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Fetal Sex and Maternal Stature vs. Spontaneous Vaginal Birth: Considering Sex Specific State-of-the-Art Anthropometric Investigations at Term Pregnancy

Uchenna Kenneth Ezemagu[1], Godwin Chinedu Uzomba[1*], Chukwuemeka Ubochi[1], Rachel Ogbu[1], Augustine Oseloka Ibegbu[1], Friday Chubuzor Egba[2], Olisa Onuora[3], Paul O. Ezeonu[4], Thecla Ezeonu[2]

1. *Department of Anatomy, Faculty of Basic Medical Sciences, College of Medical Sciences, Alex Ekwueme Federal University Ndufu Alike, Ebonyi State, Nigeria*
2. *Department of Paediatrics, Alex Ekwueme Federal University Teaching Hospital, Abakaliki (AEFUTHA) Ebonyi State, Nigeria*
3. *Department of Obstetrics and Gynaecology, AEFUTHA, Ebonyi State, Nigeria*
4. *Provost, College of Medical Sciences, Alex Ekwueme Federal University, Ndufu Alike, Ebonyi State, Nigeria*

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Corresponding Information:
Godwin Chinedu Uzomba,
Department of Anatomy, Faculty of Basic Medical Sciences, College of Medical Sciences, Alex Ekwueme Federal University Ndufu Alike, Ebonyi State, Nigeria

Email: uzomba.godwin@funai.edu.ng

ABSTRACT

Background & Objective: We considered maternal and birth anthropometric features and fetal sex in developing a labor protocol.

Materials & Methods: A prospective study of 400 mothers, having healthy pregnancies and their newborn singletons in gynecology ward of Alex Ekwueme Federal University Teaching Hospital, Abakaliki. The study adopted a convenient sampling technique to select the volunteers from 1st July to December 2020. Birth and maternal anthropometries; BMI, height, weight, birth head girth (BHG), waist girth (WG), hip girth (HG) and delivery outcomes: birth mode and duration of 1st and 2nd phases of labor, and Apgar score at 1 minute of birth were measured, using Institute of Medicine guidelines.

Results: Maternal age, weight, and HG, and WG at term pregnancy and fetal sex could determine birth mode and weight (P<0.05). The associations for duration of 1st phase of labor and maternal and birth anthropometries were inconsistent. Fetal sex, birth mode and features and maternal anthropometries; body fat, age, BMI and HG were associated with duration of 2nd phase of labor and Apgar score.

Conclusion: Maternal anthropometries predispose birth features, and advance age of mothers, relatively large WHR and fetal macrosomia at term pregnancy could increase duration of 2nd phase of labor and risk of a male birth, developing abnormal Apgar score. The strong association between anthropometric variables of a mother and her baby suggests that anthropometric investigations could enhance the choice of birth mode and minimize vaginal birth complications. The study emphasized on the need of a sex specific state-of-the art anthropometric investigations at term pregnancy.

Keywords: Medical Anthropologist, Apgar Score, Labor Protocol, Waist Gait, Vagina

Introduction

A minimum risk of spontaneous vaginal birth in healthy pregnancy can be possible, if a comprehensive obstetrics and gynecology protocol taking into account how birth and maternal features affect birth outcomes is adopted in hospitals globally. The rate, with which expectant mothers visit traditional birth attendants in our locality is overwhelming but few mothers visit maternity or conventional hospitals, especially, when labor gets complicated. Usually, neither healthy expectant mothers nor their husbands approve cesarean birth, easily (1), due to the cultural perceptions and disbelief of Cesarean deliveries (2, 3). Newborn and maternal size (4-6) and genetic and environmental factors (7-9), and nutrition, psychosocial stress, malaria and socio-demographic factors (10) could affect birth outcomes.

Knowing how fetal sex and size affect birth dynamics could enhance prognosis and diagnosis of pregnancy and birth complications (11-13). Invariably, fetal sex could affect the rate of intra uterine growth in the early stage of pregnancy (14, 15), and birth weight (16), and skin fold thickness (17). Duration of stages of labor has been linked to cervical dilatation patterns, and most countries that induce or augment labor with *Oxytocin* and practice instrumental deliveries, recommend planned cesarean section in breech delivery over vaginal delivery **(18)**. The size and position of fetal head in the pelvis could determine birth dynamics **(19)**.

In our locality, 36% of women give birth at home with the help of relatives or a traditional birth attendant, which results to 35% mortality rate of neonates in Ebonyi State, which affects more male birth than female birth: Nigeria Demographic and Health Survey **(20)**. Globally, out of four million deaths of neonates annually, 98% occur due to poverty, ignorance or lackadaisical attitude of mothers and birth attendants in developing countries **(21)**. Following the cultural expectation and death rate of male children in our locality, efforts to improve the birth outcomes are highly required.

The study correlated maternal and birth anthropometric features and fetal sex and birth mode and Apgar score, duration of 1st and 2nd phases of labor. Second, it explained the peculiarity of a male or female birth, and the need of a sex specific state-of-the-art anthropometric investigation at term pregnancy. The study could predict *dytocia* or rapid labor and provide empirical evidence via anthropometric investigations that could enhance the choice of birth mode and minimize vaginal birth complications. The data base will develop the existing labor protocol in gynecology Department of AEFUTHA, as the study is first of its kind in Nigeria.

Methods

Patients

It was a prospective study of 400 mothers, who gynecologists diagnosed to have healthy term pregnancies (range; 38±2wks) and their newborn singletons (200 male; 200 female) in gynecology ward of AEFUTHA. The cross-sectional study adopted a convenient sampling technique to select the volunteers from 1st July to December, 2020. Each mother consented to participate in the study, voluntarily.

Sample Size

Sample size calculation for cross sectional study as adopted by Olafimihan et al. **(22)**:

$$\text{Sample size} = \frac{Z_{(1-a/2)}^2\, SD^2}{d^2} \ \text{(10\% attrition rate)}$$

Where $Z_{1-a/2}$ = is standard normal variance

SD = standard deviation of variables.

d = absolute error or precision

The calculation gave a minimum sample size of 373 expectant mothers. Considering the attrition rate, we involved a total sample size of 400 mothers.

Exclusion Criteria

Cases of multiple pregnancies, still birth, congenital deformities, and underlying problems requiring planned caesarean section were excluded.

Ethical Approval

The Research and ethics Committee of AEFUTHA approved the study (AEFUTHA/REC/VOL2/2019/213).

Methods

Measurement of body height, weight, BMI, hip (HG) and waist girth (WG) of the mothers, and birth weight, head girth (BHG), and length, and birth mode and duration of 1st and 2nd phases of labor, and Apgar score at 1 minute of birth. The precision of the instruments was adjusted, and the data were obtained via direct standard measurements. The anthropometric variables of the mothers were obtained in the labor room, privately. The height and weight of the mothers were recorded to 0.1cm and 0.1kg accuracy, respectively, while they were looking at Frankfurt plane and standing erect, without support on a health scale (model RGZ-160, England) **(23, 24)**. BMI [Weight/Height^2 (kg/m^2)] was classified as underweight (<18.5 kg/m^2), normal (18.5-24.9 kg/m^2), overweight (25.0-29 kg/m^2) and obese (≥ 30 kg/m^2) (18, 25, 26), and Michelle's method for body fat calculation **(27)**. The circumference at the middle of lowest palpable rib and the iliac crest, and the widest perimeter over the buttocks of each subject at erect position and end of a normal expiration were recorded with a stretch-resistant tape as WG and HG, respectively **(26)**. Birth, head girth, weight and length within 1hr of birth, were obtained using standard methods in studies **(28, 29)**. Birth weight was measured; 0.1 kg accuracy with Bassinet weighing scale (model 180), and birth length and head girth were measured with a stretch-resistant tape (0.1cm, accuracy). Each parameter was measured twice, and the average was considered. Birth mode (spontaneous vaginal and Cesarean) and length of 1st and 2nd phases of labor and Apgar score at 1 minute of birth were recorded in the obstetrics form of each patient by the research assistants and midwives. The authors check errors in data collections daily.

Data analysis

Mean differences in maternal and birth parameters were analyzed with two sample t-tests (Table 1). Association of maternal and birth anthropometries and length of labor were analyzed in Table 2; Pearson correlation. Prediction for birth mode of a singleton, (Table 3) and length of labor (Table 4 & 5), and Apgar score at 1 minute of birth (Table 6, 7 & 8) was done with significantly related anthropometric variables (*P* value <0.05; <0.001). Frequency distribution of birth weight categories and birth mode. The data analyses were done in SPSS version 23 (SPSS Inc. Chicago, IL).

Results

The result revealed the followings: maternal age, body fat, weight and HG correlated with birth weight of a male singleton, only, while the association of male and female birth length with maternal height, weight, HG and WG was consistent. Birth mode and duration of 1st phase of labor for male birth could depend on maternal height and weight, and WHR, birth length and weight, respectively. Although, the anthropometric features could not predict the duration of 1st phase of labor, and 2nd phase for male birth, maternal BMI, HG, age and body fat could determine the length of 2nd phase of labor for a female birth. Apgar score was dependent on birth mode and weight and WG and duration of 2nd phase of labor of a female newborn. Distribution of birth weight categories and birth mode showed a greater prevalence of spontaneous vaginal birth. Further result analyses were shown in Tables 1 – 8.

Table 1. Descriptive Statistics of Maternal and Newborn Anthropometries, and Duration of Labor at AEFUTHA

Variables	Male (n= 200)			Female (n= 200)			*p-value*
	Mean ±SD	Min.	Max.	Mean±SD	Min.	Max.	
Newborn							
Birth weight (g)	3195.18±522.87	1900.00	5000.00	3091.49±429.22	1400.00	4200.00	0.200
Birth length (cm)	44.70±9.97	35.00	59.00	46.23±4.55	31.00	53.00	0.622
Head girth (cm)	35.71±2.12	24.00	39.00	34.95±4.07	18.75	35.26	0.714
1st phase of labor (hr)	14.18±1.96	10.00	18.00	13.71±2.00	10.00	18.00	0.130
2nd phase of labor (hr)	0.47±0.12	0.30	1.00	0.46±0.12	0.30	1.00	0.387
Maternal							
Age (years)	30.45±4.53	21.00	42.00	29.44±4.18	17.00	40.00	0.125
Weight (kg)	74.92±11.07	50.00	100.00	75.29±11.21	51.00	96.00	0.826
Height (m)	1.63±0.25	1.33	1.76	1.61±0.11	1.20	1.76	0.489
BMI (kg/m^2)	28.78±3.89	18.50	38.27	29.03±3.82	17.65	42.36	0.669
Waist girth (cm)	103.75±11.45	70.00	118.60	104.98±12.08	71.00	133.00	0.489
Hip girth (cm)	95.77±10.28	70.00	114.00	97.85±11.15	65.00	116.50	0.201
WHR	1.07±0.06	1.00	1.21	1.07±0.05	1.01	1.30	0.941
Body fat (%)	33.66±7.62	11.52	46.92	36.23±4.65	23.14	51.87	0.007

Mean difference of the variables were not significant, except for body fat ($p<0.05$).

Table 2. Pearson's r of Maternal and Newborn Anthropometries and Duration of Labor at AEFUTHA

	variables	Age (years)	Weight (kg)	Height (m)	BMI (kg/m^2)	Waist girth (cm)	Hip girth (cm)	WHR	% Body fat
Male birth	Weight (g)	0.320**	0.279*	0.110	0.213	0.207	0.234*	-0.033	0.135
	Length (cm)	0.130	0.540**	0.445*	0.243*	0.60**	0.473*	0.225*	0.528**
	Head girth (cm)	0.003	0.020	-0.142	0.128	-0.097	-0.094	0.001	-0.100
	1st phase of labor (hr)	-0.014	0.220*	0.284**	-0.003	-0.187	0.148	0.109	0.045
	2nd phase of labor (hr)	0.152	-0.093	0.017	-0.126	-0.036	-0.092	0.043	-0.078
	Weight (g)	-0.041	0.096	-0.048	0.173	0.034	-0.043	0.193	0.174
	Length (cm)	0.041	0.482*	0.538**	-0.048	0.537**	0.482**	0.156	-0.041
	Head girth (cm)	0.111	-0.046	-0.148	0.100	-0.013	-0.025	0.032	0.118

	variables	Age (years)	Weight (kg)	Height (m)	BMI (kg/m^2)	Waist girth (cm)	Hip girth (cm)	WHR	% Body fat
Female birth	1st phase of labor (hr)	-0.175	-0.038	0.082	-0.115	0.025	0.047	-0.076	-0.144
	2nd phase of labor (hr)	0.167	-0.160	-0.062	-0.095	-0.109	-0.120	-0.009	-0.060

***. **Correlation is significant; *P* < 0.05 and 0.001 (2-tailed), respectively.**

Table 2 associated birth length with maternal height, weight, hip and waist girths. It also associated birth weight and duration of 1st phase of labor of a male newborn with maternal weight, age and hip girth, and maternal height and weight, respectively.

Table 3. Logistics Regression Table for Anthropometric Variables and Birth Mode of Male or Female Singletons at AEFUTHA

Anthropometric variables	**Birth Mode**											
	Male						Female					
Maternal Parameters	B	Sig	OR	95% CI (lower-upper limit)		Nagelkerke R Square	B	Sig	OR	95% CI (lower-upper limit)		Nagelkerke R Square
Age (years)	-0.137	0.142	0.872	-0.054	-0.101		-0.072	0.829	0.930	0.047	0.065	
Weight (kg)	-0.030	0.763	0.971	-0.821	0.129		-0.007	0.976	0.993	-0.031	0.136	
Height (m)	-5.084	0.124	0.006	-4.176	3.041		3.615	0.867	0.372	-0.081	0.144	
BMI (kg/m^2)	0.023	0.929	1.023	-0.186	0.212		0.118	0.949	1.125	-2.170	1.219	
Waist girth (cm)	-0.778	0.041	0.460	-0.214	0.236		0.245	0.618	1.278	0.277	0.310	
Hip girth (cm)	-0.801	0.036	1.228	-0.115	0.113		-0.283	0.596	0.754	-0.632	0.009	
Waist hip ratio	0.840	0.016	0.303	-0.428	0.221		-19.669	0.688	0.001	-0.011	0.044	
Body fat (%)	-0.125	0.405	0.882	0.219	0.231		0.062	0.965	1.064	-0.932	1.333	
						0.471						0.072
Neonatal Parameters												
Birth Weight (g)	-0.001	0.012	0.999	-0.044	0.035		0.000	0.657	1.000	0.111	0.285	
Birth Length (cm)	-0.191	0.020	0.826	-0.019	0.044		0.029	0.752	1.029	-0.074	1.312	
Birth Head girth (cm)	-0.367	0.060	0.692	-0.075	0.099		0.109	0.520	1.116	-0.019	0.008	

Table 3 shows that maternal waist girth (OR: 0.460) hip girth (OR: 1.228) waist hip ratio (OR: 0.303) and neonatal weight (OR: 0.999) and length (OR: 0.826) were significant factors, which could predict birth mode of a male singleton (*P* < *.05*).

Table 4. Linear Regression Table for Anthropometric Variables and Duration of 1st Phase of Labor of Male or Female Singletons at AEFUTHA

Anthropometric Variables		Duration 1st Phase of labor									
		Male					Female				
		B	Sig	95% CI (lower-upper limit)		Adjusted R square	B	Sig	95% CI (lower-upper limit)		Adjusted R square
Maternal	Age (years)	-0.067	0.546	-0.287	0.153		-0.213	0.183	-0.528	0.102	
	Weight (kg)	0.023	0.853	-0.219	0.265		0.123	0.270	-0.097	0.343	
	Height (m)	1.333	0.673	-4.926	7.591		-18.017	0.108	-40.058	4.023	
	BMI (kg/m²)	0.056	0.852	-0.537	0.648		-1.100	0.205	-2.814	0.614	
	Waist girth (cm)	0.253	0.196	-0.134	0.641		-0.162	0.618	-0.803	0.480	
	Hip girth (cm)	-0.313	0.318	-0.729	0.103		0.228	0.513	-0.462	0.919	
	Waist hip ratio	-12.781	0.513	-52.513	25.951		2.209	0.496	-4.380	8.797	
	Body fat (%)	-0.062	0.704	-0.389	0.264	0.075	0.552	0.411	-0.775	1.878	0.106
Birth	Weight (g)	0.001	0.255	0.000	0.001		0.553	0.803	0.001	0.003	
	Length (cm)	0.185	0.206	-0.104	0.474		0.057	0.524	-0.119	0.232	
	Head girth (cm)	-0.231	0.464	-0.856	0.394		0.113	0.334	-0.118	0.345	

Table 4 shows that none of the anthropometric features could predict the duration of 1st phase of labor for a male or female singleton.

Table 5. A Linear Regression Table for Anthropometric Variables and Duration of 2nd Phase of Labor of Male or Female Singletons at AEFUTHA

Anthropometric Variables		Duration of 2nd phase of labor									
		Male					Female				
		B	Sig	95% CI (lower-upper limit)		Adjusted R square	B	Sig	95% CI (lower-upper limit)		Adjusted R square
Maternal	Age (years)	0.005	0.159	-0.002	0.011		0.041	0.013	0.009	0.073	
	Weight (kg)	0.003	0.432	-0.004	0.010		-0.011	0.346	-0.034	0.012	
	Height (m)	-0.105	0.267	-0.291	0.082		2.005	0.087	-0.296	4.305	
	BMI (kg/m²)	-0.013	0.161	-0.030	0.005		0.235	0.009	0.061	0.409	
	Waist girth (cm)	0.005	0.371	-0.006	0.017	0.076	0.061	0.067	-0.004	0.126	0.195
	Hip girth (cm)	-0.006	0.321	-0.019	-0.006		-0.075	0.037	-0.145	-0.005	

	Waist hip ratio	-0.529	0.365	-1.684	-0.626		-5.900	0.077	-12.446	0.647	
	Body fat (%)	0.001	0.940	-0.009	-0.010		-0.158	0.022	-0.293	-0.024	
	Weight (g)	-7.480	0.552	0.001	0.002		0.202	0.593	-0.548	0.951	
Birth	Length (cm)	0.004	0.398	-0.005	0.012		-0.030	0.566	-0.133	0.073	
	Head girth (cm)	-0.013	0.170	-0.133	0.073		0.006	0.730	-0.030	0.043	

Table 5 shows that maternal percentage body fat (B: -0.158), age (B value: 0.041), hip girth (B: -0.075) and BMI (B value: 0.235), were significant factors, which could predict the duration of 2nd phase of labor for a female singleton, (*P <0.05*).

Table 6. A Logistics Regression Table for Anthropometric Variables and Apgar score of Male or Female Singletons at AEFUTHA

Anthropometric Variables	Apgar score											
	Male						Female					
Maternal Parameters	B	Sig	OR	95% CI (lower-upper limit)		Nagelkerke R Square	B	Sig	OR	95% CI (lower-upper limit)		Nagelkerke R Square
Age (years)	0.104	0.564	1.109	0.024	0.078		0.398	0.076	1.489	-0.133	-0.499	
Weight (kg)	0.074	0.597	1.077	0.123	0.503		-0.023	0.938	0.977	-0.007	-0.042	
Height (m)	1.725	0.621	5.612	-0.023	0.061		2.977	0.920	19.625	1.234	1.389	
BMI (kg/m²)	-0.510	0.222	0.600	-0.130	-0.152		1.288	0.354	3.627	0.567	0.671	
Waist girth (cm)	-0.405	0.036	0.667	-0.100	-0.319		0.355	0.536	1.426	0.712	0.811	
Hip girth (cm)	0.289	0.142	1.335	0.041	0.062		-0.336	0.590	0.715	0.333	0.398	
Waist hip ratio	11.021	0.636	0.611	0.579	0.730		-43.57	0.440	0.001	2.964	3.471	
Body fat (%)	0.338	0.246	1.402	0.014	0.020		-0.929	0.290	0.395	-0.054	-0.631	
Birth Parameters						0.465						0.211
Weight (g)	-0.001	0.011	0.999	-0.003	-0.006		-0.001	0.017	0.999	-0.102	-0.214	
Length (cm)	-0.104	0.226	0.901	-0.023	-0.053		-0.053	0.548	0.948	0.321	0.455	
Head circumference (cm)	0.323	0.143	0.724	0.011	0.029		0.229	0.246	1.256	0.843	0.921	

Table 6 Waist girth (OR: 0.667) and birth weight (OR: 0.999) could predict the Apgar score of a male, but only birth weight (OR: 0.999) could predict that of a female singleton (*P < .05*)

Table 7. **Test of Association for Birth Mode and Apgar score of Male or Female Singletons at AEFUTHA**

	Male			Female		
Apgar Score	Birth Mode		p-value	Birth Mode		p-value
	Spont. Vaginal	Cesarean		Spont. Vaginal	Cesarean	
Normal	95.70%	69.20%	0.001	95.10%	58.30%	0.001
Abnormal	4.30%	30.80%		4.90%	41.70%	

Table 7 shows a significant association between birth mode and Apgar score at 1 minute of birth of a male or female singleton *(P<0.05*).

Table 8 The relationship of duration for 2nd phase of labor and Apgar score at 1 minute of birth for a female singleton was significant *(p>0.05*).

Table 8. **Correlation coefficients of duration of labor and Apgar score of a male or female singleton at AEFUTHA**

Duration of Labor	Apgar score	
	Male	Female
1st phase of labor	-0.178	-0.049
2nd phase of labor	-0.172	0.264*

indicate significant relationship *(p>0.05).

Discussion

In Africa, expectant mothers prefer enduring pain of vaginal birth to Caesarean birth, simply because of its overwhelming cultural and religious supports, which boost their morale. In Nigeria, women having healthy pregnancies hardly choose Caesarian birth, even when labor prolong **(1, 3)**, which could be attributed to the general perception that length of labor for male and female birth differ. The thought was likened to disparity in time, which couples spend to make up for a party. The hospital (AEFUTHA) was chosen for the study since it is a leading hospital in Nigeria, where mothers receive tutorial on food supplements and vaccines, and diets during antenatal appointments. It also provides a referral, specialized and general clinical services, which includes maternity, vesicovaginal fistula and childcare units, and adopts standard practices, but does not schedule a planned cesarean birth for a pregnant woman with complex anatomic stature. The study revealed simple anthropometric measures to complement accessible pregnancy investigations in hospitals, and it relied on experience and data precision of the research assistants and instruments, respectively.

Similarly, authors **(17, 30, 31)** in Southern Nigeria and Singapore **(32)**, Indonesia **(16)**, Tanzania **(33)** and Dharan **(34)** observed a mean birth weight, which was classified as normal; 3091.49±429.22g, 3195.18±522.87g, as shown in Table 1. In Northern-Nigeria, weight of a male or female newborn was dependent on maternal stature and nutrition, and climate conditions **(35, 36)**. Perhaps, we did not observe an appreciable mean difference between birth lengths, weight and head girth of male and female singletons because, the mothers received routine maternity care, supplements and vaccines, and they know the benefits of balance diet, especially, during pregnancy. Birth weight increases as maternal age advances in Eastern Taiwan **(37)**, and Lebanon **(38)**, and Kuwait **(39)**, invariably; the increment was particular to male birth weight. We also observed that male birth length was dependent on WHR and birth weight on maternal weight and BMI (Table 2), which was like the findings of Fukuda *et al*. **(40, 41)**.

Comparing the prevalence of Cesarean birth in the hospital with study **(10)**, it was relatively low. Perhaps, expectant mothers in our community were infatuated with birth through vagina or simply wish to uphold the idea that Cesarean section was meant for weak women. Unfortunately, it was only considered when vaginal birth failed. Thus, most mothers in labor prefer extra time to push the baby out through the birth canal to Cesarean birth. Purposefully, this study should assist medical anthropologists and gynecologists, expectant partners and companions in choice of birth mode. Considering fetal sex, the birth mode of a male fetus could depend on birth length and weight, and maternal WHR (Table 4). Like the study **(42)**, relatively large birth weight, and maternal hip and waist girths were risk factors of vaginal birth. Specifically, the study revealed that tall mothers, who will most likely give birth to relatively tall baby boys, should opt for Cesarean birth. Like the studies **(3, 14)** fetal *macrosomia* affects more male than female. Perhaps, the high prevalence of *macrosomia* and large WHR among male birth might have contributed to the rate of Cesarean birth and risk of abnormal Apgar score in the study. The result in Table 6, indicated that for every unit increase in birth weight (OR: 0.999, B value: -

0.001, $P < .05$), with other factors in the model controlled for, the singleton was 99.9% more likely to have abnormal Apgar score, emphasizing that vaginal birth of *macrosomic* babies could increase the risk of developing abnormal Apgar score.

Often, instrumental delivery, *Oxytocin* induction, wound complication, anesthesia reaction, Cesarean birth and thrombosis are linked to fetal m*acrosomia* **(4, 35)**. Invariably, anesthesia reaction, congenital malformation, inter-observer variability, Cesarean delivery, premature birth, unhealthy pregnancy, complicated labor and trauma affect Apgar score. Contrarily, studies **(43, 44)** could not link abnormal Apgar score to Cesarean birth and large birth weight, but the study did in Tables, 6 & 7. The high rate of abnormal Apgar score with Cesarean deliveries; male 30.80% and female 41.70%, was attributed to prolong labor and other complications of vaginal birth, which necessitated the selection of Cesarean delivery. The labor flow chart of AEFUTHA, contains the followings; *macrosamia,* fetal mal-presentation, fetal distress, uterine inertia, *cephalopelvic* disproportion, *preeclampsia* and placenta *previa,* as reasons for Cesarean birth. The reasons were attributed to the followings; poor management of women during antenatal visits and labor, attempts to manipulate breech presentations of fetus while labor was in progress, access to conventional hospitals, late referral of *dytocia,* culture and religion.

Contrary to the general perception in our locality, the study revealed that length of labor for male and female singletons did not differ (Table 1). The Length of 1st phase of labor for a male birth did correlate with maternal height and weight (Table 2), but newborn and maternal anthropometries could not predict it for either male or female singletons (Table 5). Although, authors **(45)**, suggested that overweight and advanced age of mothers in pregnancy increased the length of labor, the study specifically suggested that they could prolong 2nd phase of labor, especially that of female singletons. The relationship of Apgar score and duration of 2nd phase of labor of a female birth was positive and consistent, as shown in Table 8, requiring that Apgar score should be reconsidered as an overall assessment of a child's wellbeing at 1 minute of birth. It could be that a baby girl has more instinct to enhance the five components of Apgar scoring method to survive protracted labor than a baby boy in our locality.

Conclusion

The study revealed that mothers with complex anatomic stature at term pregnancy should opt for planned cesarean birth to avoid complications. Relatively large maternal WHR and advance age and fetal macrosomia could prolong 2nd phase of labor, and easily predispose a baby boy to abnormal Apgar score. The study emphasized on the need of a fetal sex specific state-of-the-art anthropometric investigation at term pregnancy.

Recommendation

We recommend a thorough anthropometric investigation to establish a protocol, which could ascertain fetal weight and length at term pregnancy, since the study precisely revealed that relatively large birth length and weight could complicate spontaneous vaginal delivery. We also recommend a planned cesarean birth for a woman with complex anatomic stature at term pregnancy, especially for male singleton delivery.

Declarations Section

Ethics approval and consent to participate

The study was approved by the Research and Ethics Committee of AE-FUTHA, with a reference number: AE-FUTHA/REC/VOL2/2019/213. All the participants voluntarily signed a consent form. Methods adopted in this study were carried out in accordance with relevant guidelines and regulations.

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Consent for Publication

All authors gave their consent for publication.

Data Availability

The data were documented in the gynecology ward of Alex Ekwueme Federal Teaching Hospital, Abakaliki, between 1st July and 1st December 2019. The authors confirm that all data are fully available without restriction. The entire relevant data is within the manuscript.

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Authors Contributions

Conceptualization: EUK and UGC; Methodology: EFC, EUK, IOA, OO and POE; Statistical analysis: UGC, CU and RO; Data collection: EFC, RO, CU, POE and OO; Manuscript draft preparation: UGC, CU, RO, IOA and TE; Manuscript writing: UGC, EUK, POE and IOA; Review and editing: EUK, EFC and OO; Supervision: EUK, IOA and UGC. Approval to submit to your journal: All authors.

Conflict of Interest

The authors declared no conflict of interest.

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