ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 8, Issue, 11, pp.42016-42020, November, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

PREVALENCE OF MATERNAL ANEMIA DUE TO PLASMODIUM FALCIPARUM IN DISTRICT MARDAN, KHYBER PAKHTOON KHWA, PAKISTAN

[1]Naseem Rafiq, [1]Asma Waheed Qureshi, [2,*]Luqman Khan and [1]Mian Naveed Shah

[1]Department of Zoology, Abdul Wali Khan University Mardan, Pakistan
[2]Division of Neurogenetics, Department of Developmental Biology and Neurosciences, Graduate School of Life Sciences, Tohoku University, Japan

ARTICLE INFO

Article History:
Received 09th August, 2016
Received in revised form
28th September, 2016
Accepted 20th October, 2016
Published online 30th November, 2016

Key words:

Plasmodium, Infection,
Conceived, Trimester,
Gestation period.

ABSTRACT

Over 40% of the world population lives in area where plasmodium infection is common including Pakistan. Pakistan is endemic for Plasmodium infections and incidence rate is one case per thousand populations. These parasites not only decrease the Hemoglobin level but also reduce immunity. The present study was based on identification of anemia due to plasmodium among conceived women of district Mardan. In the present work a total number of 100 female conceived women blood was studied from April 2016 to June 2016 the microscopic examination showed that all most 100% of the female during pregnancy were suffering from anemia during one or other stage of their trimester however 64% showed positive result for *Plasmodium falciparum* at early or later phase of their trimester and only 34% women were anemic only during their gestation period. It was recorded from the recent study that *Plasmodium falciparum* was one of the major cause of anemia in pregnancy in the selected area. The positive record indicates that plasmodium infection during pregnancy increase risk of low birth weight of fetus and can increase death rate during the first year of life.

Citation: Naseem Rafiq, Asma Waheed Qureshi, Luqman Khan and Mian Naveed Shah, 2016. "Prevalence of Maternal Anemia Due to Plasmodium falciparum in District Mardan, Khyber Pakhtoon Khwa, Pakistan", *International Journal of Current Research*, 8, (11), 42016-42020.

INTRODUCTION

The most common and extensive public health problem is anemia in pregnancy, affecting 24.8% of the population in world (Haniff *et al.,* 2007; Yajnik *et al.,* 2010). In developing countries 56% of all conceived mothers are anemic estimated by World Health Organization (WHO) (De Maeyer and Adiels, 1992). The prevalence of anemia in pregnancy is about 75% in Southern Asia as compared to North America and Europe with about 17% prevalence. Furthermore, 5% of pregnant women experienced severe anemia in highly prevalent countries of the world (Osungbade and Oladunjoye, 2012). Anemia has massive adverse consequences on women as the situation unfavorably affects both their productive and reproductive capabilities. First, anemia make them weak by reducing their energy and capacity for work (Axemo *et al.,* 1995). It is anticipated that anemia caused about 20% of maternal deaths; in addition, about 50% of all maternal deaths are caused by anemia (Galloway *et al.,* 2002). Blood loss during or after childbirth leads to anemia which lowers the female hematological reserve and makes women more susceptible to death, severe anemia also make a person more susceptible to infection due to lowered immunity, hemoglobin (Hb) level of less than 4 g/dl is associated with high risk of cardiac failure and death particularly during delivery or soon after, if punctual intervention is not instituted (Ross *et al.,* 1996; Osungbade and Oladunjoye, 2012). Anemia due to *Plasmodium falciparum* may cause reduced mental capacity, impaired cognitive development, and fatigue and in intense form can lead to death, especially in conceived women (Getachew *et al.,* 2012). Anemia results in morbidity and death in falciparum infection (Dondorp *et al.,* 1999). In endemic countries parasitic diseases such as *Plasmodium falciparum* have long been predictable as a vital cause of anemia (McDevitt *et al.,* 2004). Over 40% of world population lives in areas where Plasmodium infection is common, these areas include Southeast Asia, Bangladesh, Africa, areas of Middle East, India, Pakistan, Central and South America (Kondrachine and Trigg, 1997). On this continent, the greatest mortality is associated with severe anemia, especially in preschool age children, in malaria endemic areas (Gikandi *et al.,* 2008; Guerra *et al.,* 2010). Pakistan is endemic for Plasmodium infections and incidence rate of infection is one case per thousand population (Mujahid and Arif, 1998).The World Health Organization (WHO) reported that in Pakistan the percentage of Plasmodium infections credited to *Plasmodium falciparum* rose from 34% to 54% from 1987 to 1990 (Bouma *et al.,* 1996; Parvez *et al.,* 1996). The incidence of *Plasmodium falciparum* among

Corresponding author: Luqman Khan,
Division of Neurogenetics, Department of Developmental Biology and Neurosciences, Graduate School of Life Sciences, Tohoku University, Japan.

microscopy-positive cases rose from 45% to 68% from 1995 to 2006 in the Quetta city of Baluchistan and in city of Jhangara in Sindh (Durrani *et al.,* 1997; Rab *et al.,* 2001). *Plasmodium falciparum* cause malaria which contributes to anemia which effect people of all age and especially during pregnancy. It is estimated that 23 million expecting women expecting plasmodium infection per annum in sub Saharan Africa and about 400,000 pregnant women exposed to moderate or severe anemia each year (hemoglobin < 80 g/L or hematocrit < 0.25) as a result of plasmodium infection in sub-Saharan Africa (Guyatt and Snow, 2001; Getachew *et al.,* 2012). Negative consequences of Malaria in pregnancy (MIP) is an increased risk of low birth weight (LBW) for the fetus, which is usually reported (Wirima *et al.,*1996; Skette *et al.,* 2001; Guyatt *et al.,* 2004; De Beaudrap *et al.,* 2013) which is further a considerable hazard reason for developmental disability (Teplin *et al.,* 1991; Taylor *et al.,* 2000; Grantham-McGregor S *et al.,* 2007) and increases death rate during the first year of life (McCormick *et al.,* 1985; Bardaji *et al.,* 2011).

Numerous investigations found that low birth weight threat was linked exclusively with infections caused by *Plasmodium falciparum* during early stages of pregnancy (Kalilani *et al.,* 2010; Huynh *et al.,* 2011; Valea *et al.,* 2012). In Asia anemia is responsible for 12.8% of maternal mortality which is second foremost reason of maternal mortality independent of death take place from postpartum hemorrhage (Khan *et al.,* 2006;Sanghvi *et al.,* 2010). In Bangladesh the nationwide survey estimated that prevalence of anemia was 50% (Yip *et al.,* 2002; Noronha *et al.,* 2012). In Pakistan (2001) the prevalence of anemia among conceived women ranged from 39.1% estimated from health nutrition and population statistics (Steer, 2000; Yip and Ramakrishnan, 2002). The adverse effects of anemia in pregnancy are increased infant mortality resulted from low birth weight as well as maternal mortality and morbidity (Steer, 2000; Noronha *et al.,* 2012). The anemia of Plasmodium infection is complex, linking both the devastation of RBC and the production of low number of RBC's. The level of anemia caused by the different mechanisms diverge according to the pregnancy status, age, gender, anti-malarial immune status and genetic makeup of infected persons, and the confined endemicity of *Plasmodium* infection . In general, haemolysis of red blood cells is of greater magnitude in non-immune children exposing acute anemia due to *Plasmodium falciparum*, whereas the process of erythropoiesis is not seen in individuals exposed to repeated or regular falciparum infection, although, in any one individual, a number of mechanisms are liable to function (Menendez *et al.,* 2000). The development of acidosis take place as a result of anemia, and may be the principal reason of acidosis where malarial anemia is widespread, although metabolic acidosis can take place in children irrespective of severe anemia (Marsh *et al.,* 1995; English *et al.,* 1996). Blood transfution can be a deliverance mediation for individuals experiencing severe anemia and is comparatively uncomplicated to manage. On the other hand, the accessibility and safety of blood for transfusion have been mainly uneven in malarial endemic areas (Fleming, 1997). The appropriate use of blood transfusion has been shown to trim down considerably mortality among conceived women experiencing severe anemia primarily caused by *Plasmodium falciparum* infectionsand folate deficiency (Brabin and Johnson, 2005). In the management of severe anemia, such as during pregnancy or in crude subjects with sickle-cell disease, a therapeutic anti-malarial that is if possible not an antifolate should be recommended, followed by folic acid at 5 mg per day for three weeks (Stoltzuf and Dreyfuss, 1998).

The main objective of this study was: To identify Plasmodium *falciparum* in conceived mothers/pregnant woman which leads to anemia and other health issues in Mardan district Khyber Pakhtoon Khwa, Pakistan.

MATERIALS AND METHODS

Region of Intervention

The study was carried out from April 2016 to June 2016 at District Mardan, Khyber PukhtunKhwa, Pakistan. Mardan which is the 19th largest city of Pakistan. It is the second most popular city in the province located in the south west of the province at altitude of 283 meters (928 ft.).

Blood Sample Collection

Blood samples were collected from conceived mothers. The anticoagulant Ethylene Diamine Tetra Acetic Acid (EDTA) was added to the samples to prevent clotting of blood. The samples were transported to the laboratory for processing by automatic machine, to count their Hemoglobin (Hb) level and for the presence of *Plasmodium falciparum*.

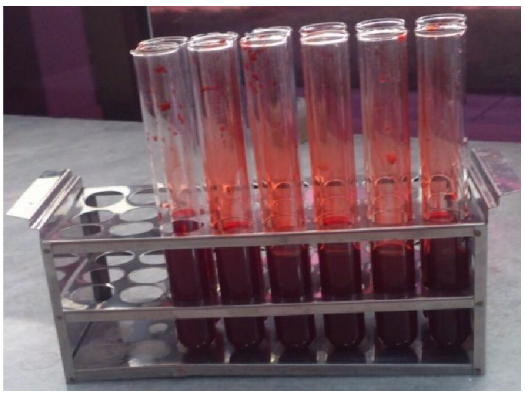

Figure 1. Collection of Blood Samplesin Test Tubes

Blood Film Preparation

Thin and thick blood films were prepared for examination of *P.falciparum*.

The Thin Film

The aim of this film was to get monolayer. Thin film was prepared by falling a drop of blood on mid of slide. Place the slide in horizontal position with the blood on mid of plane and compact surface, and by means of another slide as spreader, touched the small drop of blood in mid of slide with the rim of the spreader, allowing the blood to spread along the border. Keeping spreader at an angle of 45 and pushing the spreader firmly along the slide.

The Thick Film

Thick film was prepared by falling few drops of blood on mid of slide with the help of edge of the spreader to link with the drops of blood on slide, and stretch them to make a smooth thick film. Do not whip the blood. The diameter of spherical thick film was about 1 cm.

Figure 2. Making Of Thin Blood Smear

Figure 3. Making Of Thick Blood Smear

Staining Blood Films with Giemsa Stain

Giemsa stain is a classic blood film stain for diagnosis of Plasmodium. Each thin film was fixed by sinking slide for a few seconds in a container having methanol. The slides were positioned back to back in a staining furrow, with no doubt that the thick films were on the whole at one end of the trough. Giemsa stain solution was prepared of about 3% by mixing 3 ml of Giemsa stock solution with 97 ml of distilled water buffered to pH 7.2. The stain was poured into the trough. Stained for 45- 60 min. gently clean water was poured into the trough containing slides to float off the iridescent 'scum'. Gently poured off the remaining stain and rinsed with clean water. The slides were cautiously removed from trough, one by one, inserting them in the drying rack to dry with film side facing downward.

Microscopic examination of blood film

For the presence and species identification of parasites microscopic examination of thin and thick blood films was carried out using high power magnification using thin films under a x10 paired eyepiece and the objective of 100× oil immersion werecarried out.(Warhurst dc, Williams 1996).

RESULTS

Overall Result

A total of 100 samples taken from subjects among those 36 subjects were suffering from anemia and 64 subjects showed positive result for *plasmodium falciparum* with addition to anemia.

Hemoglobin level Result

Pregnant female anemic patients showed positive result with 36% (36/100).The normal Hemoglobin level of adult female is 12 to 15.5 grams per deciliter of blood. In pregnant women a low hemoglobin level count is generally defined as less than 13.5 grams per deciliter of blood.

Plasmodium falciparum Result

Pregnant female anemic patients showed positive result with 64 (64/100) along with the presences of parasites in their blood (i.e. *plasmodium falciparum).*

Table 1. Prevalence of*Plasmodiumfalciparum*in Female Anemic Patients in District Mardan, Khyber Pakhtoon Khwa

Status	Positive Subjects	Positive Subjects %age
Pregnant(Anemic only)	36	36%
Pregnant(*P.falciparum*)	64	64%
Total	100	100%

DISCUSSION

Results of present study showed that *Plasmodium falciparum* a protozoan parasite is one of the causative agent of anemia in pregnancy as identified through microscopic examination. Anemia is prevalent in Mardan of KPK and has been reported from other provinces. Our study is parallel (Baig-Ansari, 2008) in an urban area of Pakistan. The present study/ report confirm that a large number of subjects experience anemia during pregnancy. (Baig-Ansari, 2008) found that in an urban setting in Pakistan about 90.5% conceived women were exposing anemia.(Stevens et al, 2013) found that in Pakistan in 1995 48% female were anemic during pregnancy, 47% were exposing anemia during 1996-2000, 46% during 2001-2002, 47% during 2003-2006, 48% during 2007-2008, 49% in 2009, 50% in 2010 and 51% during 2011-2013. In this study blood taken from 100 female anemic patients were examined for presence of *Plasmodium falciparum* by making thin and thick film and staining. The pregnant women were major at risk groups in this study 64% (64/100), and 36% (36/ 100) are next affected, they were only anemic in pregnancy. In Pakistan a study on prevalence of anemia, the report indicates that 96% of pregnant women were anemic in Mardan area of Pakistan. This study has recognized as familiar connection between anemia and maternal complications which leads to early/premature child birth, low birth weight and brood with physical and mental retardation. The underlying cause is postulated due to presence of *Plasmodium falciparum* which causes anemia in pregnant women as well as new born child. This study has emphasized the outcome of bearing in mind that anemia because of having *Plasmodium falciparum* in blood especially in pregnant women expecting anemia is a sign of unfavorable outcome of birth. Thus, to reduce the effect of this complexity, measures must be carrying out at community level, which can avoid and treat anemia.

Conclusion

Anemia resulted from infection of *Plasmodium falciparum* is currently a strict health danger of consideredfemales living in Mardan, Khyber PukhtunKhwa, Pakistan. It was concluded that *Plasmodium falciparum* was the contributory cause of anemia in the study region. Anemia and Plasmodium infections awareness programs should be initiated by Health

organizations and should be further promoted at the local level reaching out to all people .We finalized that this overlooked division of anemia caused by *Plasmodium falciparum* should be calculated by Health institute in the world and next to the Pakistani administration

REFERENCES

Awan, M.M., Akbar, M.A. and Khan, M.I, 2004.A study of anemia in pregnant women of railway colony, Multan. *Pak J Med Res*., 43(1):11-4.

Axemo, P., Liljestrand, J., Bergström, S. and Gebre-Medhin, M., 1995.Aetiology of late fetal death in Maputo. *Gynecologic and obstetric investigation*, 39(2):103-109.

Baig-Ansari, N., Badruddin, S.H., Karmaliani, R., Harris, H., Jehan, I., Pasha, O., Moss, N., McClure, E.M. and Goldenberg, R.L., 2008. Anemia prevalence and risk factors in pregnant women in an urban area of Pakistan. *Food and nutrition bulletin*, 29(2):132-139.

Bardají, A., Sigauque, B., Sanz, S., Maixenchs, M., Ordi, J., Aponte, J.J., Mabunda, S., Alonso, P.L. and Menéndez, C., 2001. Impact of malaria at the end of pregnancy on infant mortality and morbidity. *Journal of Infectious Diseases*,203(5):691-699.

Bouma, M.J., Dye, C. and Van der Kaay, H.J., 1996. Falciparum malaria and climate change in the Northwest Frontier Province of Pakistan. *The American journal of tropical medicine and hygiene*, 55:131-137.

Bouma, M.J., Parvez, S.D., Nesbit, R. and Winkler, A.M., 1996. Malaria control using permethrin applied to tents of nomadic Afghan refugees in northern Pakistan. *Bulletin of the World Health Organization*, 74(4):413-421.

Brabin, B.J. and Johnson, P.M., 2005. Placental malaria and pre-eclampsia through the looking glass backwards? *Journal of reproductive immunology*,65(1):1-15.

De Beaudrap, P., Turyakira, E., White, L.J., Nabasumba, C., Tumwebaze, B., Muehlenbachs, A., Guérin, P.J., Boum, Y., McGready, R. and Piola, P., 2013. Impact of malaria during pregnancy on pregnancy outcomes in a Ugandan prospectivecohort with intensive malaria screening and prompt treatment. *Malaria journal*, 12(1):12-139

De Maeyer, and Adiels M.T., 1992. The Prevalence of Anemia in Women: A Tabulation of Available Information, Geneva, 38(3):302-316

Dondorp, A.M., Angus, B.J., Chotivanich, K., Silamut, K., Ruangveerayuth, R., Hardeman, M.R., Kager, P.A., Vreeken, J. and White, N.J., 1999. Red blood cell deformability as a predictor of anemia in severe falciparum malaria. *The American journal of tropical medicine and hygiene*, 60(5):733-737.

Durrani, A.B., Durrani, I.U., Abbas, N. and Jabeen, M., 1997. Epidemiology of cerebral malaria and its mortality. *JPMA. The Journal of the Pakistan Medical Association*, 47(8):213-215.

English, M.,Waruiru, C. and Marsh, K., 1996. Transfusion for respiratory distress in life-threatening childhood malaria. *The American journal of tropical medicine and hygiene*, 55(5):525-530.

Fleming, A.F., 1997. HIV and blood transfusion in sub-Saharan Africa. *Transfusion scienc.,*18(2):167-179.

Galloway, R., Dusch, E., Elder, L., Achadi, E., Grajeda, R., Hurtado, E., Favin, M., Kanani, S., Marsaban, J., Meda, N. and Moore, K.M., 2002. Women's perceptions of iron deficiency and anemia prevention and control in eight developing countries. *Social science & medicine*, 55(4):529-544.

Getachew, M., Yewhalaw, D., Tafess, K., Getachew, Y. and Zeynudin, A., 2012. Anemia and associated risk factors among pregnant women in Gilgel Gibe dam area, Southwest Ethiopia. *Parasites & vectors*, 5(1):296

Grantham-McGregor, S., Cheung, Y.B., Cueto, S., Glewwe, P., Richter, L., Strupp, B., 2007. and International Child Development Steering Group. Developmental potential in the first 5 years for children in developing countries. *The lancet*, 369(9555):60-70

Guerra, C.A., Gikandi, P.W., Tatem, A.J., Noor, A.M., Smith, D.L., Hay, S.I. and Snow, R.W., 2008. The limits and intensity of Plasmodium falciparum transmission: implications for malaria control and elimination worldwide. *PLoS Med*., 5(2):38

Guerra, C.A., Howes, R.E., Patil, A.P., Gething, P.W., Van Boeckel, T.P., Temperley, W.H., Kabaria, C.W., Tatem, A.J., Manh, B.H., Elyazar, I.R. and Baird, J.K., 2010 The international limits and population at risk of Plasmodium vivax transmission in 2009. *PLoSNegl Trop Dis*., 4(8):774.

Guyatt, H.L. and Snow, R.W., 2001. Malaria in pregnancy as an indirect cause of infant mortality in sub-Saharan Africa. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 95(6):569-576.

Guyatt, H.L. and Snow, R.W., 2001. The epidemiology and burden of Plasmodium falciparum-related anemia among pregnant women in sub-Saharan Africa. *The American journal of tropical medicine and hygiene*, 64(1):36-44.

Guyatt, H.L. and Snow, R.W., 2004. Impact of malaria during pregnancy on low birth weight in sub-Saharan Africa. *Clinical microbiology reviews*, 17(4):760-769.

Haniff, J., Das, A., Onn, L.T., Sun, C.W., Nordin, N.M., Rampal, S., Bahrin, S., Ganeslingam, M., Kularatnam, K.I.K. and Zaher, Z.M.M., 2007. Anemia in pregnancy in Malaysia: a cross-sectional survey. *Asia Pacific Journal of Clinical Nutrition*, 16(3):527-536.

Huynh, B.T., Fievet, N., Gbaguidi, G., Dechavanne, S., Borgella, S., Guézo-Mévo, B., Massougbodji, A., Ndam, N.T., Deloron, P. and Cot, M., 2001. Influence of the timing of malaria infection during pregnancy on birth weight and on maternal anemia in Benin. *The American journal of tropical medicine and hygiene*, 85(2):214-220.

Kalilani, L., Mofolo, I., Chaponda, M., Rogerson, S.J. and Meshnick, S.R., 2010. The effect of timing and frequency of Plasmodium falciparum infection during pregnancy on the risk of low birth weight and maternal anemia. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 104(6):416-422.

Khan, K.S., Wojdyla, D., Say, L., Gülmezoglu, A.M. and Van Look, P.F., 2006. WHO analysis of causes of maternal death: a systematic review. *The lancet*, 367(9516):1066-1074.

Kondrachine, A.V. and Trigg, P.I., 1997. Global overview of malaria. *The Indian journal of medical research*, 106, pp.39-52.

Marsh, K., Forster, D., Waruiru, C., Mwangi, I., Winstanley, M., Marsh, V., Newton, C., Winstanley, P., Warn, P., Peshu, N. and Pasvol, G., 1995. Indicators of life-threatening malaria in African children. *New England journal of medicine*, 332(21):1399-1404.

McCormick, M.C., 1985. The contribution of low birth weight to infant mortality and childhood morbidity. *New England journal of medicine*, 312(2):82-90.

McDevitt, M.A., Xie, J., Gordeuk, V. and Bucala, R., 2004. The anemia of malaria infection: role of inflammatory cytokines. *Current hematology reports*, 3(2):97-106.

Menendez, C., Fleming, A.F. and Alonso, P.L. Malaria-related anemia. *Parasitology today*. 2000; 16(11):469-476.

Mujahid, C.A. and Arif, M., 1998. Malaria situation in Pakistan to brief on National control programme. *Pakistan J Med Res*., 98(37):4.

Noronha, J.A., Al Khasawneh, E., Seshan, V., Ramasubramaniam, S. and Raman, S., 2012. Anemia in pregnancy-consequences and challenges: a review of literature. *Journal of South Asian Federation of Obstetrics and Gynecology*, 4(1):64-70.

Osungbade, K.O. and Oladunjoye, A.O., 2012 Anemia in Developing Countries: Burden and Prospects of Prevention and Control. INTECH Open Access Publisher. Dr. Donald Silverberg (Ed),953-978.

Rab, M.A., Freeman, T.W., Durrani, N., De Poerck, D. and Rowland, M.W., 2001. Resistance of Plasmodium falciparum malaria to chloroquine is widespread in eastern Afghanistan. *Annals of tropical medicine and parasitology*, 95(1):41-46.

Ross, J.S. and Thomas, E.L., 1996. Iron deficiency anemia and maternal mortality. *Working Notes Series*, (3).

Steer, P.J., 2000. Maternal hemoglobin concentration and birth weight. *The American journal of clinical nutrition*, 71(5):1285-1287.

Steketee, R.W., Nahlen, B.L., Parise, M.E. and Menendez, C., 2001. The burden of malaria in pregnancy in malaria-endemic areas. *The American journal of tropical medicine and hygiene*, 64(1):28-35.

Stoltzfus, R.J. and Dreyfuss, M.L., 1998. Guidelines for the use of iron supplements to prevent and treat iron deficiency anemia. Washington^ eDC DC: Isle Press, 18-21.

Teplin, S.W., Burchinal, M., Johnson-Martin, N., Humphry, R.A. and Kraybill, E.N., 1991. Neurodevelopmental, health, and growth status at age 6 years of children with birth weights less than 1001 grams. *The Journal of pediatrics*, 118(5):768-777.

Valea, I., Tinto, H., Drabo, M.K., Huybregts, L., Sorgho, H., Ouedraogo, J.B., Guiguemde, R.T., Van Geertruyden, J.P., Kolsteren, P. and D'Alessandro, U., 2012. An analysis of timing and frequency of malaria infection during pregnancy in relation to the risk of low birth weight, anemia and perinatal mortality in Burkina Faso. *Malaria journal*, 11(1):1.

Wirima, J.J., Steketee, R.W., Hightower, A.W., Slutsker, L., Heymann, D.L. and Breman, J.G., 1996. The effect of malaria and malaria prevention in pregnancy on offspring birth weight, prematurity, and intrauterine growth retardation in rural Malawi. *The American journal of tropical medicine and hygiene*, 55(1):33-41.

Yajnik, C., Coyaji, K., Joglejkar, C., Kinare, A. and Rao, S., 2010. Pune maternal and nutrition study. *Journal of ultra sound*, (2):215-223.

Yip, R. and Ramakrishna, U., 2002. Experiences and challenges in developing countries. *The Journal of nutrition*, *132*(4):827S-830S

****