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Comparative Appraisal of Granulocytes, C - Reactive Proteins of Cord blood and Body Weight Changes between Septicemic and Non-Septicemic Neonates and their mothers.

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ABSTRACT

Neonatal septicemia is of clinical importance due to its characterized signs of associated infection in the first month of life. This study comparatively examined serum granulocytes, C - reactive protein (CRP) and body weight changes (BWC) in pregnant mothers and their septicemic and non-septicemic neonates at birth. A total of 492 apparently healthy pregnant women and their newborns were ethically recruited and assessed for sepsis at gestational weeks 37, 38 and 39. Umbilical cord serum samples of neonates was obtained during delivery and assayed for CRP levels, polymorphs (basophil, neutrophil and eosinophils) and BWC. Neonates were monitored for 28 days to identify those who will come up septicemic. Mothers of septisemic and non-septicemic neonates, as well as their new-borns formed the experimental and control groups respectively. At 37th week of gestation, study found no significant increase ($p = 0.9808$) in maternal CRP relative to 38th and 39th weeks. For mothers of non-septicemic neonates, a significant decrease ($p = 0.0000$) was observed in CRP at weeks 2, 3 and 4 compared to week 1 post birth. ANOVA returned a insignificant increase for assessed granulocytes but eosinophil which increased significantly ($p = 0.0450$) with increasing pregnancy age. Mothers of septicemic neonates showed no significant change in polymorphs during pregnancy. Sepsis has effect on CRP during pregnancy and should be used with polymorph granulocytes during pregnancy as a routine diagnostic marker in the event of suspicion of septicemia.

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1. Introduction

In medical terms, "Neonatal sepsis" (NNS) and neonatal septicemia are used interchangeably to describe how a neonate's [newborn of between 1 and 28 days of life (Gotoff, 2010)] body system respond to infections. As in mothers, there is a huge possibility of neonatal exposures to bacterial infections, which thus potentiates septicemia. In neonates however, early and prompt diagnosis of NNS has continuously posed great threat to recovery if antibiotics therapy is not immediately initiated. This is so because blood culture which is the only approved method for NNS diagnosis apparently takes at least 72 hours to obtain; by which time infection may have progressed increasing the risk of neonatal mortality [4]. To this point, sepsis reportedly accounts for about 26% of global neonatal deaths (Lawn, 2005) with 98% of these deaths in developing countries (Omene, 2009). The total number of neonatal deaths caused by septicemia in Nigeria is reported to be between 28-30% which is among the highest in West Africa.

Since sepsis is basically a blood disorder with increasingly high bacteria levels in the circulatory system that ultimately infests and damages tissues and organs [2], [17], neonatal septicemia is of clinical importance due to its characterized signs of associated infection in the first month of life. These signs include, but unrestricted to systemic infections of the newborn, osteomyelitis, pneumonia, arthritis, meningitis, and urinary tract infections, which are clinically seen as fever, jaundice, a high white-blood-cell count, tachycardia (rapid heart rate), tachypnea (rapid breathing) and chills [2], [17] and if treatment is not initiated immediately, it may lead to septic shock, or sepsis syndrome, a potentially fatal condition characterized by a dramatic drop in blood pressure, and damage to several organs, particularly the kidneys, lungs and heart; which usually results in death (Hartel et al., 2015).

In the diagnosis of sepsis, polymorphonucleated white blood cells, granulocyte have proven to be extremely visible in blood and veritable. The serum levels of these white blood cells; basophils, neutrophils and eosinophils reportedly surge in acute phases between 4 to 6 hours post-ceding inflammation [4], [3]. This is because at inflammation, a complex interaction between invading microorganisms and their host's immune system is likely to evoke the white blood cells for unprecedented response, leading to activation of growth and differentiation inducers like the interleukin-3 and their secondary mediators; including nitric oxide, thromboxanes, leukotrienes, platelet-activating factor, prostaglandins and complement, all cause activation of the coagulation cascade, the complement cascade, and the production of prostaglandins, leukotrienes, proteases and oxidants [16], [19].

Although in neonates, polymorphs are deficient in chemotaxis and killing capacity, less deformable and unable to move to the site of infection, possessing an immature bone marrow that cannot replace polymorphs quickly during infections, the fetus however has some preformed immunoglobulins which are primarily acquired through nonspecific placental transfer from the mother; even though these immunoglobulins are deficient in action and number at birth, especially in preterm babies. Also, macrophage numbers, chemotaxis and cytokine production are also impaired, with T-cells & Natural killer (NK) cells at record low counts and functionally immature (Berglund et al., 2008). Neonates are thus more susceptible to infection because complement maturation occurs when infants are 6-10 months old. Neonatal sera also have reduced opsonic efficiency against GBS, *E. coli* and *Streptococcus pneumoniae* because of decreased levels of fibronectin (Kampf et al., 2014).

Recently, limited studies have examined the relationship between serum CRP, neonatal and maternal

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polymorphs and the associated changes in bodyweights between mothers and and septicemic neonates. In developed countries like the US, 7-13% of all live births are reportedly evaluated for neonatal sepsis. Only 3-8% of those evaluated have culture-proven sepsis. The incidence of neonatal septicemia in US is 0.2% (Verastegui et al., 2010). Another study from US in preterm infants done from 1996 to 2007 shows an incidence of eosinophil (EOS) of 0.6%. Many studies focus specifically on incidence of EOS in the developed countries. The incidence of EOS in Israel from 1995 to 2005 was 2.42% (Pencina and Agostino, 2004). Hartel et al. from Germany studied neonatal septicemia from 2009-2010 in 23 centers and showed an incidence of EOS 0.6%. Data from a hospital in Netherlands was analyzed from 1978 to 2006. They reported that incidence of EOS decreased from 4% to 1.2% over time, which means that because of improved care the EOS decreased in developed settings (Ihaka and Gentleman, 2006). In effect however, even though variations exist in reports relating to neonatal sepsis across the world, little or no reports have comparatively documented the changes in maternal and neonatal bodyweights occasioned by alterations in serum CRP and granulocytes due to sepsis. This necessitated the quest for current study.

1.1 Aim of Study

The study examined changes in granulocytes, C-reactive protein of cord blood and body weight changes between septicemic and non- septicemic neonates and their mothers. Specifically, the study will;

i. compare changes in serum CRP levels of mothers at 37, 38 and 39 weeks of pregnancy.

ii. compare changes in serum CRP levels of mothers of septicemic neonates and mothers of non-septicemic neonates during pregnancy.

iii. examine changes in polymorphs (basophil, neutrophil and eosinophils) of mothers of septicemic neonates and mothers of non-septicemic neonates for gestational weeks 37, 38 and 39 and between septicemic and non-septicemic neonates at birth.

iv. comparatively examine body weight changes between mothers of non-septicemic neonates and mothers of septicemic neonates during pregnancy and between septicemic and non-septicemic neonates at birth

2. Materials and Methods

2.1 Study Area

Study was conducted in selected antenatal homes; General Hospital Obiaruku, Central Hospital Warri, and Eku Baptist Government Hospital, Delta State, Nigeria. Delta state is a 16,842 square kilometre (6,503 sq meters) area of land located approximately between longitude 5^0 00 and 6^0.45`East and latitude $5^0$00 and $6^0$.30` North of the equator. It is a densely populated area of an estimated population of 4,112.445 (2,069,309 males and 2,043,136 females) (NPC, 2007).

2.2 Study design

Study was experimental in nature, drawing sample from population of registered antenatal cases in above study area. Using a purposive sampling technique, a total of four hundred and ninety-two (492) apparently healthy pregnant women and their neonates were examined, grouped into two based on the presence or absence of sepsis in their neonates. The groups comprised of two hundred and forty-six (246) pregnant mothers and two hundred and forty-six (246) neonates who were ethically recruited from General Hospital Obiaruku, Central Hospital Warri, and Eku Baptist Government Hospital; all in Ukwani, Uvwie, and Ethiope East Local Government Areas of Delta State respectively. For each group, body weight and serum were assessed at gestational weeks 37, 38 and 39, prior to delivery and neonates at birth, and was analysed for CRP levels, polymorphs (basophil, neutrophil and eosinophils). Neonates were followed for a period of one month and those that came down with septicemia were recorded. Based on septicemia the sample were

grouped into control (parameters of neonates that did not have septicemia and their mothers during gestation) and experimental (parameters from neonates that came down with septicemia and their mothers during gestation).

2.3 Population of study

Study population was targeted at neonates and their mothers in selected antenatal home.
Pregnant mothers on regular antenatal visit to the hospital were selected for participation.

2.4 Sample and sampling technique

Purposive sampling technique was adopted for this study. The sample size was calculated using the Kish formula of prevalence; with a prevalence of 20% resulting in a sample size of 246 patients (Kish, 1965).

$$\mathbf{n = (Z1\text{-}\alpha)\ 2\ (P\ (1\text{-}P)/D^2)}$$

Where,

Z1-α = confidence level as z-score (95% = 1.96 from z-table)
P = Prevalence (20%)
D = Absolute value (5%)

2.5 Inclusion criteria

Pregnant women who are on regular antenatal visit to the hospital and their new borns were selected for participation. Apparently healthy pregnant women who are on their 37th week of gestation were also recruited into the study. Their neonates after delivery were prospectively studied.

2.6 Exclusion criteria

Neonates of parents who refused to provide informed consent were excluded from the study. Pregnant women who develop any clinical signs of sepsis in week 37, 38 and 39 of their pregnancy and their neonates were also excluded from the study. Mothers who were on any form of treatment that may interfere with result were also excluded from the study. All outborn neonates admitted into the pediatric unit of the hospital were also excluded.

2.7 Ethical Considerations

Ethical clearance (REC/FBMS/DELSU/20/82) was obtained from the Research and Ethics committee of the College of Health Sciences, Faculty of Basic Medical Sciences, Delta State University, Abraka, Delta State, Nigeria. Also, the Hospital Management Board of Delta state gave an approval (A. 551/Vol. III/36) before commencement of study; especially with the condition that participants' physicians were directly involved in data collection and monitoring post birth. Again, using a carefully structured consent forms, informed consent was obtained from all participants, issued to gravid mothers to seek their consensual permissions before commencing investigation. Only mothers who consented to cooperate (haven been briefed on the rules and nitty gritty of the study) were examined.

2.8 The Consent form

The consent form was written in plain language, free from unnecessary words, granting allowance for eligible participants only with the goal of clearly responding to each of the following points;

1. that He / She (Participants) has been briefed, read and understands key information about the study.
2. that He / She (Participants) has been given the opportunity to ask questions whenever and however they dim fit, relating to the study

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3. that He / She (Participants) voluntarily agrees to oblige the researcher with in relevant supports and/or access to procedural rules relating to the study in accordance with the spelt out / orally explained guides for brain and cardiovascular changes in relation to sound elements only.
4. that He / She (Participants) understands that they can withdraw at any time of their choice without any compulsion, while not having to face any penalty.
5. that confidentiality issues were firmly explained to them before actual participation (using no actual names but pseudonyms for purpose of data anonymization)
6. that the use of obtained data in research, publications, sharing and archiving were explained; even though the public will be blurred from knowing the actual participants' identity. All methods were carried out in accordance with relevant guidelines and regulations

2.9 Procedure

Study was conducted at the pediatric unit of General Hospital Obiaruku, Central Hospital Warri, and Eku Baptist Government Hospital in Delta state, Nigeria, using pregnant women who are in their 37^{th}, 38^{th} and 39^{th} week of gestation. A detailed history was taken and recorded on proforma that was specially designed for the study. Blood samples were collected from them on week 37, 38 and 39. Serum samples were analysed for basophil, neutrophil eosinophils counts and CRP levels. Blood samples were also obtained from umbilical cord of neonates on the day of delivery and analyzed for same parameters. Neonates were monitored for a duration of one month. Neonates who were re-admitted to the hospital after birth and confirmed to have sepsis within 28days after birth through a positive culture result and their mothers formed the experimental group; whereas, neonates without sepsis and their mothers formed the control group.

2.10 Collection of specimens

2.10.1 Serum

Using a five millilitres (5ml) disposable syringe, subjects' intravenous blood was obtained from the median cubital vein of their forearm. The blood sample was collected and transferred into an EDTA sample collection container. Samples were then centrifuged at 6000 rpm for 10minutes and subjected to biochemical analysis. For neonates, umbilical cord serum sample was collected during delivery and transferred into an EDTA sample collection container.

2.11 Analysis C-reactive proteins

C-reactive protein was estimated quantitatively using the CRP ELISA kit. The Human C-Reactive Protein (Hu CRP) ELISA quantitates Hu CRP in human serum and plasma. Content of the kit include Pre-coated 96 well plate, standard, standard dilution buffer, biotinylated detection antibody, streptavidin-HRP, HRP diluent, wash buffer, chromogen, stop solution, adhesive plate covers.

2.12 Test principle

Human CRP solid-phase sandwich ELISA (enzyme-linked immunosorbent test) is used to determine how much of a target is bound between two antibodies. The wells of the provided microplate have been pre-coated with a target-specific antibody. Following that, samples, standards, or controls are put to the wells, which bind to the fixed (capture) antibody. The sandwich is then filled with the second (detector) antibody, which is followed by a substrate solution that reacts with the enzyme-antibody-target combination to create a measurable signal. This signal's strength is related to the amount of target in the original specimen. The optical density will be determined with a conventional plate reader at 450 nm. The amount of CRP Antibody Enzyme Conjugate detected is directly proportional to the amount of CRP present in the sample.

2.13 Determination of Granulocyte Counts (Polymorphs)

Granulocyte count parameters were analysed using Diatron Abacus 380 3-part WBC Differential Analyzer.

2.14 Determination of Body Weights

Neonates' weights were measured in kilogram (kg) to the nearest 0.1 kg using a weighing scale (Cardinal Scale Manufacturing Co., Webb City, MO) with the selected neonate in light clothing and without shoes. Maternal body weights were assessed with the bathroom scale.

2.15 Data and statistical analysis

Student's T-test was used to compare differences in mean between subjects (Neonates and Mothers). One-way Analysis of Variance (ANOVA) was used for multiple comparison within and between groups. Confidence level for all statistical based calculations was set at p values < 0.05, while presenting results as mean ± SD.

3. Results

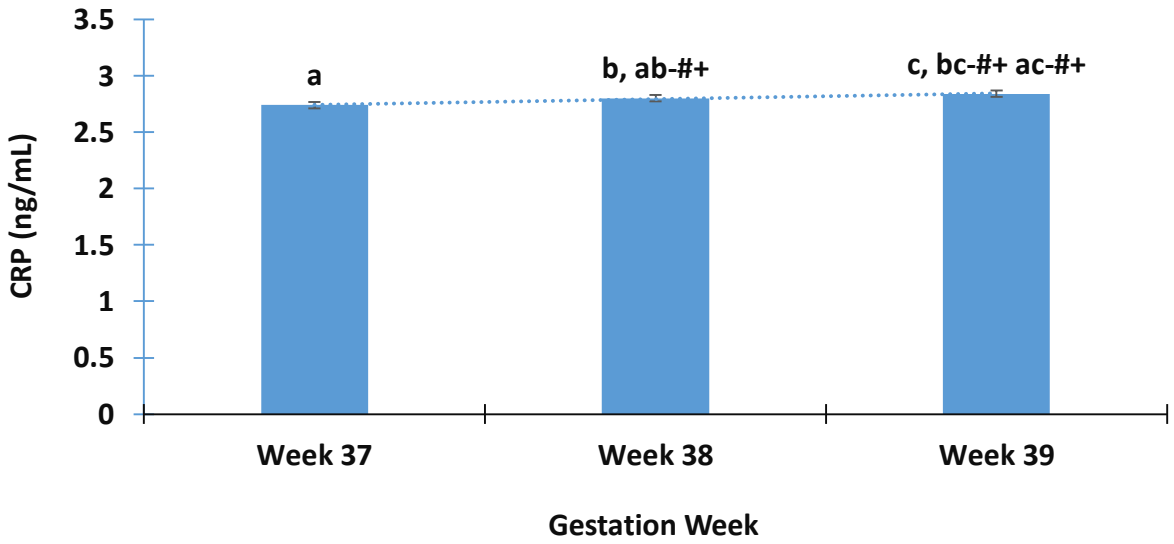

Figure 1: Comparative Changes in Serum CRP of Mothers at different Gestational Weeks before Birth

a: 37th week, b:38th week; ab-#+ insignificant increase ($p > 0.05$) in CRP for 38th gestation week relative to 37th, bc-#: insignificant increase in serum CRP for 38th and 39th week upon comparison, and ac: insignificant increase between 37th and 39th gestation week, following comparison.

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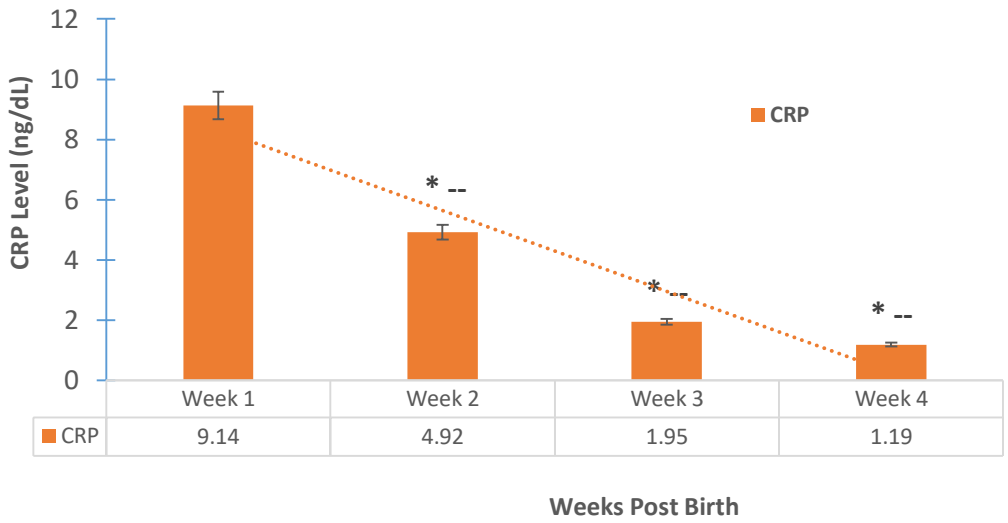

Figure 2: Comparative Changes in Maternal Serum CRP During Pregnancy (Mothers of Septicemic Neonates) Based on Time of Diagnosis of Neonatal Septicemia.

*-- = statistically significant decrease ($p < 0.05$) in CRP for weeks 2, 3 and 4 post birth as compared to week 1.

Table 1: Post-Hoc (Tukey) test for Sources of Difference in Serum CRP for Mothers with Septicemic Neonates Based on Time of Diagnosis of Neonatal Septicemia

Week of Septicemia presentation in their neonates	**1**	**2**	**3**	**4**
	p-value	p-value	p-value	p-value
1		0.0001 *	0.0000 *	0.0000 *
2			0.0000 *	0.0000 *
3				0.1201 #
4				

$p < 0.05$ = Significant.

Notable from above table was a statistically significant increase ($p < 0.05$) in serum CRP levels during pregnancy of mothers of septicemic neonates. More importantly, CRP levels during pregnancy of mothers of neonates who had septicemia in weeks 1 increased significantly as compared with those of week 2-4. This change was however decreased insignificantly ($p > 0.05$) in mothers of neonates who had septicemia in week 4 upon comparison with those in week 3.

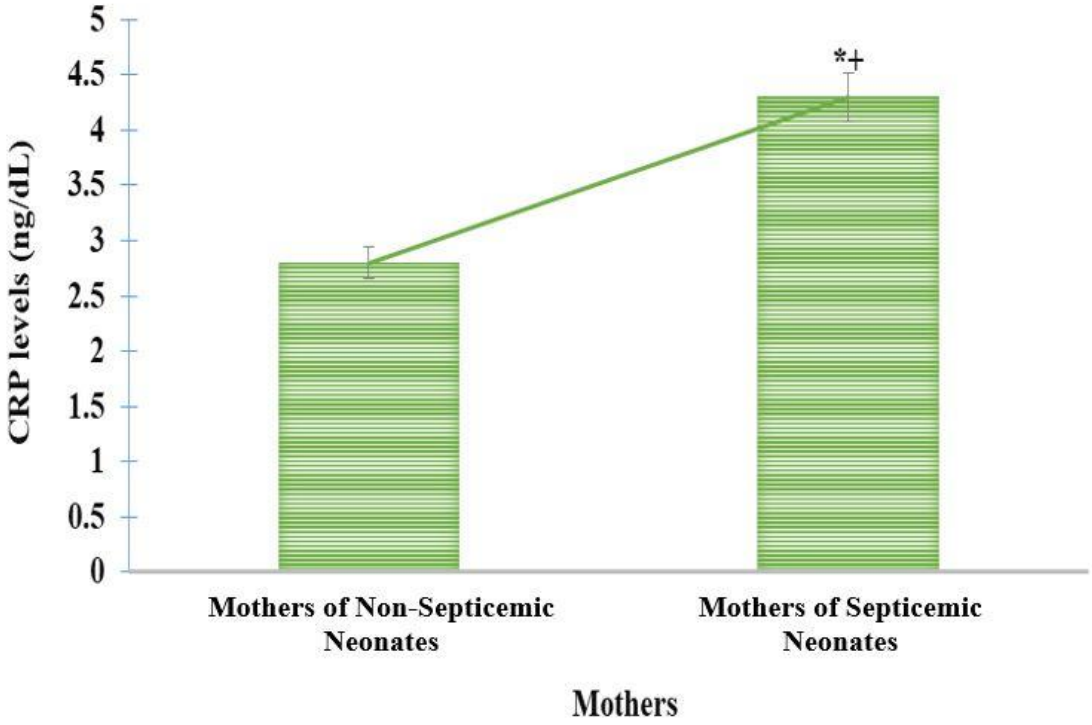

Figure 3: Comparisons of CRP of Mothers of Septicemic and Non-Septicemic Neonates During Pregnancy

Table 2: Comparative Changes in Polymorph Granulocyte Counts During Pregnancy of Mothers of Septicaemic Neonates at Different Weeks of Septicemia Presentation in their neonates

Granulocytes	Septicemias Presentation Time					
	Week 1	Week 2	Week 3	Week 4	ANOVA (p-value)	Remark
Basophil (10^9/L)	0.05±0.01	0.02±0.00	0.03±0.01	0.03±0.01	0.5709	insignificant
Eosinophil (10^9/L)	0.17±0.04	0.24±0.03	0.19±0.09	0.08±0.00	0.3785	insignificant
Neutrophil (10^9/L)	7.43±1.01	6.22±1.27	3.80±0.96	3.46±0.26	0.1655	insignificant

at $p \leq 0.05$. = insignificant. Results are presented as Mean ± SEM

In table 3 above, ANOVA proved insignificant ($p > 0.05$) for all assessed polymorphs (basophil, neutrophil, eosinophil).

Table 3: Comparative Changes in Polymorph Granulocyte Counts at Different Weeks of the Third Trimester of Pregnancy

Granulocytes	Gestational Weeks				
	Week 37	Week 38	Week 39	ANOVA (p-value)	Remark
Basophil (10^9/L)	0.04±0.01	0.04±0.00	0.04±0.00	0.9850	insignificant
Eosinophil (10^9/L)	0.12±0.02	0.15±0.02	0.19±0.02	0.0450	significant
Neutrophil (10^9/L)	4.12±0.30	4.02±0.30	4.43±0.37	0.6538	insignificant

Results are presented as Mean ± SEM

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From table 4 above, ANOVA returned a statistically significant increase ($p < 0.05$) for Eosinophil counts. This change was however insignificant for other assayed granulocytes in pregnant mothers at weeks 37, 38 and 39 preceding birth.

Table 4: Comparative Changes in Polymorph Granulocyte Counts during Pregnancy between Mothers of Septicemic Neonates and Mothers of Non-Septicemic Neonates

Granulocytes	Mothers of Non-Septicemic Neonates	Mothers of Septicemic Neonates	t-Cal	t-test (p-value)	Remark
Basophil (10^9/L)	0.04±0.01	0.03±0.01 $^{\#-}$	1.023	0.1351	insignificant
Eosinophil (10^9/L)	0.15+0.02	0.17±0.04 $^{\#+}$	1.432	0.0810	insignificant
Neutrophil (10^9/L)	4.19±0.32	5.23±0.63 $^{\#+}$	2.013	0.1121	insignificant

$p \leq 0.05$. Results are presented as Mean ± SEM

Table 5 above presents a t-test result that compares changes in average maternal haematological variables in Mothers of septicemic neonates to mothers of non-septicemic neonates during pregnancy. Here, a statistically insignificant increase was observed in granulocytes of mothers of septicemic neonates than non-septicemic.

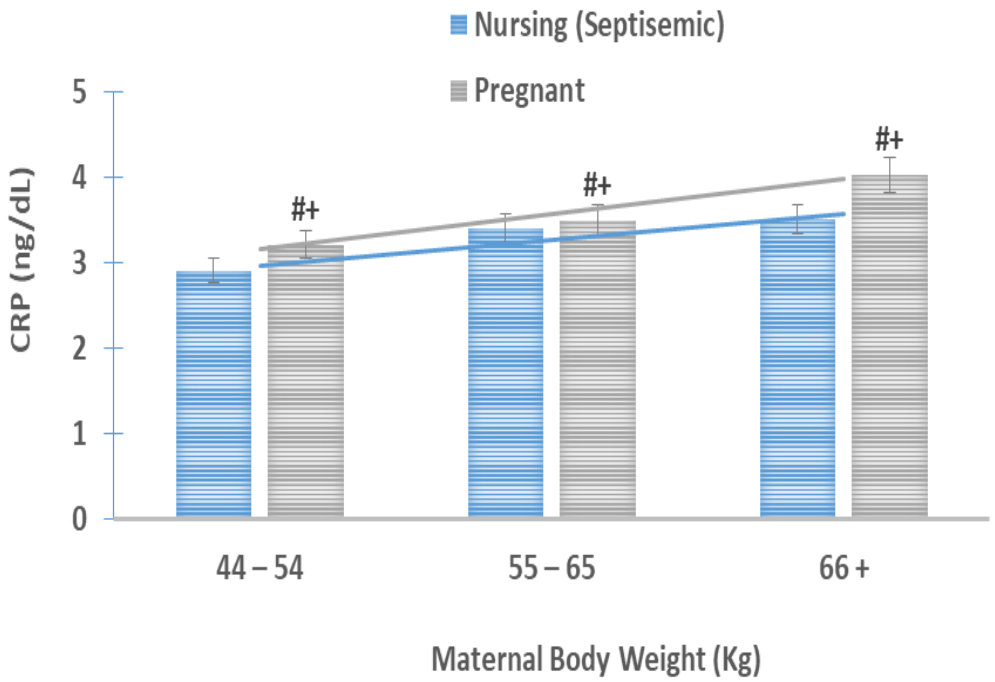

Figure 4: Comparative Changes in CRP and Maternal Body Weights

#+: insignificant increase

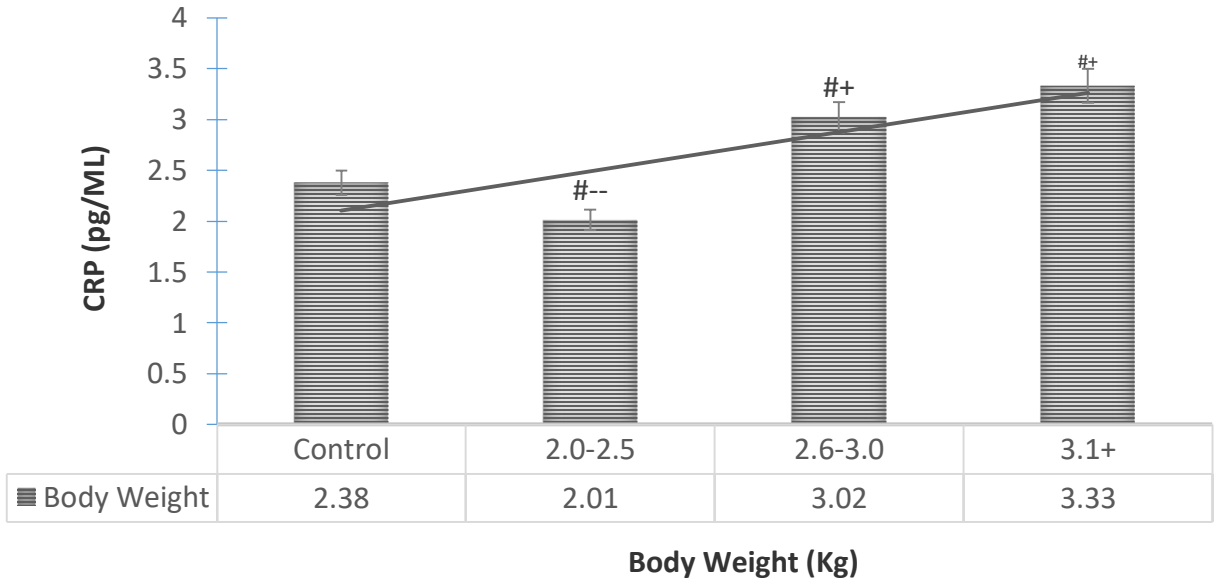

Figure 5: Comparative Effects of CRP on Neonatal Body Weights

#+: insignificant increase, #--: insignificant decrease

4. Discussion

Neonatal infection is an important cause of morbidity, prolonged hospital stay and mortality among infants, particularly those born preterm and of very low birth weight (Vergnano et al., 2011; Adams-Chapman and Stoll, 2006).

Neonatal infections are unique in several ways. Infectious agents can be transmitted from the mother to the fetus or newborn infant by diverse modes. Newborn infants are less capable of responding to infection because of one or more immunologic deficiencies. Coexisting conditions often complicate the diagnosis and management of neonatal infections. The clinical manifestations of newborn infections vary and include sub-clinical infection, mild to severe manifestations of focal or systemic infection, and, rarely, congenital syndromes resulting from in utero infection. The timing of exposure, inoculums size, immune status, and virulence of the etiologic agent influence the expression of disease. Maternal infection which is the source of transplacental fetal infection often remain undiagnosed during pregnancy because the mother was either asymptomatic or had nonspecific signs and symptoms at the time of acute infection.

In this study, a comparative examination of changes in granulocytes, C-reactive protein of cord blood and body weight changes between septicemic and non- septicemic neonates and their mothers was carried out. Using purposive sampling technique, a total of four hundred and ninety-two (492) subjects, comprising of two hundred and forty-six (246) pregnant women and two hundred and forty-six (246) neonates were ethically recruited from General Hospital Obiaruku, Central Hospital Warri, and Eku Baptist Government Hospital; all in Ukwani, Uvwie, and Ethiope East Local Government Areas of Delta State respectively. Pregnant women who met spelt-out criteria were approached and assessed for body weight, age and other sociodemographic records in their 37^{th}, 38^{th} and 39^{th} weeks of the third trimester of their gestation. Blood samples were also obtained from these pregnant women and assessed for body weight changes, serum CRP, and polymorph granulocyte counts (Basophil, Eosinophil, Neutrophil). Also, umbilical cord serum samples were collected from their neonates at the point of delivery. After delivery, neonates were then monitored (for four weeks; being the neonatal period) for any sign of septicemia, while separating and grouping those

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who came up septicemic through a positive culture result (experimental groups; consisting of mothers of septicemic neonates and their neonates) from the mothers of apparently healthy neonates and neonates (control groups; mothers of apparently healthy neonates and their neonates). Prior to child birth, this study assessed maternal body weight, CRP and granulocyte counts for gestational weeks 37, 38 and 39.

A careful look at figures 1 and 2 shows the maternal records for CRP at the 37^{th}, 38^{th} and 39^{th} gestational weeks before birth. From the figures, one will observe a statistically insignificant increases (as returned by one-way analysis of variance, ANOVA) in CRP with increasing gestational week; apparently proving to be highest (although, insignificantly) at the 39^{th} gestational week. The implication of this is that; increased gestational weeks had an insignificant improvement effect on maternal CRP levels as against lower weeks. This, in effect is likely to increase the rate of inflammation in the assessed mother in particular (and possibly their neonates) after birth as there are strong evidences that link TNF-α to the potentiation of inflammation in humans, especially neonates. Also at baseline, tables 2-4 revealed that mothers had a statistically significant increase ($p < 0.05$) in eosinophil counts, insignificant for basophil and neutrophil counts at pregnancy week 39 as compared with weeks 37 and 38.

In this study, the hematological values of new-born across for which other days in the 28 days (four weeks) of post-uterine life were compared depending on week of septicemia onset. Notable from the baseline (control) was Basophil, Eosinophil and Neutrophil counts of 0.16 10^9/L, 0.31 10^9/L and 13.96 10^9/L respectively.

During pregnancy, this study also compared CRP and hematological parameters of mothers whose neonates came up with sepsis in the first four weeks (experimental group) with those whose neonates stayed healthy within the first 4 weeks after delivery (control). One key observation is the relatively low serum CRP levels in control as compared with other weeks. Although, this may not necessary be implicative of neonatal sepsis, however, they are important markers of the average baseline records of the new-born which got monitored as the week progressed. While laboratory sepsis markers complement the evaluation of clinical signs and risk factors in diagnosis of neonatal sepsis, the median CRP values for men and women are reportedly 1.5 and 1.52 mg/l; the 90th percentiles being 6.05 and 6.61 mg/l, respectively; infants and neonates have much lower values than adult male and females (Hengst, 2013).

A raised CRP is not necessarily diagnostic for septicemia, as elevations may also occur due to the physiologic rise after birth or non-infection-associated conditions (Benitz et al., 2018). Thus, concerns have been raised about the reliability of CRP during the early stage of septicemia being neither able to diagnose nor to rule out an infection with certainty. Benitz et al. (2018) have also asserted that the sensitivity in the diagnosis of culture-proven early-onset sepsis can increase from 35% (95% confidence interval 30–41%) at the initial sepsis workup to 79% (72–86) after 8–24 h, and 89% (81–94) for the higher of two levels obtained after 8–48 h after the initial workup. Concurrently, they reported a decrease in specificity from 90% (88– 92) to 78% (76–81) and 74% (71–77) for CRP levels performed as described above.

For body weight comparisons, CRP caused no significant change (increase or decrease) in maternal body weight. At the time of this writing, little or no literatures have been reported on neonatal and maternal body weight changes relative to serum CRP; especially as it affects neonatal septicemia. Albeit, in children and adolescents, underweight is a significant risk factor for infection especially in developing countries, probably reflecting malnutrition, poorly developed immune system and poor hygienic standards. In developed countries, studies have shown that obese children and adolescents have a higher infection rate [18]. Similarly, various research has shown that both underweight and obese adults have a U-shaped

increased infection rate. Skin and respiratory tract infections, as well as surgical-site infections, have repeatedly been observed to be more common in the latter than in normal-weight subjects. Obesity, paradoxically, has been shown to reduce the mortality of critically ill individuals in several trials. As a result, being underweight or obese is linked to an increased risk of infection [6]. However, confounding factors such as malnutrition, hygienic status and underlying disease or co-morbidities might aggravate accurate assessment of the impact of body weight on infection risk.

5. Conclusion

This study has shown that maternal CRP analysis during pregnancy has a potential for predicting neonatal septicemia. Although not 100 percent accurate to confirm or rule out sepsis, it can be used (but not solely) during pregnancy as a routine diagnostic marker with other septicemia markers in the event of suspicion of septicemia as maternal infection during pregnancy is a key factor in early onset neonatal septicemia which accounts for over 70 percent of sepsis related deaths in neonates. Also, granulocyte (Basophil, eosinophil and neutrophil) counts during pregnancy does not directly predict septicemia in neonates suggesting that there is no link between septicemia and granulocyte during pregnancy. Further studies may be required to completely rule out these granulocytes as it relates to their role in pregnancy and septicemia in a broader and larger population.

6. References

[1] African Neonatal Sepsis Trial g, Tshefu A, Lokangaka A. (2015). Simplified antibiotic regimens compared with injectable procaine benzylpenicillin plus gentamicin for treatment of neonates and young infants with clinical signs of possible serious bacterial infection when referral is not possible: a randomised, open-label, equivalence trial. Lancet; 385: 1767-1776

[2] Bakhubaira, S. (2013) Hematological parameters in severe complicated Plasmodium falciparum malaria among adults in Aden. Turk J Haematol; 30:394–399.

[3] Blake, G.J., Rifai, N., Buring, J.E., & Ridker, P.M. (2013). 'Blood pressure, C-reactive protein, and risk of future cardiovascular events', Circulation, 108(24), 2993-9.

[4] Buttery, J.P. (2012). 'Blood cultures in newborns and children: optimising an everyday test', Arch Dis Child Fetal Neonatal Ed; 87:25–28.

[5] Centres for Disease Control and Prevention. (2016). 'Prevention of perinatal group B streptococcal disease: a public health perspective', MMWR Morb Mortal Wkly Rep., 45:1–24.Härtel C., Adam N., Strunk T., Temming P., Müller-Steinhardt M., and Schultz C. (2015). "Cytokine responses correlate differentially with age in infancy and early childhood," Clinical and Experimental Immunology, vol. 142, no. 3, pp. 446–453.

[6] Dobner, J., and Kaser, S (2018). Body mass index and the risk of infection - from underweight to obesity. Clinical Microbiology and Infection, 24(1), 24-28.

[7] Hogasen, A.K. (2017). 'New diagnostic and therapeutic possibilities in neonatal sepsis'. Tidsskr. Nor. Lacgeferon; 38:252–255.

[8] Imoru, M., Shehu, A.U., Ihesinlor, G.U. and Kwaru, H.A. (2013). Haematological changes in malaria infected children in North-West, Nigeria. Turkish Journal of Medical Sciences; 43: 838 – 842.

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[9] Lau, D.C., Dhillon, B., Yan, H., Szmitko, P.E., and Verma, S. (2015). Adipokines: molecular links between obesity and atherosclerosis. Am J Physiol Heart Circ Physiol, 288(5), 2031-41.

[10] Nigeria's National Population Commission on the 2006 Census. (2007). Population and Development Review, 33(1), 206-210. Retrieved December 25, 2020, from http://www.jstor.org/stable/25434601.

[11] Pradhan, A.D., Manson, J.E., Rifai, N., Buring, J.E., and Ridker, P.M. (2001). C-reactive protein, interleukin 6, and risk of developing type 2 diabetes mellitus. JAMA, 286(3), 327-34.

[12] Raitakari, M., Mansikkaniemi, K., Marniemi, J., Viikari, J.S., & Raitakari, O.T (2005). Distribution and determinants of serum high-sensitive C-reactive protein in a population of young adults: The cardiovascular risk in young Finns study. J Intern Med, 258(5), 428–34.

[13] Ramasamy S, Biswal N, Bethou A, Mathai B. (2014). Comparison of two empiric antibiotic regimen in late onset neonatal sepsis--a randomized controlled trial. J Trop Pediatr; 60: 83-86.

[14] Roman Fischer and Olaf Maier. (2015). Interrelation of Oxidative Stress and Inflammation in Neurodegenerative Disease: Role of TNF. Oxidative Medicine and Cellular Longevity: vol. 2015, Article ID 610813 18 pages

[15] Stolz, D., Christ-Crain, M., Bingisser, R., Leuppi, J., Miedinger, D., Müller, C (2001). Antibiotic treatment of exacerbations of COPD: a randomized, controlled trial comparing procalcitonin-guidance with standard therapy. Chest. 131:9–19.

[16] van der Poll, T., van Deventer., S.J.H (1999). Cytokines and anticytokines in the pathogenesis of sepsis. Infectious Disease Clinics of North America. 13(2): 413–426.

[17] van Wolfswinkel, M.E., Vliegenthart-Jongbloed, K., De Mendonca, M.M., Wever, P.C., McCall, M.B., Koelewijn, R., Van Hellemond, J.J. and Van Genderen, P.J. (2013). Predictive value of lymphocytopenia and the neutrophil-lymphocyte count ratio for severe imported malaria. Malar J; 12:101.

[18] Wang, H.E., Griffin, R., Judd, S., Shapiro, N.I., and Safford, M.M (2013). Obesity and risk of sepsis: a population-based cohort study Obesity. Silver Spring, 21, E762-E769.

[19] Zimmerman, G. A., Mcintyre, T. M., Prescott, S. M., and Stafforini, D. M (2002). The platelet-activating factor signaling system and its regulators in syndromes of inflammation and thrombosis. Crit. Care Med. 30, 294–301.