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Phenotypic Characterization of Local Chickens (*Gallus Gallus Domesticus*) In Bekwarra Cross River State, Nigeria

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Abstract

This study was conducted in Bekwarra Local Government Area of Cross River State, Nigeria, to identify and determine some characteristics of local chickens. A total of 530 adult chickens of both sexes and 111 fresh eggs were carefully examined at seven administrative council wards of the local government. About 43.00% of the birds observed were male while 57.00% were females. Statistical Package for Social Sciences (SPSS) was employed to carry out descriptive statistics on qualitative and quantitative data of identified chicken population in the respective areas.The result showed predominantly pea comb type (38.90%). Eye color was black (44.72%), light-brown (14.91%), dark-brown (12.83%), dark-red (11.30%), orange (11.32%), and pink (1.10%). For plumage colour, 36.23% were classified as black, 20.00% as white, 13.02% as brown, 9.43% as red, 7.93% as multicolored, 3.21% as black-white, 3.02% as grey, 2.45% as grey-white, 2.26% as black-brown, 0.94% as ash-black and 0.57% as ash respectively. Most chickens (31.90%) had yellow shanks, while 19.60%, 18.50%, 11.30%, 6.40%, 5.10%, 3.40%, 3.00%, 0.40%, had white, greenish, milky, ash, dark-ash, pink, red, and light brown respectively. An average live, body circumference, body length, shank, head and neck length were; 1.80kg, 42.7 ± 0.03cm,55.8 ± 0.21cm, 12.20 ± 0.4cm, 5.1 ± 0.03cm, and 8.9 ± 0.5cm. The average egg width, egg length and egg weight were; 5.2 ± 0.03cm, 7.6 ± 0.01cm, 31.6 ± 0.05g with 12 clutch size and 3 clutches per hen per year. The indigenous chicken population in Bekwarra, Nigeria, is mostly black with black eyes, white eggs and yellow shank. There were distinctive differences in almost all the measurable traits parameters examined. These distinctions provide the basis for which they could be classified and improved.

Keywords: Phenotypic; Characterization; Local chickens; Bekwarra

Introduction

The Nigerian livestock population is estimated to be 165.3 million [1] However, the native chicken constitutes 80% of the120 million poultry birds in Nigeria leaving Guinea fowl 11.20%, duck 5.70%, turkey 2.00% and others 1.10% [2] Native chicken constitutes about 45.8-83.2% of the total meat consumed in Africa. This meat is characterized by excellent taste, flavor, juicy, tender, inviting, nutritious, appetizing with low fat and cholesterol. It contains 51% water and 320 calories, 100g of meat compared to exotic broilers with 71% water and 151 calories, [3,4]. More than 80% of the total indigenous chicken population in Nigeria are found in the rural households. Their products are preferred by majority of Nigerians because of the leanness and suitability for special dishes [5]These outputs (egg and meat) are readily available to both the rural and urban areas and serves significantly as a rich source of protein in diets.

Indigenous chickens are hardy, can withstand harsh climate under minimal management, possess ability to incubate and hatch on their own, brood and scavenge for their food, with appreciable immunity from endemic diseases, and can thrive effectively well under inadequate nutrition at different agro-ecological zones. They possess distinct genetic resources which significantly influence their production potentials, survivability and adaptation. They survive on crop residue, weed seeds, insects, kitchen and agro- industrial waste **[6]** Its production is popular in the rural area as high cost of formulated feed, health management, lack of electricity and poor brooding technique limits industrial poultry production. Local chickens are however important as it account for the nutritional needs of the family, small cash flow reserve during celebration from the sales of eggs, meat and live birds. They are also useful for religious and recreational purposes and can be harnessed for rural poverty reduction. They are kept to supplement meals, honor guest as gifts, supply manure for crops and to serve as a means of checking time [5]The sales of local chickens (live birds and other products) contribute about 15.38% of rural household income in Nigeria. Some are potential egg producers, while others are known for their excellent meat quality and or for dual purposes. These species represent a valuable resource for livestock development because their extensive genetic diversity allows for rearing poultry under varied environmental conditions, providing a range of products and functions.

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The regular breeding failure in livestock production can be attributed to the gross absence of comprehensive information on animal genetic resources. This could however be controlled through detailed characterization studies of a sub population of local chickens in a large population. [7] observed that local chickens are the most thriving industry for small holder farmers in Nigeria and contributes about 25.6% of the country economy. This therefore, indicates that efforts to improve upon local chickens would directly alleviate rural poverty and boost the nation's economy.

In Nigeria, indigenous chickens were characterized along the genetic lines of plumagecolour and feather type as(normal and frizzled), body structure as (naked neck and dwarf types) and colour variants as (black, white, brown, mottled etc.) The genetic resources embedded in local poultry of Bekwarra, still await full exploitation that could provide the basis for improvement to produce breeds that can adapt to local conditions for the benefits of farmers. This suggests that characterizing local chicken would help to assess their genetic resources for improvement and selection purposes This study was carried out to identify and determine some characteristics of local chickens in Bekwarra Local Government, Cross River State, Nigeria, to provide a comprehensive information on their genetic resourcesand production potential.

Material and Method

Study area

This study was carried out in Bekwarra, Northern Cross River State, Nigeria. The state is located at latitude 8°41'N and 14°5'E of the equator with a total population of 4,151,193 and land mass of 69,436km^2 (NPC, 2001). Bekwarra lies within latitude 6° 41'38''N and 8° 71'E of the equator and occupies 306 km^2 with a total population of 105,822 [8]. The area is a thick rain forest zone, characterized by minimum temperature of 10-22.3°C in December which could rise to a maximum of 18.5-35.8°C in February. The altitude of the study area ranges from 400-3000mm above sea level. Annual rainfall is between 1500-1849.3mm in areas with lower altitude and 1556-1960mm in the high lands areas. It has low intensity of light due to thick forest with a relative humidity ranging between 61% in February, 92% in August and yearly average of 95% [9].

The vegetation of the zone represents an interface between temperate a tropical rainforest which favors livestock and crop production which are the main activities in the area. Bekwarra Local Government Area is made of has 10 administrative council wards namely: Gakem, Ugboro, Ikparikobo, Nyanya, Abuochiche, Ibiaragidi, Ukpah, Ububa, Beten and Afrike.

Sampling technique and procedure

Seven council wards was carefully studied, with four villages from each of; Nyanya, Gakem, Ugboro, Beten, Abuochiche, Ibiaragidi, and Ukpah. The sample frame was four villages per council ward, and 4-5 households per village. In each household, 5-7 matured chickens (hens and cocks) were sampled for quantitative and qualitative traits. Fresh eggs collected from chicken in the sampled area were also considered for external egg quality traits.

Purposive and multistage sampling technique was adopted in selecting the wards and villages with large population of local chickens for close observations. This was done based on wide information provided by the community heads of each wards. Households and matured birds were selected at random from the list of households that have been keeping local chickens for more than three years.

Data collection

Primary data was collected with the aid of 208 well-structured questionnaires. Multistage sampling technique was employed for selecting respondents. The first stage involved the selection of seven wards from the local government area. The second stage involved the selection of villages from the selected wards, and the third stage involved the selection of 5-6 households in each of the selected villages. Adult local chicken in the selected households were then observed for both qualitative and quantitative trait measurements. Fresh eggs were collected at random from the sampled house for egg quality measurements. Data was collected from a total of 530 adult local chicken and 111eggs. The population was composed of males 222 and 308 females. Among the households sampled, birds were observed individually for phenotypic traits including; plumage features, eye, shank, egg and beak colour, comb as well as feather type. Body spur and comb length and height were measured. Other body and egg traits were examined. These parameters were determined as thus:

Shank Length (SL) - the length of the torso-metatarsus from the hock joint to the pad, with the aid of a calibrated measuring tape in centimeter. **Kneel Length (KL)** –was be considered as the length from the v-joint to the end of the sternum using a meter rule or measuring tape in centimeter (Cm). **Wing Length (WL)** –was taken as the length of the wing from the scapula joint to the last digit of the wing in centimeter (Cm).**Body Length (BL)** – was determined with tape as the distance from the tip of the beak over the neck through the trunk in centimeter (Cm). E**gg length (EL)** – was determined as the distance from one end of the egg to another in centimeter.**Egg Width (EW)** – was measured as the widest diameter using micrometer screw gauge in centimeter. **Body Girth (BG)** – was taken as circumference of the breast region with graduated measuring tape in centimeter (Cm).**Egg Wight (EWT)** –gg weight was measured using a sensitive digital scale 'ohaus (D110 max: 4100g) balance in grams (g).

Data analysis

Statistical Package for Social Sciences (SPSS) was employed to carry out descriptive statistics on both qualitative and quantitative data of indigenous chicken population identified in the study areas.

Result and Discussions

Table 1 presents the physical characteristics of indigenous chicken in Bekwarra, Northern Cross River state Nigeria. The commonest plumage colour is black with 36.23%, followed by white with 20.00%, brown 13.02%, 9.43% red, 7.93%

Table 1: Physical characteristics of Indigenous Chickens in Bekwarra, Nigeria.

COLOUR	FREQUENCY	PERCENTAGE
PLUMAGE COLOUR		
Black	192	36.23
White	106	20.00
Brown	69	13.02
Red	50	9.43
Multi- colored	42	7.93
Black- white	17	3.21
Grey	16	3.02
Grey- white	13	2.45
Black-brown	12	2.26
Reddish –black	5	0.94
Ash-black	5	0.94
Ash	3	0.57
	N(530)	**100.00**
SHANK COLOUR		
Yellow	169	31.90
Black	104	19.60
White	98	18.50
Greenish	60	11.30
Milky	34	6.40
Ash	27	5.10
Dark-ash	18	3.40
Pink	16	3.00
Red	2	0.40
Light brown	2	0.40
	N(530)	**100.00**
BEAK COLOUR	259	48.90
Yellow	112	21.10
Brown	59	11.10
Ash	48	9.10
White	36	6.80
Pink	10	1.90
Orange	6	1.10
	N(530)	**100.00**
EYE COLOUR		
Black	237	44.72
Light-brown	79	14.91
Dark-brown	68	12.83
Dark-red	60	11.32
Orange	59	11.13
Pink	27	5.09
	N(530)	**100.00**
FEATHER TYPE		
Normal	303	57.20
Naked neck	131	24.70
Frizzled	96	18.10
	N(530)	**100.00**
COMB TYPE		
Pea	206	38.90
Single	128	24.20
Rose	98	18.50
Double	80	13.70
Walnut	25	4.70
	N(530)	**100.00**

multicolored, 3.21% black-white 3.21%, grey 3.02%, grey-white 2.45%, black brown 2.26%, 0.94% reddish-black and ash-black, and 0.57% ash.

Variation in phenotype is what characterizes local chickens [10,11] in Botswana observed indigenous chicken to be multi colored, but predominately black. [12,13] reported similar observation for the indigenous chickens of Plateau state Nigeria. These reports are in agreement with those obtained in this study. The explanation is that a number of genes interacts to determine plumage colour [14] and probably because indigenous chickens have not been artificially selected. Yellow and black were the most frequent shank colours with 31.90% and19.60% respectively. Other variant colours like white and greenish were next with 18.50% and 11.30% which were followed closely by milky 6.40%, ash 5.10%, dark-ash 3.40%, pink 3.00%, red 0.40% and light -brown red 0.40%. The observed occurrence of yellow and black in this study is comparable to evidence in literatures [15-17]. The variations in shank colour observed are most probably due to the difference between free ranging local chickens in different geographical areas, and the combination of pigments and gene responsible for colour determination. The presence of yellow shank is due to dietary carotenoid pigments in the epidermis when melanin was absent. The occurrence of black results from the presence of melanic pigment in the dermis and epidermis. The presence of black pigments in the epidermis might account for the greenish shank. In the absence of both pigments, the shanks were white. The varying shade of milky, ash and other colours was due probably to the interactions of the dermis-epidermis pigments.

The low frequency of white shank colour in the areas contradicts [18,19]who reported 47.92% for chickens in Botswana. The proportion of black shank 19.60% observed in this study was lower than the findings of [20] who reported 42.20%.

The frequent eye colour among chicken populations studied were black and light–brown with 44.72% and 14.91% respectively. This is followed by dark-brown 12.83%, dark –red 11.32%, orange11.13%, and 5.09% pink. This is consistent with the reports by [21].

Eye colour characteristics depend on carotenoid pigmentation and blood circulation in the eye. Black (48.90%) was the most wildly distributed beak color in the study area. This was followed by yellow, brown, ash, white, pink and ash with 21.10%, 11.10%, 9.10%, 6.80%, 1.90%, and 1.10%, respectively.

Pea comb type predominated with 38.90%, next was single 24.20%, rose18.50%, double13.70%, and walnut 4.70%. The predominant pea comb in this study area tallies with the reports by [22] for chickens from Dekina. In contrast, single combed chickens were reported to be predominant, followed by rose [23-25] for indigenous chicken in Nigeria. [26,27], observed similar reports in Asia and Bangladesh. The occurrence of different comb types might be due to the interactions of different genes responsible for comb expression.

Combs are vital for heat loss in birds [28]. This implies large

comb would provide an efficient means of heat dissipation. Therefore, high proportion of pea comb type observed in the study area suggests selections advantage. There was difference in comb size with sex the of birds. Both small, medium and large comb occurred at variable proportions in Nigeria. Chickens with small comb were frequent followed by medium and large. Small and medium size comb was predominant with female and male were observed with large combs. This shows that male birds with large combs are significantly resistant to heat effect than female.

According to [29] reproductive hormone such as follicle stimulating hormone (FSH) have pleiotropic effect on the size of face and head appendages. Hence, the occurrence of small sized comb in the population suggests that the size of the face and head appendages of chickens observed could have been influenced by reproductive hormones. This might also, be attributed to sexual dimorphism since all male chickens in the study area appeared to have larger combs than females.

Normal feather type (57.20%) was the most prevalent among the chicken population studied. Frizzle was 18.10% with naked neck chicken 24.70%. This is in line with the findings of [30] for indigenous chicken in Tanzania. Possible explanation for rare expression of frizzled character in the study area is that frizzing gene is a rare mutant with recessive effects and lack selection advantage in the population. Also, frizzled feather pattern tends to provide poor insulation in cold climate

Body Measurement Traits of Indigenous Nigerian chickens

Table 2 shows the mean values and standard error (SE) of bodymeasurement traits of local chicken. The mean population of hen, cock, growers and chicken owned per house hold were 5.1 ± 0.09, 3.4 ± 0.02, 4.1 ± 0.04 and 3.8 ± 0.03 respectively. The average body weight of 1.5 ± 0.05Kg for hen and 2.0 ± 0.01Kg for cock observed in this study were higher than 1.3Kg reported by [31,32] This study confirmed the research findings on local chickens by [33] in Plateau State and could be compared with the findings of [34] for traditional scavenging chickens of Uganda. However, [35]reported much higher weight (3.0Kg) in Yobe for commercial birds. The higher weight is expected because commercial birds grows faster than local birds. Low body weight observed in this study can be attributed poor management and genetic make-up of birds. Variations in the weight of male and female birds in the studied area are in harmony with previous reports by [36-41]for Nigerian, Tanzania, Eastern Europe, and Ethiopia native chicken populations. This however indicates that the live weight of an animal is sex dependent.

Differential growth rate of animals account for the heavier weight of male to female birds observed in Nigeria. This further buttress the fact that indigenous chickens in Bekwarra, Nigeria has not yet undergone gene mixing with exotic lines else their weight would have been quite higher.

The mean shank length (12.2 ± 0.04cm) of adult chickens found in the study area is higher comparable with 11.3cm reported by [42] and 10.0 ± 0.29cm reported by for local chicken population in Jos North, Nigeria. This length further contradicts

Table 2: Mean and standard error (SE) of Body Measurement Traits of Indigenous chickens.

Characters	Mean (x)	Standard error (SE)
Number of chickens		
Hen	5.1	0.09
Cock	3.4	0.02
Growers	4.1	0.04
Chicks	3.8	0.03
Body weight (Kg)		
Hen	1.5	0.05
Cock	2.0	0.01
Body parameters (Cm)		
Body circumference	42.7	0.03
Body length	55.8	0.21
Shank length	12.2	0.04
Keel length	9.8	0.02
Wing length	25.0	0.70
Tail length	14.7	1.71
Neck length	8.9	0.50
Head length	5.1	0.03
Beak length	3.8	0.10
Comb length	3.9	0.60
Spur length	1.3	0.18
Wattle length	3.3	0.21
Wattle height	3.3	0.01
Comb height	5.2	0.23

previous report by who indicated shorter shank length range of 5.5 ± 0.1Cm, 7.43 ± 7.36Cm and 7.54 ± 0.9Cm and 9.1Cm for local chickens of North Central, Eastern Nigeria and Ethiopia.

The long shank length observed in this study results from breed difference, prevalence of major gene and extensive husbandry system which allows birds to scavenge long distance for their food.

The comb length, comb height, wattle length and height in the study varied with sex. The explanation for this is due probably to age, genetic constitution, and breed difference. Indigenous birds in Bekwarra possess a body circumference of 42.7 ± 0.03cm, with short spur. This is consistent with the research findings by who reported 31.50 ± 0.33cm and 37.08 ± 0.24cm for the indigenous chickens in Ayingba and DekinaKogi State. It however contradicted the report of who indicated 13.05 ± 19.15cm for five genetic groups of native chickens, and Mancha, 2004 who reported 26.90cm and 27.50cm, and 38.1Cm for necked neck, and frizzled normal feathered chicken sin Plateau state. This variation might be attributed to genetic composition of birds and feed availability.

Chickens in the study area have long body, wing, and tail length (55.8 ± 0.21cm, 25.0 ± 0.70cm, 14.70 ± 0.03cm) respectively. Long body length (55.8 ± 0.21cm) observed in this study higher

contradicted 27.0 ± 01cm reported by for native chickens in Botswana, 33.8 ± 0.50cm by for birds in Kogi state, 36.70cm, 37.60cm and 39.2cm indicated by for naked neck, frizzled and normal chicken, respectively.

The comb length (3.9 ± 0.6cm), comb height (5.2 ± 0.23cm), and wattle length (3.30 ± 0.21cm) and wattle height (3.30 ±0 .01cm) in the study varied among birds and sex. The explanation for this due probably to age, genetic constitution, and breed difference.

Moderate neck and keel length were observed with 8. 9 ± 0.50cm, and 9.8 ± 0.02cm, respectively. The mean value and standard error of wattle and comb height of chickens studied were 3.3 ± 0.01cm, and 5.2 ± 0.23cm.

Table 3 shows the Pearson correlations among some egg traits of local chickens in Bekwarra, Nigeria. The direct effect of egg weight and number of chickens hatched was positive and significant (r= 0.263; p<0.01). There existed a positive association between the number of clutches per hen per year and clutch size per year, numbers of chicken hatched per year, egg weight and egg length though not significant (r= 0.134; r= 0.066; r= 0.020 and r= 0.116).

Highly significant and positive relationship existed between clutch size per year and the number of chickens hatched.

Egg weight, egg width and egg length are associated with clutch size per hen per year but not significant (r= 0.103; r= 0.074 and r= 0.160). Similar relationship also existed between the number of chickens hatched per hen per year and egg weight, width and length (r= 0.120; r= 0.129; r= 0.061). Egg weight is directly affected by egg length (r= 0.248 p<0.01) and positively related to egg weight though not significant (r= 0.078). Egg width was positive and related to egg length though non- significant.

That there was no significance between clutch size and other egg parameters reported in this current study agreed with the research findings Similarly, that egg width has non- significant correlations with egg length contradicted the reports by The high correlation of egg length with egg weight in this study implies that the selection for egg length could improve egg weight. Similarly, the high value of correlation between clutch size and the number of chickens hatched observed in this study implies that a unit change in the clutch, increases the number of chickens hatched per hen per year. The correlation between the number clutch per hen per year and egg width in this study is consistent with the evidence in literatures by This high correlation suggests that selection for egg number could improve egg weight.

Table 4 represents some of the egg production traits of indigenous Nigerian chickens. The average mean weight, length and width of local chickens observed were31.6 ± 0.30g, 7.6 ± 0.10cm, and 5.2 ± 0.30cm. The chickens exhibited 83.7 ± 1.30% hatchability. Mean clutch size per hen was 12.5 ± 0.30 and 2.5 ± 1.3 was the number of clutches per hen per year. Mean value of 12.5 ± 0.09 eggs per clutch recorded in this study agreed with the reports of for native chicken kept under extensive system. This study compares favorably with the reports of who observed an average clutch size of 10 eggs in Jos Northern, Nigeria and contradicted the findings of Mapiye and Sibanda, 2005 who indicated (7.86-8.52) eggs per clutch in who reported 21.12 eggs for the local chicken population in Benue and Nasarawa state, respectively. The mean egg weight 31.6 ± 0.05g observed in this study agreed with who reported 31.61g but lesser than 37.99 ± 0.8g for local chicken under intensive system reported by and 39.0 ± 0.1g, and 37.1 ± 0.1g for guinea savannah and rain forest zones of Nigeria by The variation in egg weight observed in this study is due to difference in bird genetics, management system, locations, feed quality and availability, disease factors and seasonal variations. Seasonal variations affect feed quality and availability and directly influence egg production and egg quality in birds.

Eggs from frizzled chicken in Bekwarra were heavier than necked neck and that of normal feathered chickens under the same conditions. This aligned completely with the results reached by which indicated that frizzled and necked neck chicken laid heavier egg compared to normal feathered birds. The variation in egg weight in relation to plumage characters is due to thermo regulation efficiency and genetic make-up of the different birds.

The high percentage hatchability (83.7%) of local chickens observed in Bekwarra is similar to 88.24% reported by Nwosu and Birds in Bekwarra, Northern Cross River State exhibits higher hatchability potential compared to 69.3% for the native chicken population in Dekina, Kogi State indicated by and 56.0% by for birds in Western Nigerian. These differences are due primarily to variation in egg shell characteristics, egg size, brooding management and egg storage.

Table 3: Correlation coefficients among Egg Traits of Local Chickens in Nigeria.

Traits	CHY	CTS	NOH	EGW	EWT
CTS	.134^{ns}				
NOH	.060^{ns}	.815**			
EGW	.263**	.103^{ns}	.120^{ns}		
EWT	.020^{ns}	.074^{ns}	.129^{ns}	.078^{ns}	
EGL	.116^{ns}	.160^{ns}	.061^{ns}	.248**	.159^{ns}

*** = (p<0.05)** **** = (p<0.01)** **^{ns} = Not significant**

CHY= Number of clutches per hen per year, **CTS=** Clutch size per hen, **NOH**= Number of chickens hatched per hen, **EGW** = Egg weight in gram, **EGL** = Egg length in centimeter, **EWT** =Egg with in centimeter.

Relatedness among measurable Egg Trait of Indigenous Nigerian Chickens

Table 4: Egg Production Traits of Indigenous Nigerian chickens.		
Egg production traits	**Mean (x)**	**Standard error (SE)**
Clutch size	12.5	0.30
No. of clutch/hen/year	2.5	1.30
Hatchability (%)	83.7	0.02
Egg weight (Cm)	31.6	0.05
Egg length (Cm)	7.6	0.01
Egg width (Cm)	5.2	0.30
Egg Production Traits of Indigenous Nigerian chickens		

Management system, nutrition, and genetic composition of the sub-populations could account for the variation in eggs length, width, clutch size and number of clutches per hen per year in this study. Predominance of white coloured eggs followed by brown coloured observed in this study was also reported by This must have resulted from the fact that native chickens are kept with little or no controlled breeding and the frequent mating of white with brown plumage colour population.

Conclusions

The indigenous chicken population in Bekwarra revealed heterogeneity in most of morphological and phenotypic traits considered. Further work can be done to standardize the phenotypic characters observed in the study area. Notwithstanding, it can be maintained at the interim that the local chickens in Bekwarra, Nigeria are multicolored. They are pea combed, black eyed and beak, with yellow shank.

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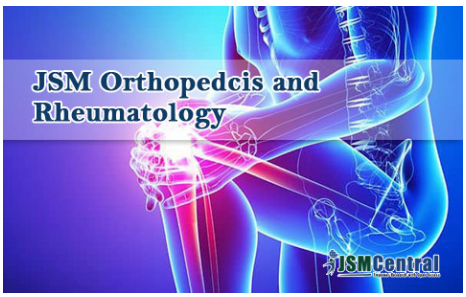

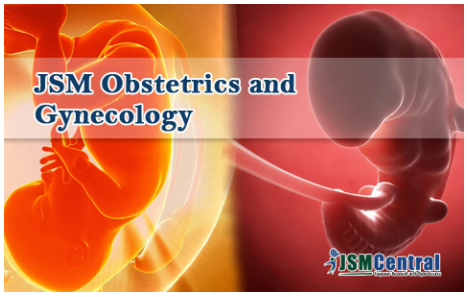

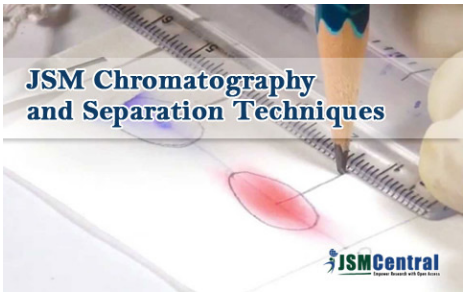

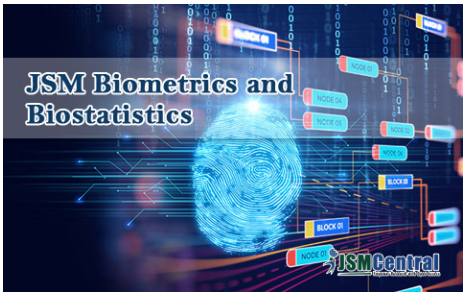

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