



ISSN 2278 – 0211 (Online)

Pattern of Serum Alpha-Foetoprotein of Full- Term Neonates in Sokoto North-Western Nigeria

Abubakar A. F.

Lecturer, Department of Chemical Pathology and Immunology, Faculty of Basic Medical Science, College of Health sciences, Usmanu Danfodiyo University Sokoto, Nigeria

Mainasara A. S.

Department of Chemical Pathology and Immunology, Faculty of Basic Medical Science, College of Health sciences, Usmanu Danfodiyo University Sokoto, Nigeria

Das S. C.

Department of Chemical Pathology and Immunology, Faculty of Basic Medical Science, College of Health sciences, Usmanu Danfodiyo University Sokoto, Nigeria

Bello A.

Department of Chemical Pathology and Immunology, Faculty of Basic Medical Science, College of Health sciences, Usmanu Danfodiyo University Sokoto, Nigeria

Abdullahi A. U.

Department of Chemical Pathology and Immunology, Faculty of Basic Medical Science, College of Health sciences, Usmanu Danfodiyo University Sokoto, Nigeria

Abstract:

Background: Numerous studies have reported the reference range of serum alpha- foeto protein in apparently healthy full-term neonates, which could help in screening, diagnosis and monitoring of intrauterine anomaly during pregnancy. However such studies are lacking in Sokoto metropolis. The objective of this study was to determine the reference range of serum alpha-foetoprotein (SAFP) in full-term singleton neonates and its relationship to gestational age, birth weight and birth length in Sokoto north western Nigeria.

Materials and Methods: A cross-sectional descriptive study was conducted in some selected hospitals in Sokoto metropolis, between March and November 2012. Using semi-structured questionnaire data on gestational age, birth weight, length, gender were collected of full-term singleton normal delivery babies of apparently healthy mothers. Four millilitres of cord blood were collected to determine the SAFP using Enzyme linked Immunosorbent assay (ELISA) Method. The data was processed using analyse it 221t, the $P \leq 0.05$ was considered statistically significant. The SAFP values ware analysed using descriptive statistics. The association between the variables are analysed using Pearson correlation.

Results: Full-term neonates ($n=104$) were enrolled for the study. The reference range and mean \pm SD of SAFP of 104 apparently healthy singleton babies were 143.3 to 372 ng/ml and 243.57 ± 51.9 ng/ml respectively. There was significant negative correlation between SAFP and respective GA ($r = -0.33, p < 0.05$). No association was not observed between SAFP and birth weight or birth length. ($r = 0.29, p > 0.05$)

Conclusion: This study reported the mean and preliminary reference range of serum alpha-foetoprotein distribution in the neonatal population of Sokoto, North-Western Nigeria. This could be of help in the screening and diagnosis of intra-uterine foetal anomaly during pregnancy.

Keywords: Serum alpha-foetoprotein, Reference range, Full-term neonate, Sokoto

1. Introduction

Alpha-foetoprotein (AFP) also known as alpha-1-foetoprotein or alpha-foetoglobulin. It is a glycoprotein made up of a single polypeptide chain. Its molecular weight is about 75 kilo Delton. AFP is first synthesized by yolk sac of the developing embryo. The foetal liver begins to synthesize it from sixth week of gestation onward and reaches the highest peak in foetal plasma at about 13 weeks. It falls progressively from then until term (Bolarin, 2013)¹. The AFP level is very low at birth and is absent or undetectable in the plasma at about two weeks postpartum, serum AFP as biochemical marker is used in Obstetrics monitoring of physiological

condition like multiple gestation, screening of foetal anomaly intrauterine like neural tube defects, Down's syndrome. However, if SAFP resurfaces after disappearance from plasma is considered as tumour marker¹ (Bolarin, 2013)¹.

Alpha-foetoprotein (AFP) as tumour marker is defined as a biochemical substance, the concentration of which can be related to the presence or progress of a disease/tumour (Coombes, 1982)². It has many characteristics which includes; being specific for a particular tumour/ tissue; it's secreted into the body fluid; its concentration is proportional to the tumour/ disease burdens, short half-life (approximately 5days), so that rapid changes reflect response to therapy. Has more than 80% sensitivity and specificity (Bucman,³ 1982 and Beastall *et al.*, 1991)^{3,4}. Hence, it is used for screening, monitoring and follow up for early reoccurrence (Beastall, 1991)³.

Full-term neonate is referred to as baby born at ≥ 37 completed weeks, it has an average birth weight and birth length of 3.2 Kg and 50cm respectively (Ashwood 1992)⁵

A study done in this locality in 1988, on newborn for the prediction of gestational age based on respective neonatal serum alpha-foeto protein, found that there was negative correlation between gestational age and respective neonatal serum alpha foetoprotein of neonates born at Usmanu Danfodiyo University Teaching Hospitals Sokoto. (Ibrahim, 1988)⁶

In 1998 a study done in Dusseldorf Germany, reported that at birth the mean serum AFP level of 256 terms babies were 41.687ng/ml (Blohm *et al.*, 1998)⁷, similarly in 2004 a study done in Turkey reported that, the mean, and reference range of alpha1- foetoprotein levels of cord blood samples of 94 term neonates (GA of 37-41weeks) were 67.246 \pm 52.137ng/ml and 105-226.00ng/ml, respectively (Funda *et al.*, 2004)⁸. Another study in Egypt (2001) showed that, the mean of serum AFP of 500 full-term neonates was 141.9 \pm 89.9 ng/ml.(Shawky 2001)⁹. A study at Israel in 2004, showed the mean of umbilical cord serum AFP of 82 neonates to be 61.6 \pm 44.8 ng/ml. (Bader *et al.*, 2004)¹⁰, also in 1998 a study done in Italy reported, that the mean of serum AFP of 150 apparently healthy newborns was 151.00 \pm 61 ng/ ml for males and 150.00 \pm 59.0 ng/ml for female at p value < 0.001(Bellini *et al.*, 1998)¹¹

Though the neonatal serum alpha-foetoprotein level of has been studied in various region of the world: Germany (1998), Israel (2004), Italy (1998), Greece (1999), Turkey (2004) and Egypt (2001). There is paucity for information on this in Sokoto North – Western Nigeria.

The purpose of this study was to define the reference range of serum alpha- foetoprotein (SAFP) in the cord venous blood (CVD) of full-term neonates, relationship between SAFP and gestational age, birth length and weight in Sokoto metropolis

2. Materials and Method

2.1. Study Area

Sokoto which is the capital city of sokoto state is located North Western part of Nigeria. Its geographical coordinates are 13°3'5" North, 5° 13' 53" East, the land area measured 28232.37 square kilometre and situated 900metre above sea level.(Tsoho 2010)¹²

2.2. Study Design

A cross-sectional descriptive study that was performed on apparently healthy full term neonates born at department of Obstetrics and Gynaecology (labour room) of Maryam Abacha Women and Children Hospital (MAWCH), Specialist Hospital Sokoto (SHS) and Usmanu Danfodiyo University Teaching Hospital Sokoto (UDUTH) between March and August 2012 in Sokoto Metropolis.

2.3. Study Population

The subjects were selected consecutively, after a written/or verbal parental consent was obtained. The study had received ethical approval from local Ethical committee. Babies that were delivered vaginally at full term of pregnancy whose mothers signed consent form were included. Premature babies, twin babies and babies delivered through caesarean section or with birth defects were excluded from the study. Gestational age was calculated using mother's last menstrual period (LMP) by applying Nagele's rule and using foetal ultrasound done on/or before 20th weeks of gestation .The birth weight was measured using table top paediatric beam balance graduated in gram (both digital and manual). The birth length was measured using tailoring rule metre graduated in centimetre.

2.4. Data and Sample Collection

A semi structure questionnaire was formulated, and data were collected at labour room of the enrolled health institution in Sokoto metropolis (UDUTH, MAWCH and SHS), the data collected includes: gestational age of neonates, birth weight, length, gender. Four millilitres of blood from the neonates cord blood, which was used to determine the serum AFP of the neonates (g/L). The samples were allowed to clot at 28°C and were centrifuged at 3000rpm for 5 minutes, the clear unhaemolysed sera were separated from the clotted blood, sera were stored at -20°C, which were later used to measure serum AFP. The SAFP of the neonates were determined using semi-automated solid phase ELISA sandwich method (Using syntron kits procured from Monobind Inc. Diagnostic Ltd, 100 North Pointe Drive Lake Forest, CA 92630 USA. through the local agent based in Lagos AGGAPPE Ltd. (Afonja *et al* 2010)¹³.

2.5. Data Analysis

The dataset was stored in Microsoft office Excel for window 2007 spreadsheet, and was analyzed using micro excels analysit221t, Statistical computer software 2010 version P-values less than 0.05(≤ 0.05) were regarded as statistically significant. The serum alpha

foetoprotein was analyzed using descriptive statistics. The association between gestational age, births weights and birth length with respective neonatal serum alpha-foeto protein was analyzed using Pearson correlation.

3. Results

A total of one hundred and four (104) full term neonates were enrolled for the study and all the subjects were delivered vaginally at full term of pregnancy (37-40 weeks of gestation).The gestational age group varied from 37 weeks to 40 weeks, and 51 were male newborns and 53 were female.

.The mean birth weight (BW) of the newborns studied was 3.56 ± 0.421 kg and the mean birth length of the neonates was 49.21 ± 4.17 cm. (Table 1)

Gestational Age (Weeks)	n	Male/Female	BW (kg)	LB (cm)
		mean \pm SD	mean \pm SD	mean \pm SD
37 – 40	104	51/53	3.56 ± 0.421	49.21 ± 4.17
37	34	18/16	4.46 ± 0.73	48.53 ± 8.10
38	35	14/21	3.10 ± 0.36	49.43 ± 1.29
39	19	11/8	3.18 ± 0.31	49.89 ± 1.240
40	16	8/8	3.09 ± 0.20	49.38 ± 0.80

BW=Birth Weight; LB=Birth length.

Table1: Demographic characteristics of full term newborns assessed in the present study

The mean and standard deviation of serum AFP in all full term neonates (M+F)(n=104) was found to be 243.57 ± 51.90 ng/ml. The male/female distribution of mean serum AFP were recorded as 250.44 ± 54.65 ng/ml in male (n=51) and 236.96 ± 48.90 ng/ml in female (n=53) The difference between these two means was statistically not significant ($P > 0.142$) (Table 2)

GA (Weeks)	NSAFP (ng/ml) (Male +Female)	NSAFP (ng/ml)		P Values
		Male	Female	
37	258.06 ± 41.00 (n=34)	262.83 ± 35.08 (n=18)	252.69 ± 47.39 (n=16)	0.593
38	257.09 ± 50.16 (n=35)	268.71 ± 55.92 (n=14)	249.35 ± 49.69 (n=21)	0.814
39	213.56 ± 50.07 (n=19)	230.17 ± 60.98 (n=11)	190.72 ± 10.21 (n=8)	0.708
40	218.82 ± 58.78 (n=16)	218.45 ± 65.91 (n=8)	219.20 ± 55.32 (n=8)	0.062
37 – 40	243.57 ± 51.9 (n=104)	250.44 ± 54.65 (n=51)	236.96 ± 48.9 (n=53)	0.142

GA=Gestational Age; NSAFP=Neonatal Serum alpha-fetoprotein

Table2: Impact of GA and sex on the concentration of serum alpha-foetoprotein (SAFP) in the cord blood of full term newborns in the present investigation, (result are in Mean \pm SD)

There was significant negative correlation between NSAFP and respective GA ($r = -0.33$ at p value of 0.0005) (Fig 2). No statistical association was observed between neonatal serum alpha-foetoprotein (NSAFP) and respective birth weights and birth lengths.

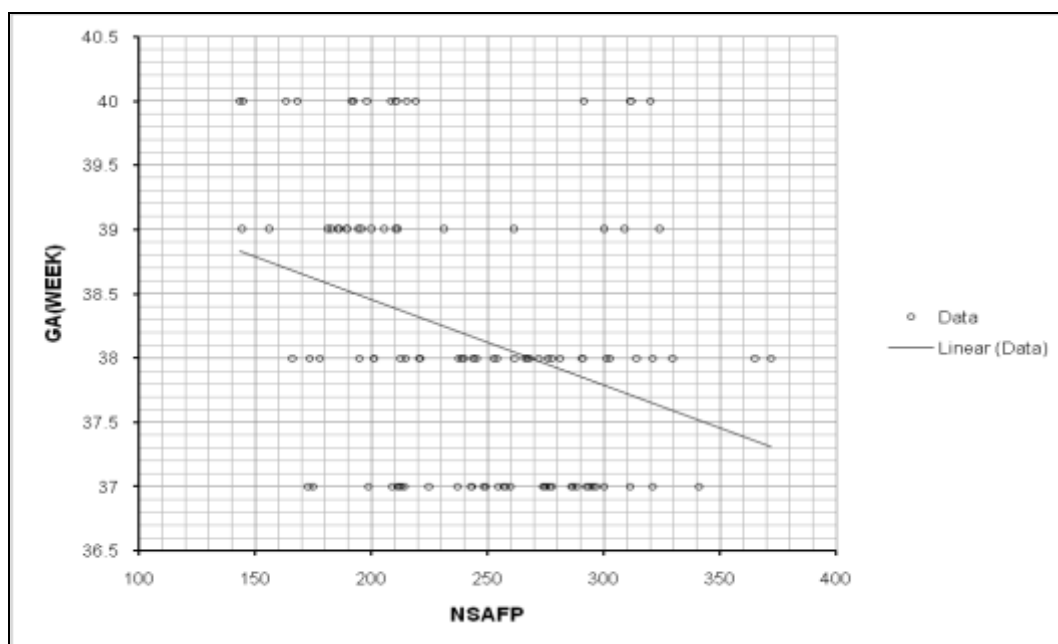


Figure 1

FIGURE 1 shows a negative correlation between neonatal serum alpha-foetoprotein and respective gestational age
 NSAFP= Neonatal serum alpha-foetoprotein in ng/ml
 GA= Gestational age in Week

4. Discussion

This study reveals the mean gestational age, birth weights and birth length is 38.2 ± 1.1 weeks, 3.56 ± 0.421 kg and 49.21 ± 4.17 cm, respectively. This is Similar to finding of study done by Abubakar *et al* in 2012 which found the mean Gestational age, birth weight and birth length to be 37.7 ± 1.4 weeks, 3.76 ± 0.45 kg, and 49.41 ± 4.17 cm, respectively (Abubakar et al 2012)¹⁴

The mean of serum alpha-foeto protein in this study were found to be 243.57 ± 51.9 ng/ml, this is slightly higher than the previous studies done in Turkey (2004), in Egypt(2001) and in Israel (2004), which found to be 67.2 ± 91.6 ng/ml, 141.9 ± 89.9 ng/ml and 61.6 ± 44.8 ng/ml respectively. The reference range of neonatal serum alpha-foetoprotein in this study was found to be 143.57 to 372 ng/ml, which is also slightly higher than the various study done in Germany(1998), Greece(1999), Egypt (2001) and Turkey (2004) found to be 27.6 to 58.7, 23.0 to 95.0, 51.7 to 181.6 and 105 to 226 respectively. The reason for this difference could be attributable to race variation. This is supported by a study done by Zarzour *et al.* (1998) in USA which showed that the normal level of serum AFP is said to be higher in black race compared to other races (Zarzour et al., 1998)¹⁵. Other possible reasons could also be due to factors like ingestion of traditional concoctions during pregnancy, Some mothers might possibly have suffered from Obstetric complications during pregnancy such as antepartum haemorrhages, which all contribute to high level of serum AFP in both foetus and mothers (Mizejewski et al., 2003)¹⁶ There was significant negative correlation between NSAFP and respective GA ($r = -0.33$, p-value 0.0007), which is supported by studies done in this locality, (1988)⁶, Turkey (2004)⁸, Egypt (2001)⁹, USA (2003) and Germany (1998)⁷

Funda *et al* in Turkey (2004), found a significant correlation between neonatal serum alpha foetoprotein (NSAFP) values for both birth weight and gestational age. In the present study, no such significant correlation was observed between NSAFP and birth weight ($r = 0.02$, p-values = 0.86960) this could be due race variation, Similarly, no significant difference was found between sex and NSAFP levels as in the findings by previous studies, done by Funda *et al.*, in turkey (2004), Ibrahim in this locality (1988), Shawky *et al.*, in Egypt (2001).

5. Conclusion

This study reported the mean and preliminary reference range of serum alpha-foetoprotein distribution in the neonatal population of Sokoto, North-Western Nigeria. This could be of help in the screening and diagnosis of intra-uterine foetal anomaly during pregnancy and also possible neonatal screening and diagnosis of child hood tumour

6. References

1. Bolarin M.O.(2013). AID to Chemical pathology second edition, Pp650-651
2. Coombes RC (1982). Metabolic manifestation of cancer, British hospitals medical journal, volume 27 pp21-22
3. Bucman R (1982). Tumour markers in clinical practice. British hospital medical journal, volume 27, pp 9-20

4. Beastall GH, Cook B, Rustin GJS, Jennings J A(1991). A review of the role of established tumours markers. *Annals journal of clinical biochemistry*, volume 28 pp 5-18
5. Àshwood, E.R (1992).Evaluating health and maturation of the unborn: The role of clinical laboratory. *Journal of clinical chemistry*, volume 38, PP1523-1529
6. Ibrahim MK, (1988): Cord blood alpha foetoprotein levels as an index of maturity in the newborn. A comparative study of methods of estimating gestational age. *Journals of national postgraduate*, volume 54, pp44-52.
7. Blohm ME, Vesterling Horner D calamines G , Gobel U(1998). Alpha foeto protein references values in infants upto 2years of age. *Journal of clinical chemistry*, volume5 pp135-42
8. Funda C, Aysen A,Nazan S, Can D,Engin A (2004) .Serum alpha foeto protein inhealthy fullterm neonates and infants. *Marmara Medical journal universite Tip fukultesi turkey*,volume12, PP 221-232
9. Shawky RM, Abdul el Fattah S, Eldin Azzam ME, Rafik MM, Osman A (2001). Alpha-foetoprotein in screening for congenital hypothyroidism. *East Mediterranean health journal*, volume7, pp 171-3
10. Badar D , Riskin A, Vafsi O,Israel N,Merksamer R, Dar H (2004):Alpha foetoprotein in early neonatal period, *journal of clinical chemistry*, volume 349, pp15-23.
11. Bellini C, Wanda B, Parodi E, Sera G(1998).. Serum alpha foetoprotein in new born. *Journal of clinical chemistry*, volume44 page 2548-2550
12. Afonja O.A.(2010). *Basic clinical biochemistry second edition (examination of blood)*, pp 112-4.
13. Tsoho UH (2008). Growth and history of the establishment of Makera Assada in sokoto metropolis to the year of 2007, PhD Thesis, History Department, Usmanu Danfodiyo University sokoto.
14. Abubakar PA, Bissala AE, Emmanuel IE Ahmed Y (2012).The relationship between the weights of the placenta and birth weights of the neonates in a Nigerian hospital, *Nigerian medical journal* volume 53, pp 80-84
15. Zarzour SJ, Gabert HA, Diket al., St Amant M, Miller JM jr (1998). An abnormal maternal serum alpha-foetoprotein and pregnancy out come. *International journal of Maternal and foetal medicine*, volume 7, pp 304-307
16. Mizejeswki GJ (2003). Levels of alpha-foetoprotein during pregnancy and early infancy in normal and diseases states. *Journal of Obstetrics and Gynaecology*, volume 58, pp804-826