IgG antibody in BCG vaccinated neonates in Asaba, Nigeria

[1]Eyaufe, A. A., [2]Esumeh, F. I.,[3] Adeniran, K., [1]Osagie, R. N., [4]Festus, O.O., [5]Igbinovia, O. and [2]Isibor, J. O.

[1]Medical Microbiology, Faculty of Clinical Sciences, [2]Microbiology, Faculty of Natural Sciences, Ambrose Alli University, Ekpoma Nigeria [3]Pediatrics Department Federal Medical Centre, Asaba, Nigeria [4]Department of Medical Laboratory Science, Faculty of Basic Medical Sciences, Ambrose Alli University Ekpoma, [5]Community Health Department, Faculty of Clinical Sciences, Ambrose Alli University Ekpoma, Nigeria.
Correspondence: Eyaufe O. Aidevbo, Email: aidesid0652@hotmail.com

Abstract

Mycobacterial infection induces cell mediated and humoral responses, although the role of cell mediated immunity is well established. This study examines IgG antibody levels in BCG vaccinated neonates in Asaba pre and post BCG vaccination (six weeks after BCG was administered). One hundred and eighty two (182) serum samples from neonates (120 pre BCG vaccination and 62 post BCG vaccination) were analyzed using the Diagnostic Automation *Mycobacterium tuberculosis* ELISA kits. TBIgG levels were significantly higher post BCG vaccination than TBIgG levels pre BCG vaccination ($P< 0.05$). TBIgG levels increased from 19u/ml pre BCG vaccination to 62u/ml post vaccination. Post BCG vaccine administered resulted in an increase in TBIgG levels from 20u per ml / 19u/ml in males and females respectively to 62 u/ml post BCG vaccination for males and females. The response was the same for male and female subjects that enrolled for this study. Therefore the potential role of antibodies in combating mycobacterial infection should be revisited.

Key words: IgG antibody, BCG, Vaccination, Neonates, Asaba

{Citation: Eyaufe, A. A., Esumeh, F. I., Adeniran, K., Osagie, R. N., Festus, O.O., Igbinovia, O., Isibor, J. O. IgG antibody in BCG vaccinated neonates in Asaba, Nigeria. American

Journal of Research Communication, 2014, 2(8): 131-138} www.usa-journals.com, ISSN: 2325-4076.

Introduction

Bacillus Calmette – Guerin (BCG) is the only available vaccine against tuberculosis and has been in use for over eight years (Kashyap *et al*., 2010). BCG consists of an attenuated strain of *Mycobacterium bovis,* which has been reported with varied efficacy (0 – 80%) depending on the studies and geographical location (Glassroth, 1997; Brodin *et al*., 2004 and Pinto *et al.*, 2004). Inspite of this, more people have been vaccinated with BCG than any other vaccine (Ota *et al*., 2002). Although the efficacy of BCG vaccine against the pulmonary disease in adults is variable, it provides consistent protection against childhood diseases (Ota *et al.,* 2002). Worldwide, over 90% of children are immunized with BCG making it the most commonly administered vaccine, with more than 120 million doses used each year (Ritz *et al.*, 2008).

The potential role of antibodies for protection against *Mycobacterium tuberculosis* infection has been underestimated on the assumption that they are intracellular pathogens (Acosta *et al.,* 2010). Opsonization with anti-*Mycobacterium tuberculosis* IgG antibody enhances both classical and alternative complement pathways. Furthermore, anti-*Mycobacterium tuberculosis* IgG antibody enhances the phagocytic ability of the macrophages (Manivannan *et al.*, 2006).

In Nigeria, BCG is part of routine immunization given to children at birth as a single dose of 0.05 ml injected intradermally into the upper left arm (National Programme on

Immunization, 2004). Since the inception of immunization in Nigeria, the emphasis has been on vaccination coverage and not on the development of an immune response to the vaccine administered. The aim of this study is to quantitatively determine IgG response to BCG vaccine by measuring IgG antibody before BCG was administered to neonates (pre BCG vaccination) and six weeks after (post – BCG vaccination).

Materials and methods

Babies of 1 – 28 days old that attended immunization clinic in Federal Medical Centre, Asaba, Nigeria were enrolled in the study. Federal Medical Centre is a designated Centre for National Programme for Immunization (NPI). Ethical permit was obtained from the research and ethics committee of the health institution while verbal informed consent was obtained from mothers of the babies. 2mls of venous blood was collected from selected subjects into plain vacutainers using 21G and 23G sterile needles. 0.05ml of BCG vaccine was injected intradermally into the upper left arm of the neonates after cleaning with sterile cotton wool swabs wetted with methylated spirit. 120 neonates (76 males and 44 females) were enrolled in this study. Of the 120 neonates that had the pre BCG vaccination, 62 (41 males and 21 females) reported for the post BCG vaccination. 2mls of blood in plain vacutainers were centrifuged at 3,000 rpm for 5 minutes and supernatant (serum) removed using eppendorf automatic pipettes into another set of plain properly labeled vacutainers. The Serum samples were transported in geostyles (insulated cold boxes containing frozen ice packs) to the Institute of Child Health, Laboratory Ibadan, for analysis. The choice of babies for the study was based on the fact that BCG is given at birth. The serum samples were assayed for the presence of TBIgG using the Diagnostic Automation *Mycobacterium*

tuberculosis IgG antibody ELISA kit. The samples were analyzed according to manufacturer's instructions.

Results

Table 1 shows the sex and age distribution of neonates pre and post BCG vaccinations. 120 (76 males and 44 females) babies were screened pre-BCG vaccination, while 62 (42 males and 20 females) reported post BCG vaccination, thus representing a drop out rate of 48%. Fig 1 shows TBIgG levels pre and post BCG vaccination. TBIgG increased from 19u/ml pre BCG vaccination to 62u/ml post BCG vaccination. Figure 2 shows TBIgG levels in male and female neonates pre and post BCG vaccination. TBIgG levels was 20u/ml and 19u/ml for males and females respectively before BCG was administered, while post BCG vaccination TBIgG levels was 62 u/ml for males and females.

Table 1: Sex and age distribution of neonates pre and post BCG vaccination

Age (days)	Male (Pre Vaccination)	Female (Pre Vaccination)	Male (Post Vaccination)	Female (Post Vaccination)
1 – 14	51	35	34	18
15 – 28	25	9	8	2
Total	76	44	42	20

Discussion

This study has used TBIgG to assess humoral response to BCG vaccination in neonates that were administered BCG vaccine in Federal Medical Centre, Asaba, Nigeria. TBIgG antibody in assessing humoral response was based on reports by Bam and Karu (2009) that IgG TB antibody has high sensitivity and specificity for tuberculosis diagnosis. Manivannan *et al.* (2006) also reported that anti *Mycobacterium tuberculosis* IgG antibody

also enhances the phagocytic ability of macrophages. They also reported that BCG induced antibody promotes important enhancing effects on both the innate and cell mediated immune responses to microbacterial infection.

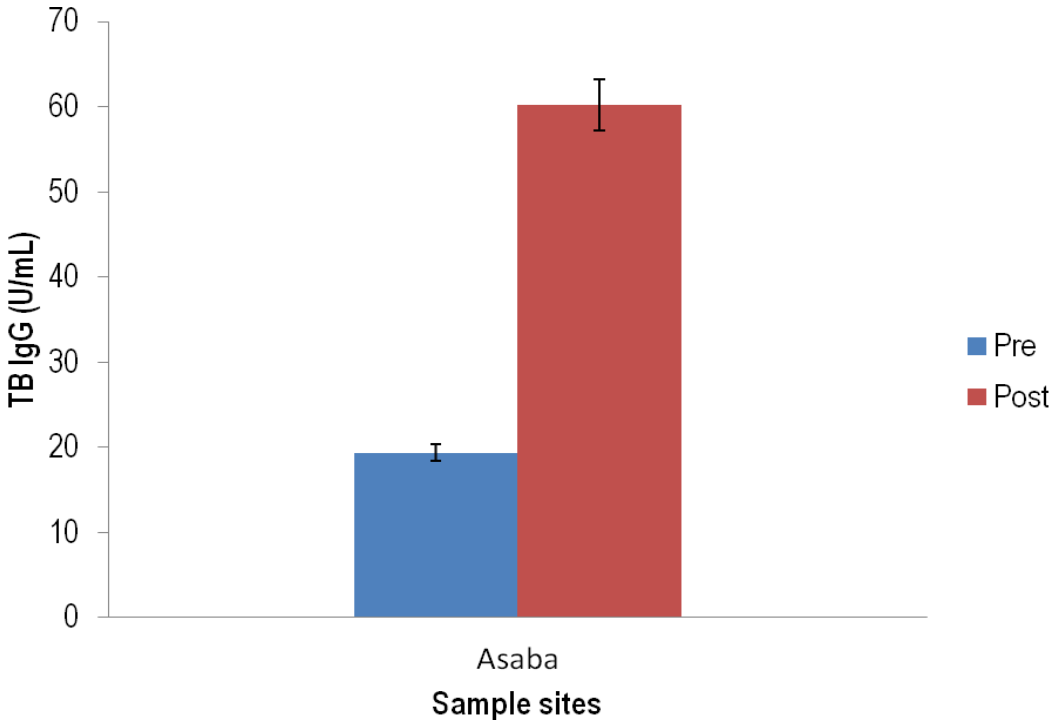

Figure 1: TBIgG levels pre and post BCG vaccination.

TBIgG levels increased post BCG vaccination. This increase in TBIgG levels agrees with studies by Beyazova *et al* (1995) and Pulickal and Fernandez, (2007), but at variance with the findings of Rota *et al* (1994) who reported a decrease in IgG levels. IgG response was the same for males and females pre - and post - BCG vaccination. This can be attributed to the age of the subjects. The average age of the male and female subjects enrolled for this study was 11 days and 10 days respectively. IgG is the only antibody class that can easily cross the placenta (Kuby, 1997). This will also reveal maternal influence on the humoral response to BCG vaccine, although Choi *et al*. (2012) using a mouse model has reported that maternal

immune status to *Mycobacterium tuberculosis* does not appear to impact on the immunogenicity of BCG vaccine in their progeny.

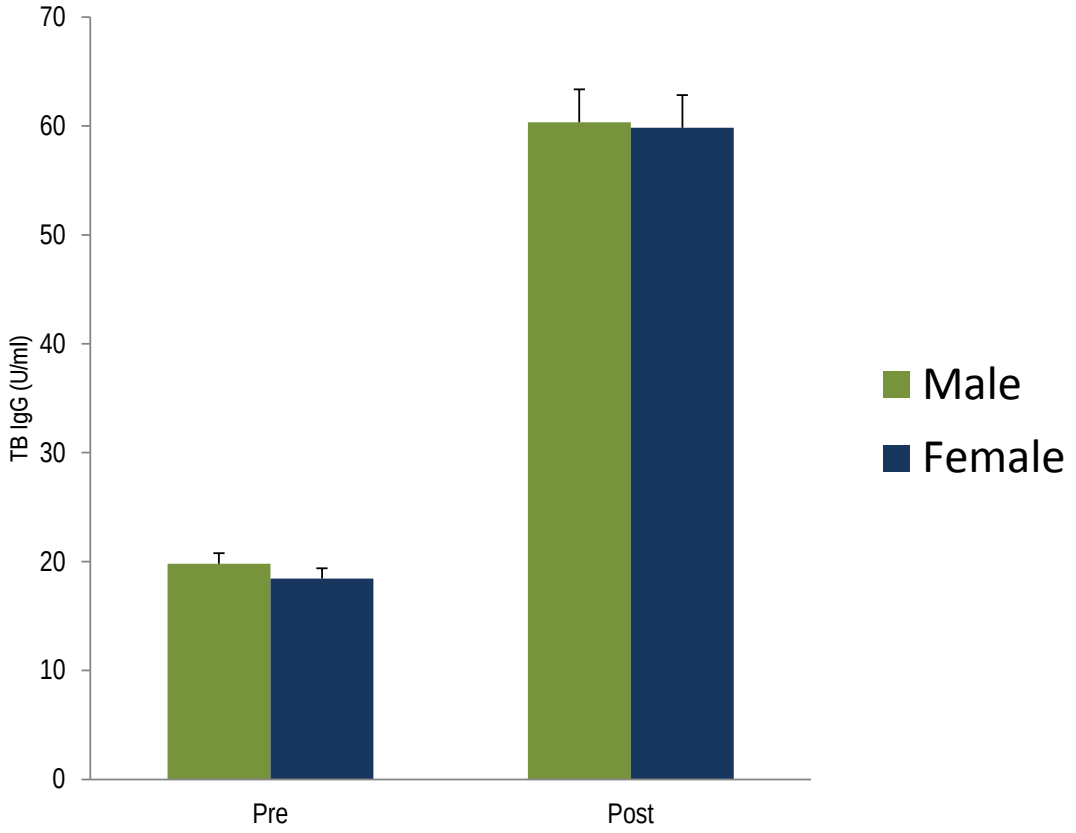

Figure 2: TBIgG levels in male and female neonates pre and post BCG vaccination.

Conclusion

In Nigeria, most studies done on immune response to BCG vaccine were based on the formation of scars on the upper left arm after vaccination. This study has therefore provided useful data on humoral immune response to BCG vaccine in infants.

Acknowledgement

The authors are grateful to the staff of the Pediatrics Department, Federal Medical Centre, Asaba, Nigeria.

Declaration of Conflicting Interest

The authors declare that there are no conflicts of interest.

References

Acosta, A., Norami, M.N. and Sarmiento, M.E. (2010). Antibody mediated immunity – A missed opportunity in the fight against tuberculosis. *Malaysian Journal of Medical Science,* 17(2): 66 – 67.

Bam, N. and Karu, R.(2009). IgM and IgG antibodies in tuberculosis. *Journal of Institute of Medicine.* 31(3): 34 – 36.

Beyazova, U., Rota, S., Cevheroglu, C. and Karsligil. T. (1995). Humoral response in infants after BCG vaccination. *Tubercle & Lung Disease*. 76(3): 248-253.

Brodin, P.,Majilessi, L., Broseh, R. Smith, D., Banoroft, G., Clarks S., Williams, A., Leclerc, C and Cole, T. S. (2004). Enhanced protection against tuberculosis by vaccination with Recombinant *Mycobacterium microti* vaccine that induces T cell immunity against region of difference 1 antigens. *The Journal of Infectious Diseases*, 190: 115 – 122.

Choi, J.S., Kim, Y. R., Rho, M. S., Ewann, F., Miclcarek, N., Song, K.M., Czerkinsky, C. and Kim, O.J. (2012). Effect of maternal Immune status on responsiveness of BCG vaccination in mouse neonates. *Osong Public Health and Research Perspective* 3(2): 68 – 73.

Glassroth, J. (1997). Vaccines for tuberculosis: the glass remains half empty. *Annals of Internal Medicine*. 127: 403 – 404.

Kashyap, R.S., Husain, A.A., Morey, H. S., Panchbai, S.M., Deshpande, P. S., Purnhit, J.H., Taori, M.G and Daginawala, F.H. (2010). Assessment of immune response to repeat

stimulation with BCG vaccine using invitro PMBC model. *Journal of Immune based Therapies and Vaccine.* 8: 1476 – 1485.

Kuby, J. (1997). *Immunology* 3rd ed., W. H. Freeman & Co. New York 664 pp.

Manivannan, S., Narayan, R.V and Romanathan, V.D. (2006). Anti *Mycobacterium tuberculosis* IgG antibody mediated complement activation by *M. tuberculosis*. *Journal of Immunology and Immunopathology* 8(2): 140 – 141.

National Programme on Immunization (2004). Basic Guide for Routine Immunization Service Providers. 135 pp.

Ota, O.C.M., Vekemans, J., Schlege – Haueter, E.S., Fielding, K., Sanneh, M., Kidd., M., Newport, M., Aaby, P., Whitle, H., Lambert., P., McAdam, P.W.J., Siergrist, C., and Marchant, A. (2002). Influence of *Mycobacterium bovis* on antibody and cytokine responses to human neonatal vaccination. *The Journal of Immunology*. 168: 919 – 925.

Pinto, R.M.B., Camacho, R.L., Britoon, J. W., Girquel, B and Triccas, A. S. (2004). *Mycobacterium tuberculosis.* Defective in phthioceroldimycocerosate translocation provides greater protective immunity against tuberculosis than the existing Bacille Calmette – Guerin vaccine. *The Journal of Infectious Diseases.* 189: 105 – 112.

Pulickal, S. A., and Fernandez, J.V.G (2007). Comparison of the Prevalence of tuberculosis infection in BCG vaccinated versus non-vaccinated school age children. *Indian Pediatrics.* 44: 344 – 347.

Ritz, N., Hanekom, W.A., Browne – Robbins, R., Britton, W.J. and Curtis, N. (2008). Influence of BCG vaccine strain on the immune response and protection against tuberculosis. *Microbiology Review* 32(5): 821 – 841.

Rota, S., Beyazova, U., Karsligil, T. and Cevheroglu, C. (1994). Humoral response against antigen 60 in BCG vaccinated infants. *European Journal of Epidemiology.* 10(6): 713 – 718.