts are statistically significant at 5% level of probability.

neous spike at the highest inclusion level could be attributed to several factors. At low levels of oregano supplementation, the phytochemicals present may compete with magnesium for absorption in the intestines. This competition could lead to reduced magnesium availability, resulting in lower seminal magnesium levels. Oregano may influence gut health and alter the absorption dynamics of minerals. At lower inclusion levels, the digestive system might not be sufficiently stimulated to absorb magnesium effectively, leading to decreased levels in seminal fluid. Increased oregano supplementation could induce a stress response in roosters, particularly at high inclusion levels. This stress might cause a temporary release of magnesium from tissues into the bloodstream or seminal fluid, resulting in an instantaneous spike due to altered metabolic processes. The body regulates magnesium levels tightly. At low supplementation, the body may not perceive a need to adjust magnesium levels significantly. However, at high levels of oregano, physiological responses may trigger a rapid adjustment mechanism that leads to an acute increase in magnesium concentration as the body attempts to maintain balance. There are several possible reasons why semen pH and seminal calcium in local roosters were unaffected by dietary treatment with oregano leaf meal. The test ingredient may not contain sufficient levels of essential nutrients or minerals that directly influence semen pH and calcium levels. If the dietary treatment does not provide the necessary components for altering these parameters, no significant changes would be observed. The bioactive compounds in oregano may not be adequately absorbed or metabolised to influence seminal fluid composition. If the active components do not reach sufficient concentrations in the bloodstream or reproductive tissues, they will not affect semen quality. The duration and concentration of oregano leaf meal used in the diet may have been insufficient to elicit a measurable effect on semen parameters. Longer-term studies or higher dosages might be necessary to observe any potential impacts on pH and calcium levels.

Spermatological Characteristics

The observed effects of oregano leaf meal supplementation on the reproductive parameters of roosters, including higher percentages of live sperm and normally-shaped spermatozoa at 1.50 g kg^{-1}, as well as variations in sperm motility and concentration at different inclusion levels, can be attributed to several factors. Oregano contains bioactive compounds such as carvacrol and thymol, which have strong antioxidant properties. These compounds can reduce oxidative stress in the reproductive system, thereby improving sperm viability and morphology by protecting sperm cells from damage during spermatogenesis. The inclusion of oregano may improve gut health and nutrient digestibility, leading to better nutrition for the roosters. Improved nutrient absorption can enhance the quality of sperm produced, resulting in higher percentages of live and normally-shaped spermatozoa. The dosage of 1.50 g kg^{-1} may represent an optimal level that stimulates beneficial physiological responses without causing adverse effects. Higher concentrations might lead to diminishing returns or even negative effects due to potential toxicity or metabolic disturbances. Moreover, the highest level of oregano supplementation (3.0 g kg^{-1}) may provide sufficient phytochemicals that enhance metabolic activity and energy production in sperm cells, leading to improved motility compared to control birds that did not receive any supplementation. The antioxidant properties of oregano could lower lipid peroxidation in seminal plasma, which is crucial for maintaining sperm membrane integrity and motility. Control birds lacking oregano supplementation may experience higher oxidative stress, resulting in reduced motility. Oregano supplementation might positively influence the ionic composition of seminal plasma (e.g., potassium, sodium), which is critical for sperm motility. The control group may lack these beneficial changes, leading to poorer motility outcomes. Furthermore, higher levels of oregano supplementation may stimulate spermatogenesis through enhanced blood flow and improved testicular function due to its bioactive compounds, leading to increased sperm production. At these higher dosages, the cumulative effects of multiple phytochemicals in oregano may work synergistically to promote higher sperm concentrations for enhanced reproductive health. Increased sperm production at higher oregano levels could create a feedback loop where improved health and vitality lead to even greater reproductive performance, resulting in elevated sperm concentrations.

CONCLUSION

High seminal levels of sodium and fructose observed in the chickens that fed high inclusion levels of ORM (i.e., 3.00 and 4.50 g per kg diet) implicates the role of test feeding in increasing energy availability for enhanced sperm activities, which translated to higher sperm concentration and progressive motility in the birds that fed 3.00 and 4.50 g ORM. This result demonstrates a dose-dependent relationship, where by high levels of ORM supplementation led to pronounced changes in these seminal and spermatological indices. Moreover, the significant effect of ORM supplementation at 1.50 g per kg diet on the seminal and spermatological indices that determine semen quality were attributed to the antioxidant properties of oregano. This inclusion level of ORM supplementation sponsored increased seminal potassium along with percentages of live and normally-shaped spermatozoa. Hence, the study concluded that ORM supplementation at 1.50 g kg^{-1} diet influences seminal biochemistry and spermatological characteristics for good semen quality in Yoruba breeder chickens.

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REFERENCES

Abiola M.O., Apuu S., Daramola J.O., Wheto M. and Akunjute O.F. (2023). Semen quality and sperm characteristics in broiler breeder cockerels fed vitamin E during hot season. *Acta Sci. Anim. Sci.*, **45**, e56848. https://doi.org/10.4025/actascianimsci.v45i1.56848

Adeoye G.O., Oleforuh-Okoleh V.U. and Chukwuemeka U.M. (2017). Influence of breed type characterization and age on spermatological traits of Nigerian local chickens. *Agro-Science*, **16 (1)**, 11-16. https://doi.org/10.4314/as.v16i1.3

Association of Official Analytical Chemists, AOAC. (2005). Official Method of Analysis, 18th edn. Association of Officiating Analytical Chemists, Washington DC, USA, pp. 914-926

Bah G.S., Chaudhari S.U.R. and Al-Amin J.D. (2001). Semen characteristics of local breeder cocks in the Sahel region of Nigeria. *Revue Elev. Med. Vet. Pays Trop.*, **54 (2)**, 153-158

Burrows W.H. and Quinn J.P. (1937). The collection of spermatozoa from the domestic fowl and turkey. *Poultry Science*, **16 (1)**, 19-24. https://doi.org/10.3382/ps.0160019

Dim C.E., Oyeagu C.E. and Ogwuegbu M.C. (2022). Egg lipid profile, growth traits, blood biomarkers and physical egg characteristics of heavy ecotype laying hens fed oregano (*Origanum vulgare*) meals. *Int. J. Vet. Sci.*, **11 (3)**, 344-352. https://doi.org/10.47278/journal.ijvs/2021.114

Gutiérrez-Grijalva E.P., Picos-Salas M.A., Leyva-López N., Criollo-Mendoza M.S., Vazquez-Olivo G. and Heredia J.B. (2018). Flavonoids and phenolic acids from oregano: Occurrence, biological activity and health benefits. *Plants*, **7 (1)**, 2. https://doi.org/10.3390/plants7010002

Isidahomen C.E., Okpeku M. and Osezua K.E. (2014). Semen characteristics, biochemistry and mineral content of indigenous cocks in Nigeria. *Int. J. Appl. Res. Technol.*, **3 (5)**, 70-75

Luvanga J. and Kashoma I. (2022). Effect of ecotype and age on semen characteristics of three Tanzanian native chickens. *East Afr. J. Sci. Technol. Innov.*, **3 (4)**, 1-15. https://doi.org/10.37425/eajsti.v3i4.508

Maty H.N., Al-Maatheedi M.S. and Ahmed S.M. (2021). Effect of Oregostem® and imbalance diet on body performance and reproductive efficiency in male quails. *Iraqi J. Vet. Sci.*, **36 (1)**, 29-37. https://doi.org/10.33899/ijvs.2021.128810.1602

Nerdy N. (2018). Determination of sodium, potassium, magnesium, and calcium minerals level in fresh and boiled broccoli and cauliflower by atomic absorption spectrometry. IOP Conference Series Materials Science and Engineering, 288 (1), Art. No. 012113. https://doi.org/10.1088/1757-899X/288/1/012113

Peters S.O., Shoyebo O.D., Ilori B.M., Ozoje M.O., Ikeobi C.O.N. and Adebambo A.O. (2008). Semen quality traits of seven strain of chicken raised in the humid tropics. *Int. J. Poultry Sci.*, **7 (10)**, 949-953. https://doi.org/10.3923/ijps.2008.949.953

Sayed M.A.M., Abouelezz F.M.K. and Abdel-Wahab A.A.M. (2017). Analysis of sperm motility, velocity, and morphometry of three Egyptian indigenous chicken strains. *Egyp. Poult. Sci. J.*, **37 (4)**, 1173-1185. https://doi.org/10.21608/epsj.2017.5605

Soliman M.M., Mousa S.M. and Bahakaim A.S. (2016). Effect of dietary oregano supplementation on productive performance and some physiological parameters of Inshas chickens strain. *Egyptian Poultry Sci. J.*, **36 (1)**, 67-83. https://doi.org/10.21608/epsj.2016.11375

Valsa J., Skandhan K.P., Khan P.S., Sumangala B. and Gondalia M. (2012). Split ejaculation study: Semen parameters and calcium and magnesium in seminal plasma. *Central Europ. J. Urol.*, **65 (4)**, 216-218. https://doi.org/10.5173/ceju.2012.04.art7

Yakubu J.A., Onyeodi U.A., Daniyan L.O., Shuaibu A., and Abangwu U.J. (2022). Space-earth coupling with relation to earth's thermal capacity: A case study for Nsukka region, Nigeria. *Int. J. Phy. Sci.*, **17 (1)**, 1-9. https://doi.org/10.5897/IJPS2021.4964