MATERNAL ANAEMIA AND ASSOCIATED FACTORS IN MPWAPWA DISTRICT, TANZANIA

AMON PETER TUMBO, MD

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT FOR THE DEGREE OF M.MED. (COMMUNITY HEALTH) IN THE UNIVERSITY OF DAR ES SALAAM

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1.0. ABSTRACT

To determine the prevalence and associated risk factors of maternal anaemia, we conducted a community based cross-sectional survey in Mpwapwa district. A total of 724 pregnant women were studied. Data were collected from the beginning of November to mid December, 1992.

Anaemia, as defined by WHO cut-off point of haemoglobin less than 11g/dl, was recorded in 61%(441/724) of the study population. Both the prevalence of anaemia and the mean haemoglobin levels decreased gradually as age increased except for age group 20-24 years. However, the mean haemoglobin level was significantly higher among women who reported that they were using iron supplements (11.1g/dl than among those who didn't (10.3g/dl) (Student t-statistic = 8.9; p-value <0.001). There was no significant difference between the mean haemoglobin levels of subjects who reported that they were using chloroquine chemoprophylaxis (10.4g/dl) and those who didn't (10.5g/dl). Subjects who had booked for antenatal clinic had lower prevalence of anaemia 57.2%(299/523) compared with those who had not 70.6% (142/201). The difference 13.4% was statistically significant (95% CI = 5.8%, 21%; Mantel-Haenszel (M-H) Chi-square test = 11.1; p-value = 0.001; df = 1). About 6%(46/724) of the study subjects had multiple parasitic infections, those with malaria parasites or hookworm alone were 9.5%(69/724) and 13.4%(97/724) respectively.

Analysis using logistic regression model showed that the significant risk factors associated with maternal anaemia were age below 20 years (Odds Ratio (OR) = 2.0; 95% Confidence Interval (CI) = 1.35%, 3.0%), malaria (OR = 2.7, 95% CI = 1.7%, 5.1%), hookworm (OR = 2.3; 95% CI = 1.3%, 3.8%), other intestinal helminths (OR = 2.6 95% CI = 1.1%, 6.2%). The risk of anaemia was higher among women who reported that they were using chloroquine chemoprophylaxis than in those who did not (OR = 2.2; 95% CI = 1.3%, 3.9%). Antenatal clinic attendance and iron supplementation were associated with a reduction of risk of anaemia by 30% and 57% respectively.

In conclusion, maternal anaemia is a major public health problem in Mpwapwa district. Measures to its control should concentrate on pre-pregnancy deworming, increasing use of antenatal clinic and iron supplementation during pregnancy.

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ACKNOWLEDGEMENTS

This dissertation work is dedicated to all staff members of the Tanzania Food and Nutrition Centre (TFNC) whose publications prompted me to study maternal anaemia in Mpwapwa district.

I would like to register my thanks to the Ministry of health and Muhimbili University College of Health Sciences (MUCHS) for their financial support which made the execution of the dissertation work possible.

I am particularly thankful to Dr. W. Mpanju-Shumbusho, formerly Head, Department of Community Health, for making all the necessary arrangements for my study.

I am greatly indebted to my supervisors, Drs. G.I. Msamanga MD; MSc; ScD and F. Kawau MD; MSc, for their guidance in doing this work, through their constructive criticisms and encouragement all the way through.

I would also like to extend may apreciation to Mr M. Madondola, Laboratory technician from Mpwapwa district hospital, for his great assistance in examining the specimens.

Thanks are also to Mr J.B. Mtui, Computer programmer in the department of Epidemiology and Biostatistics (MUCHS) for his assistance in carrying out data analysis.

I highly appreciate the cooperation and assistance we received from the District Commissioner, Miss B. Mawani, the District Medical Officer, Dr. F. Ng'ingo and the all local leaders we worked with.

I would also like to acknowledge the cooperation we received from all women who took part in the study.

I wish to express my gratitude to my wife Verian Haibey and to my daughter Helena for their continuous moral support and encouragement.

Lastly I express my acknowledgement to various individuals who contributed, in one way or another, to the success of work.

DECLARATION

I DECLARE SOLEMNLY THAT THIS DISSERTATION IS MY OWN ORIGINAL WORK AND IT HAS NOT BEEN SUBMITTED FOR A SIMILAR DEGREE IN ANY OTHER UNIVERSITY.

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1.0. INTRODUCTION

Anaemia in pregnancy is a serious health problem, particularly in developing countries, where there are still many factors contributing to it. In these countries most of a woman's life is somehow interwoven with anaemia right from infancy and early childhood through pre-school age to childbearing age. The iron balance during childbearing age is disrupted by blood loss during menstruation and delivery, increased iron demand of the growing fetus and uterus and reduced intake due to pregnancy related nausea and vomiting. Maternal anaemia affects the mother, the foetus and the newborn. To the mother it reduces the capacity to carry out productive work, to manage the household and care for children. It also causes loss of the body's ability to resist infection, general ill health and death. Death is likely to occur with a haemoglobin level of 4g/dl or less[1]. To the foetus it causes intrauterine growth retardation, low birth weight and pregnancy wastage, while to the newborn it is an underlying cause of increased perinatal mortality and development of anaemia.

Many studies have shown that iron deficiency and malaria are the main causes of anaemia in pregnancy[2,3,4]. Based on this knowledge many studies have also been conducted to establish the effect and dosage of iron supplements during pregnancy[5,6]. This work was followed by implementation of anaemia control programmes in many countries, concentrating on distribution of iron supplement and fortification of food with iron[7]. The latter approach has been used successfully in developed countries,

while iron supplementation remains a strategy of first choice in the third world countries. An attempt to control anaemia in these countries has not produced significant effect. Most of the supplementing programmes in the third world have been initiated without considering the prevailing local conditions which limit the impact[7]. Such factors include; inadequate population coverage, failure to sustain constant supply of haematinics, poor user compliance, late antenatal clinic booking, the presence of blood depleting parasites and repeated infections. In the study conducted in Burma and Thailand, Charoenlarp and others found out that 10-35% of a study subjects did not take oral iron tablets because of side-effects[7]. In the same study it was found out that hookworm was the main reason for the failure to raise haemoglobin to normal levels in some individuals when iron therapy was administered. A study conducted in England to find out whether iron was being taken by patients as prescribed, showed that 28% of the patients took lower doses than the amount prescribed[8].

The distribution of haematinics and chloroquine tablets to pregnant women attending antenatal clinics has been going on in Tanzania since 1974[9]. Yet anaemia with its deleterious effects has continued to affect the health of many women. The reasons for this failure are similar to those mentioned above: low population coverage, inadequate supplies of the supplements, late antenatal clinic booking, poor compliance, presence of blood depleting parasites and chronic and repeated acute infections.

The past experiences suggest that there is a need to find out whether the approach taken is relevant to our countries in terms of its affordability and acceptability. Health workers should guard against a paternalistic and commandment-like approach whereby they tend to encourage women to practise what they themselves do not want. Iron supplementation is unlikely to give the desired effect in countries where hookworm, malaria, infections and undernutrition are still prevalent. It is only by attending to such influencing factors that the situation might be changed.

2.0. REVIEW OF LITERATURE

In this section an attempt was made to review the literature on anaemia with a focus of attention on the global situation of anaemia, situation of anaemia in Tanzania and public health importance of anaemia in pregnancy.

2.1. Definition of Anaemia

Anaemia is defined as a decrease in haemoglobin per unit of blood volume below an arbitrarily set normal which varies according to age, sex, physiological state and the environment. According to World Health Organization, anaemia in pregnancy is defined by haemoglobin less than 11g/dl[10]. Some countries and institutions, however, have adopted different cut-off points. Tanzania Food and Nutrition Centre defines anaemia by haemoglobin less than 10g/dl regardless of age, sex and physiological status[11]. This level has been adopted as it is below which there is no stainable iron in the bone marrow and clinical features of anaemia develop.

Anaemia has many causes ranging from genetic through parasitic and other infections to nutritional factors. Based on causes, Leavell and others classified anaemia into three overapping types: anaemia due to diminished erythropoiesis, due to blood loss and due to increased haemolysis[12]. The important nutrients in the production of the red blood cells include: iron, folic acid, vitamin B_{12} and some minerals (copper, zinc, magnesium and cobalt)[11]. Iron plays an important role in several metabolic activities. In haemoglobin it carries oxygen from the lungs to the tissues and carbon dioxide from the tissue to the lungs. In the myoglobin it stores and circulates oxygen

within the muscles and is linked to some of the body enzymes[12]. In a healthy individual with adequate nutritional status there is an equilibrium of iron in which the daily amount of iron absorbed from the gut is sufficient to compensate for the daily losses, cover for metabolic requirements and maintain adequate body stores. This state however, may be disturbed by inadequate dietary intake, poor absorption and increased losses or requirements.

Dietary iron exists in haem and non-haem forms. Haem iron is found in meat, poultry and fish. Non-haem iron is obtained from food of plant origin and is absorbed in small amount, 1-7% compared with 20-30% of haem iron[13]. The absorption of non-haem iron is influenced by several factors. The presence of ascorbic acid and haemoglobin in the diet enhances absorption. On the other hand phytic acids in cereals, legumes and many of the vegetables, calcium in dairy food products and phenolic compounds and tannins in tea and coffee inhibit the absorption of non haem iron[14].

Chronic blood loss is commonly caused by blood depleting parasites and results in iron deficiency anaemia. Hookworm infection is the most common blood depleting parasite in Tanzania. This parasite is prevalent along the coastal belt and in some of the high altitude areas. According to the annual Mpwapwa district hospital report, hookworm infection ranked third among the top ten diseases in 1991[15]. It has been reported that hookworm infection is usually common in the adult population[16]. Necator americanus is capable of sucking 0.03-0.05ml of blood in a day, while

Ancylostoma duodenale can suck 0.2ml of blood[17]. Although blood loss in hookworm infection is proportional to hookwormload, it has been found out that hookworm anaemia develops in individuals who do not take adequate dietary iron[18]. Trichuris trichiura is widely spread in Tanzania and its health effects include loss of blood. According to McCullough both Schistosoma haematobium and S. mansoni are endemic in Tanzania[19]. S. haematobium is widely spread especially in the eastern and south-eastern interland of lake Victoria, in lowlands and in the Coastal belt. The distribution of S. mansoni on the other hand is focal with one extensive zone along the eastern shores and the Islands of lake Victoria[19]. Both infections cause chronic inflammatory reaction with granuloma formation and bleeding tendency.

The destruction of the red blood cells may be caused by some parasitic and bacterial infections, hereditary haemolytic disorders and poisoning. Anaemia is common in malaria and results from destruction of red blood cells, sequestration of the red cells in the spleen and bone marrow depression. Malaria transmission in Mpwapwa district is seasonal with increase in incidence towards the end of the rainy season[20]. The prevalence of sickle cell disease, which causes blood haemolysis is about 1% in Tanzania, while sickle cell trait has been reported in 18 regions. Mitchell et al. found out that 17% of the children who were admitted at Muhimbili Medical Centre in 1972 were carriers of sickle cell trait, while 4% had the actual disease. In Karagwe the corresponding figures were 12% and 1%[21]. It is known, however, that most of the individuals with the disease die before maturity.

2.2. Global Situation of Anaemia

Anaemia is a world-wide problem affecting about 1.3 billion people. Nutritional anaemia is the most common, affecting about seven to eight million people world-wide[14]. Although anaemia persists silently in older ages of the male population, it is more common and severe in underfives, pre-school children and women of reproductive age with estimated world prevalence is 43%, 37% and 51% respectively[22].

While anaemia in general has been controlled in Europe and North America, it is highly prevalent in countries of Asia and Africa, followed by those in Latin America and Oceania[22]. In the WHO collaborative study reported earlier it was found out that 60-80% of pregnant women were anaemic in Burma and 63-75% in Thailand[7]. Iron supplementation raised the haemoglobin levels to normal in 80% of the cases. In a study conducted in Papua New Guinea in 1988, anaemia was recorded in 92% of the school children[23]. Among the low income pregnant women in the capital of Liberia, 78% were found anaemic in 1982[24].

A study conducted among pregnant women in the Guinea Savanna of Northern Nigeria showed that about 46% of them were anaemic and 16% had to be given blood[25]. A study conducted in Chad in 1988 showed that 67% of the pregnant women had anaemia, 70% of them had iron deficiency[26]. The study also showed that there was a correlation between maternal and newborn haematopoiesis and some of the iron parameters in the newborns were related to the iron status of the mothers.

A study carried out in Jamaica in 1982 showed that anaemia was a problem in pre-school children and pregnant and lactating women[27]. Using WHO cut-off points anaemia was recorded in 61.6% of pregnant women, 58.7% of lactating women and 55% of pre-school children. Another study conducted in Guyana in 1982 showed that 61.6% of the pregnant women and 41% of the lactating mothers were anaemic[28]. In general the prevalences of anaemia in the country were higher among the urban than rural residents.

2.3. Situation of anaemia in Tanzania

Anaemia is the most widespread nutritional disorder in Tanzania. According to Kavishe its distribution follows that of malaria, being severe in the coastal zone and other lowland areas, moderate to severe in the lake zone, moderate in plateau zone and mild in the highland zone[29]. Many anaemia prevalence studies have been conducted in Tanzania. In 1964 Sturrock investigated a rural community in Tanga region and recorded anaemia in 80% of the general population, 76% of the adult males, 89.5% of the adult females and 60.7% of the children aged 2-9 years[30]. Mwanukuzi et al. in 1972 studied pregnant women attending clinic for the first time with gestation age of 24 weeks and they recorded anaemia in 67% of the women[2]. Later in 1974 Nhonoli carried out another study to determine the natural history of pregnancy anaemias and found out that all the studied women were anaemic[31]. In both studies, however, anaemia was defined by a cut-off point of 12g/dl. According to WHO estimates, 50% of pregnant women in Tanzania were anaemic in 1988[32]. In a community based study conducted in Kilimanjaro, Mara and Morogoro regions,

anaemia was recorded in 18% of the adult males in Kilimanjaro, 75% in Morogoro and 80% in Mara. The corresponding figures for the adult females were; 21%, 81% and 80% respectively[33]. Kavishe in 1991 reported that anaemia affected 32% of the general population, 45% of the underfives and 80% of the pregnant and lactating women[34].

Studies carried out in Tanzania have also shown some of the factors associated with anaemia. Between 1959-1960 Blackman carried out a hospital based study in Dar es Salaam and he found out that iron deficiency was the main cause of anaemia in 50% of the adult population. In the majority, anaemia was attributed to hookworm infection. Megalobastic anaemia was recorded in only 7% of the cases, most of whom were pregnant. Malaria, on the other, was the main cause of anaemia in children[35]. During the same period Meredith et al. carried out a similar study in Dar es Salaam and they found out that anaemia in children was caused by malaria and that iron therapy had no effect[36]. In a hospital based study conducted in Dar es Salaam in 1963, Rowland found out that hookworm infestation was associated with anaemia, iron therapy raised the haemoglobin levels[4]. Nhonoli also reported that hookworm infestation was the main cause of anaemia in the area[31]. In 1981 anaemia accounted for 11.5% of all admissions in the paediatric wards at Muhimbili Medical Centre[37]. At the same centre anaemia was the main cause in 40% of all the deaths that occurred between 1985-87[38]. According to Kavishe anaemia is the direct cause of 5% and the underlying cause of 62-75% of maternal deaths that occur in Tanzania[34].

2.4. Public Health Importance of Anaemia in Pregnancy

2.4.1. Anaemia and pregnancy

During the whole period of pregnancy, a woman requires about 500mg of iron for the increased red cell mass, 290mg for the foetus, 25mg for the placenta and 250mg for compensation of the basal losses[39]. Most of this iron is needed during the second and third trimesters. The daily iron requirement increases from 1.4mg before pregnancy to between 2.5mg and 5.2mg during the 2nd and 3rd trimesters[13]. This iron requirement cannot be covered from dietary iron alone, instead it has to be obtained from the body reserves. If, therefore, a woman becomes pregnant while having depleted iron stores, she is likely to develop anaemia unless she takes iron supplements. Studies conducted in countries where malaria is endemic showed that iron deficiency during pregnancy increases with parity, while prevalence of anaemia decreases as parity increases [3,40,41].

Delivery of low birth weight babies is common in anaemic women. Chanarin et al. in 1971 observed that babies delivered by mothers with haemoglobin less than 10g/dl had low birth weight[42]. Yusufji et al. in 1973 also found out that anaemic mothers delivered low birth weight babies[43]. Agboola in 1975 observed that low haematocrit(28% or less) was associated with low faetal weight[44]. Studies conducted in different countries showed that maternal anaemia is also associated with perinatal mortality. Apgar scores of 3 or less have been observed in up to 20% when maternal haemoglobin is less than 10 g/dl[45]. It has also been established that anaemic women deliver babies with normal haemoglobin levels[46,47]. but the infants develop anaemia

after 2-3 months due to deficiency in iron storage[48].

2.4.2. Anaemia and Infection

Many people have studied the association between iron deficiency anaemia and infection but their findings have caused some controversies. In 1973, for example, Massawe and Nsanzemuhire noted that there was less growth of bacteria in vitro in blood from patients with iron deficiency anaemia than patients with sickle cell anaemia or those without anaemia[49]. Later in 1974, Massawe and others observed that attacks of malaria in hospital patients with iron deficiency occurred once iron therapy had been started[50]. This was explained by the increase of young erythrocytes following iron treatment which are highly parasitized. In a randomized controlled trial conducted among adult Somali nomads Murray et al. showed that significantly more episodes of malaria occurred in the iron-treated group[51] compared to controls. Another study conducted among children aged between 6 months and 5 years in the Gambia, workers showed increased risk of fever to children with iron deficiency anaemia treated with iron compared to controls[52]. But Harvey et al. in 1989 reported findings which were contrary to those reported above that iron deficiency protects the individual against infection. They did not observe significant difference between treatment and control groups in terms of number of episodes of suspected malaria during iron therapy[23] and this difference was attributed to the immune status of the respective study populations. But according to DeMaeyer, anaemic individuals are protected from infections by free iron binding proteins which withhold iron from invading organisms that require it for growth[10]. Joynson and others found out that

in anaemic individuals there is impairment of lymphocyte trans-formation and production of microphage migration inhibition factor[53]. Chandra in 1974 found out that anaemia affects the development of lymphoid tissue resulting in reduction of myeloperoxidase, a cytoplasmic enzyme of granulocytes, which is essential for phagocytosis[54]. In clinical practice, however, it has been observed that infection is common and severe in anaemic individuals (Massawe SN, Obstetrician, personal communication).

2.5. Antenatal Clinic (ANC) Booking

Although more than 85% of the pregnant women in Tanzania book for antenatal clinic[55] most of them tend to book very late. Kapiga in 1988 found out that 64% of the women who attended antenatal clinic at Bagamoyo district hospital booked at a gestation age of more than 22 weeks[56]. Similarly, Magari in the same year reported that two thirds of the women who attend antenatal clinic in Tanzania book when they are 28 weeks pregnant or more[57]. The recommended booking gestation age by the Ministry of Health is between 8 and 12 weeks (Mzige, Director of preventive services, Ministry of health. personal communication 1992).

3.0. RATIONALE AND OBJECTIVES

3.1. RATIONALE

The maternal mortality rate in Tanzania is still high in spite of the comprehensive Maternal and Child Health (MCH) services introduced in 1974. According to Mandara and others the average maternal mortality rate between 1985-1987 was 185 per 100,000 live births[58]. In 1991 the Ministry of Health estimated that 200-400 maternal deaths occurred per 100,000 live births[55]. Anaemia was one of the main causes of maternal deaths, the others being abortion, pelvic infections and ruptured uterus. Anaemia accounted for 37% of the maternal deaths which occurred at Muhimbili Medical Centre in 1988[59].

Isolated anaemia prevalence studies have been conducted in Tanzania, however, as most of them were hospital based their data may not reflect the actual situation. The prevalence of maternal anaemia in Mpwapwa District has not been established. As mentioned earlier, anaemia in the general population is reported to be moderate in the district. The author, however, thought that the problem of anaemia might be severe due to recurrent food shortages, prevalent parasitic infections and inadequate utilization of the available health services. According to the annual district hospital report, anaemia in 1992 ranked fourth in the top ten diseases[15], surpassed by malaria, diarrheal diseases and hookworm infection. Anaemia however, was defined by a cut-off point of 8.5g/dl. It would have ranked high in the list if WHO definition was used.

A review of the world literature shows that nutritional anaemia results from a complex interaction of many factors which vary from one community to another. In a study conducted in Niger, Brunengo et al. reported that parity and maternal age are associated in the risk of maternal anaemia[6]. Contrary to the above finding, Mwanukuzi et al. did not find such association in Tanzania[4]. In another study conducted in Nigeria, Fleming reported that there was an association between malaria and maternal anaemia[3]. This finding was contrary to that reported by Nhonoli in Dar es Salaam[34].

It is noted, however, that in most of the above mentioned studies, important confounding variables such as age and presence of parasitic infections were not controlled for during data analysis. It was against this background that the study was conducted in order to determine the magnitude of anaemia in the district and identify the associated factors so as to make available informations which will contribute to the control of anaemia in the district.

3.2. Broad Objectives

3.2.1. To determine the prevalence of maternal anaemia in Mpwapwa district and identify its associated risk factors so as make available information which will contribute towards the control of anaemia.

3.3. Specific Objectives

3.3.1. To determine the prevalence of anaemia by maternal characteristics (maternal age, parity, pregnancy spacing and socio-economic status)

3.3.2. To determine the prevalence of anaemia by parasitic infections (malaria, schistosomiasis, hookworm and trichuriasis).

3.3.3. To determine the prevalence of anaemia by diet and frequency of food intake.

3.3.4. To determine the prevalence of anaemia by maternal morbidity (nausea and vomiting in pregnancy, fever, diarrhoea and vaginal bleeding).

3.4. The hypothesis

Pregnant women with unfavourable maternal risk factors (age of less than 20 years, increased morbidity, late antenatal clinic booking and those infected with malaria or helminths) are more likely to be anaemic than those without.

4.0. METHODOLOGY

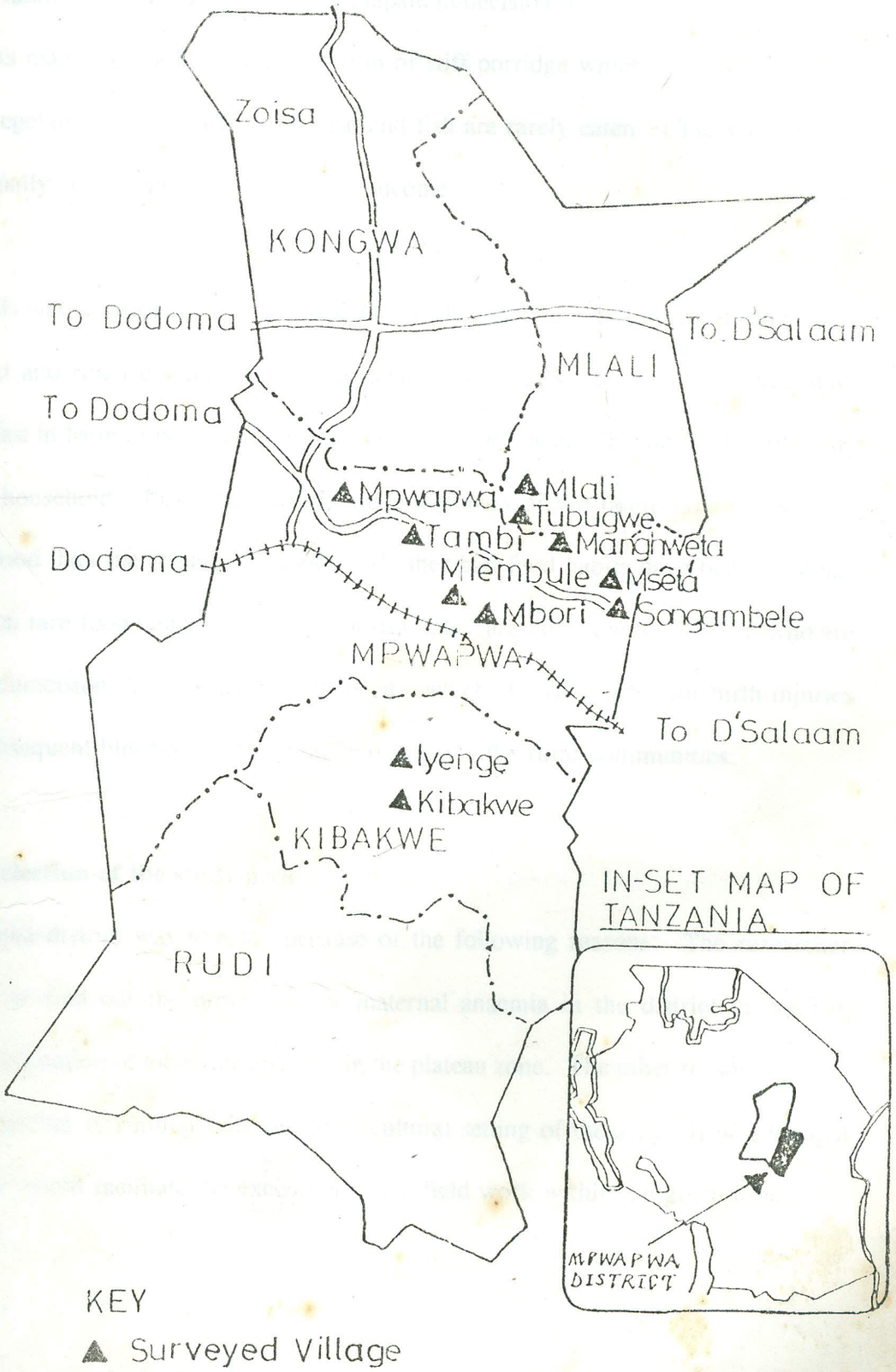
4.1. Study Design

A community based cross-sectional survey was conducted in Mpwapwa district from the 1st of November to 15th of December, 1992.

4.2. Description of the study area.

Mpwapwa is one of the four districts of Dodoma region. It borders with Morogoro region in the East, Arusha region in the North, Iringa region in South and Dodoma district in the West. The district has an area of 11,522 sq.km. and is divided into 6 divisions and 26 wards. According to the 1988 census, there were 339,954 people in the district of whom 164,903 were males and 175,051 females[60]. The average household size was 5.8 people. Health services are delivered through one hospital, four health centres and 43 dispensaries. The district experiences two seasons: the rainy season between December and April and the dry season between May and November. The district gets little and unreliable rain-fall. The average annual rainfall is less than 500mm, which results in recurrent food shortage. The main occupations are subsistence farming and livestock rearing. Maize, millet, sorghum and groundnuts are grown as food and cash crops. The major ethnic tribes in the district are the Wagogo, Wakaguru and Wahehe. The majority of the people are either christians or moslems.

Figure 1: Map of Mpwapwa district showing the surveyed villages



The traditional family in Mpwapwa district is patriarchal, favouring male dominance in the family. The females do not participate in decision making in the family. Diet consists mainly of carbohydrates in form of stiff porridge which is frequently taken with vegetable relish or legumes, meat and fish are rarely eaten. Chicken and eggs are usually sold to subsidize household income.

Animals are considered as an index of wealth and are slaughtered during some cultural and ritual ceremonies. In most families, meals are taken twice in a day. Breakfast in form of porridge is only given to children, depending on food availability in the household. Proportionally the male members of the family are served with more food than the females. Taboos and other bad food habits have been existing, albeit on rare food items. The eggs, for example, are not eaten by children who are not circumcision. The female circumcision, which is a risk factor for birth injuries and subsequent bleeding, is still practised in some the rural communities.

4.3. Selection of the study area

Mpwapwa district was selected because of the following reasons: The researcher wanted to find out the prevalence of maternal anaemia in the district to confirm TFNC's notation of moderate anaemia in the plateau zone. The other reason was that the researcher is familiar with the socio-cultural setting of the area. It was thought that this would facilitate the execution of the field work within the given time.

4.4. Target population and Study Sample

The target population was all pregnant women in Mpwapwa district in the period between the 1st of November and 15th December 1992.

4.5. Sample size determination

Based on the estimated 50% prevalence of maternal anaemia and precision of 5%, a sample size of 800 subjects was calculated by the following formula:

$n = (1.96)^2 p(1 - p)/d^2$ (Hilji, lecture notes, 1989).

where: n = estimated total sample size

d = margin of error (5%)

p = estimated prevalence of anaemia (50%)

$n = (1.96)^2 0.5(1 - 0.5)/0.05^2$

$= 384.$

This number was then multiplied by 2 (cluster factor) giving a total of 768 which was raised to 800 for convenience.

4.6. Sampling technique

To get a more representative sample a multistage cluster sampling method was used. The district was divided into 3 clusters: Mpwapwa town, Kibakwe division and the remaining part of the district. Socioeconomically the people in these clusters differ significantly. The number of subjects studied in each cluster varied in proportionally

to the population in the respective clusters. Thus 100 subjects (10%) were selected from each of the first and second clusters (34405/339954, 41526/339954) respectively). Six hundred (80%) subjects were to be selected from the third cluster (264023/339954). In each of the first and the second clusters one ward (Vinghawe and Kibakwe) were randomly selected. From Kibakwe two villages (Kibakwe and Iyenge) were selected. In the third cluster two divisions (Mlali and Mpwapwa) were first selected. Then from Mpwapwa division one ward (Mbori) was selected, from which 4 villages (Mbori, Tambi, Mlembule and Songambele) were selected. Two wards (Iduo and Mlali) were selected from Mlali division. Then two villages were selected from each of them (Mlali Bondeni and Mlali Iyegu from Mlali and Mseta and Manghweta from Iduo). The list of ten-cell leaders in each village and the urban ward was obtained from the respective leaders and updated where it was necessary. Then a house-to-house survey was conducted in each cell, starting from the house of the ten-cell leader. This exercise continued from one village to another until the required number of subjects was covered. A woman was considered pregnant if she reported being pregnant or gave a history of amenorrhea without explainable cause. Fundal height examination was done whenever there was doubt. Two women were excluded from the study as they were found not pregnant and were referred to the district hospital for further investigation. For subjects who were less than 3 months pregnant we mainly relied on the history of last normal menstrual period. Every woman found pregnant was given a stool container in which she was asked to put a portion of stool and submit it on the following day when she was interviewed.

4.7. Data Collection

Data were collected by interviewer-administered questionnaire and laboratory investigations. The work was conducted by the author with assistance from a laboratory technician from the district hospital.

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4.7.1. Interview

The interview was conducted in Swahili by the researcher using a structured questionnaire. This was designed for the collection of data on socio-demographic status, frequency of food intake, morbidity experienced during the current pregnancy and antenatal clinic booking. The nature of the research was clearly explained to the local leaders and to every pregnant woman. Data inconsistencies were checked during the interview. The antenatal card and known past local events were used to get informations which could not be remembered. After the interview, each woman was given a container for urine specimen and was instructed to return to the Laboratory technician after collecting urine for blood slide and haemoglobin estimation.

4.7.2. Laboratory Methods

The following laboratory examinations were carried out with the help of a laboratory Technician: haaemoglobin estimation, blood checking for malaria parasites, stool for helminthic ova and urine for S. haematobium ova.

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4.7.2.1. Blood examination

Haemoglobin estimation was done by oxyhaemoglobin method using BMS haemoglobinometer. Blood smears were also examined for malaria parasites using Field stain method, according to Cheesbrough[61], (Appendix 10.1).

4.7.2.2. Stool examination

Stool was examined for the presence of intestinal parasites ova, using formal ether concentration method according to Cheesbrough[61], (Appendix 10.2).

4.7.2.3. Urine examination

Urine was examined for S. haematobium ova according to Cheesbrough[61], (Appendix 10.3).

4.8. Data analysis:

Data cleaning and coding were done after data collection. Then the data were analyzed by computer at the Institute of Public Health, MUCHS, using SPSS software. The haemoglobin levels were computed to provide the range, mean and prevalence of anaemia. Anaemia was defined by WHO cut-off point of haemoglobin less than 11g/dl. A comparison of the mean haemoglobin values in different groups was done by student t-statistic. The hypothesis concerning the linear association between maternal factors and anaemia was tested by Mantel-Haenszel Chi-square test and 95% confidence interval. Logistic regression analysis was performed to determine the relative risk of anaemia, while controlling for confounding factors.

Initially, binary covariates were created (1,0) then each variable was entered one at a time. Values of Beta coefficient and relative risks were examined each time a new variable was entered. The final model examined the association between hookworm, malaria, age below 20 years, chloroquine chemoprophylaxis, iron supplementation, other intestinal helminths grouped together and antenatal clinic attendance and anaemia (using WHO cut-off point of 11g/dl). Non significant covariates (gravidity, parity, fever and nausea and vomiting) with p-value >0.05 were later grouped together and then were entered into the model as a single independent covariate. Adjusted odds ratios were obtained directly from the regression model and for each covariate the 95% CI was calculated by exponentiation of the Beta coefficient and its standard error.

4.9. Ethical clearance.

Before conducting this study permission was obtained from Research and Publication committee of MUCHS as well as from the district and respective local leaders. Also an informed consent was obtained from each woman. All women agreed to participate in the study. Women who were found with parasitic infections were treated, while those who were found with severe anaemia or other complications were referred to the district hospital.

4.10. Quality control.

Quality control for the examination of slides was carried out during the study. Random samples of 100 fixed blood slides were chosen, 25 from each of the first

and second clusters and 50 from the third cluster for validation at the Parasitology Laboratory at the Institute of Public Health. Only one negative slide was found positive.

4.11. Pretest.

Pretest was done at the district hospital. The collected data were analyzed and some relevant corrections were made to the questionnaire.

4.12. Study limitations.

1. We could not study 76 subjects from the 3rd cluster. This might have affected the representativeness of the study sample.

2. We could not get some of the informations, like dates of last normal menstrual period and delivery from some of the subjects. The missing information might somewhat have affected the results.

4.13. Definition of terminologies.

Parity: Delivery at a gestation age of 28 weeks or more.

Pregnancy spacing: A period between two successive pregnancies. In this study the interval between the last two pregnancies was used.

Marital status: A state of being either single, married, divorced, widowed or cohabiting.

Mchicha: Vegetable relish prepared from Amaranthus caudatus.

Kisamvu: Vegetable relish prepared from cassava leaves.

Matembele: Vegetable relish prepared from leaves of sweet potatoes

Malaria infection: Was defined by a positive blood slide.

Gravidity: A state of having conceived.

5.0. RESULTS

Table 1 shows the distribution of age and anaemia in the study population. Of the 724 study subjects, 20% were aged below 20 years and 10% were 35 years or older. Anaemia was recorded in 60.9% (441/724) of the study population. The haemoglobin values ranged between 5g/dl and 15.2g/dl with a mean of 10.5g/dl (SD = 2.0). In subjects with hookworm infection haemoglobin values ranged between 5g/dl and 15g/dl with a mean of 9.6g/dl, while in those with malaria it ranged between 5g/dl and 15g/dl with a mean of 9.8g/dl.

Table 2 shows that the mean haemoglobin level in subjects who were aged below 20 years was relatively lower than in those aged above. Except for age group 20-24 years, both the prevalence and the mean haemoglobin values showed a gradual decline with increasing age.

Figure 2 gives the distribution of haemoglobin levels in subjects with different parasitic infections and those without. The haemoglobin values in subjects with malaria were normally distributed (73% of the observations fall within the interval $(\bar{x} - SD, \bar{x} + SD)$. In those with hookworm the distribution of haemoglobin values was not normal (62% of the observations fall within the interval $(\bar{x} - SD, \bar{x} + SD)$.

The prevalence of anaemia in relation to maternal age is given in Table 3. Analysis showed association between maternal age and anaemia.

Table 1: Age distribution of the study population, Mpwapwa district, 1992

Age (Years)	Total No. of Subjects		No of anaemic subjects	
	No*.	%**	No.	%
<=14	2	0.3	2	100.0
15-19	145	20.0	99	68.3
20-24	233	32.2	131	56.2
25-29	148	20.4	93	62.8
30-34	123	17.0	75	61.0
35+	73	10.1	41	56.2
Total	724	100.0	441	60.9

*Number of subjects

**Percentage of subjects

Table 2: Mean haemoglobin by maternal age, Mpwapwa district, 1992

Age group	No.*	Mean Hb	SD.	t-statistic	P-value**
<=14	2	10.1	0.1		
15-19	145	10.1	2.0		
20-24	233	10.7	2.0	3.0	<0.005
25-29	148	10.5	2.0	2.0	<0.05
30-34	123	10.5	2.0	2.0	<0.05
35 Or more	73	10.8	2.0	2.3.	<0.02
Total	724	10.5	2.0		

*Number of subjects.

**Compares the mean haemoglobin of age group 15-19 years with those of the older age groups.

Figure 2: Distribution of haemoglobin concentration among subjects with parasitic infections and those without, Mpwapwa district, 1992

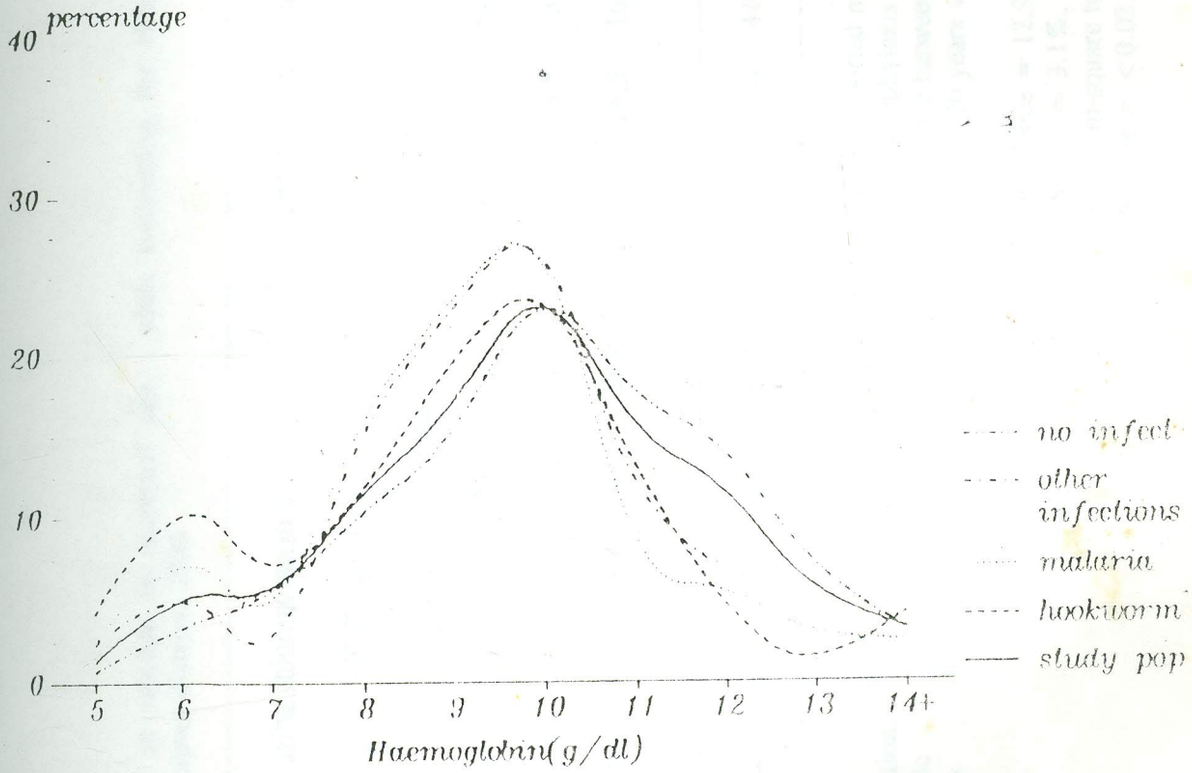


Table 3: **Prevalence of anaemia in relation to maternal age, while controlling for chloroquine chemoprophylaxis and iron supplementation, Mpwapwa district, 1992**

	Reported using chloroquine/iron						Reported not using Chloroquine/iron					
	Age group(years)						Age group(years)					
	<20		=>20		Total		<20		=>20		Total	
(g/dl)	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
<11	26	57.8	86	54.4	112	55.2	75	73.5	254	60.6	329	63.1
=>11	19	42.2	72	45.6	92	44.8	27	26.5	165	39.4	192	36.9
Total	45	22.2	158	77.8	203	100.0	102	19.6	419	80.4	521	100.0

Subject reported using chloroquine chemoprophylaxis and iron supplementation.
Difference between percentage of anaemic cases <20 years old versus >=20 years old.
Difference = 3.4%
95% CI = -10.3%, 17.1%
Mantel-Haenszel Chi-square test = 0.6
p-value = 0.7; df = 1

Subject reported not using chloroquine chemoprophylaxis and iron supplementation.
Difference between percentage of anaemic cases <20 years versus those >=20 years old.
Difference = 12.9%
95% CI = 3.1%, 22.9%
M-H-Chi-square test = 5.9
p-value = <0.02; df = 1

Among subjects who reported that they were not taking iron supplements and chloroquine chemoprophylaxis, those aged less than 20 years had higher prevalence of anaemia compared with the older ones, 73.5% and 60.6% respectively.The difference (12.9%) was statistically significant (95% CI = 3.1%, 22.9%; M-H Chi-square test = 5.9; P-value = <0.02; df = 1). On the contrary, among those who reported taking iron supplements and chloroquine chemoprophylaxis, there was no significant difference in prevalence of anaemia between those aged below 20 years and the older group.

Figure 3 gives the prevalence of anaemia in relation to gravidity. The prevalence of anaemia was higher in primigravidae (women who were pregnant for the first time) than multipravidae. Overall there was a significant decline in percent prevalence of anaemia with increasing gravidity except in gravida 4 (M-H Chi-square test = 6.1; p-value = 0.01; df = 1).

Table 4 gives the mean haemoglobin values in relation to gravidity. Women who had 5 or more pregnancies had higher mean haemoglobin (10.8g/dl) than the primigravidae (10.6g/dl). The difference was statistically significant (Student t-statistic = 3; P-value = <0.02).

Table 5 gives the prevalence of anaemia in relation to gestation age. Data analysis showed that there was no significant difference in prevalence of anaemia among

Figure 3: Prevalence of anaemia in relation to gravidity, Mpwapwa district, 1992

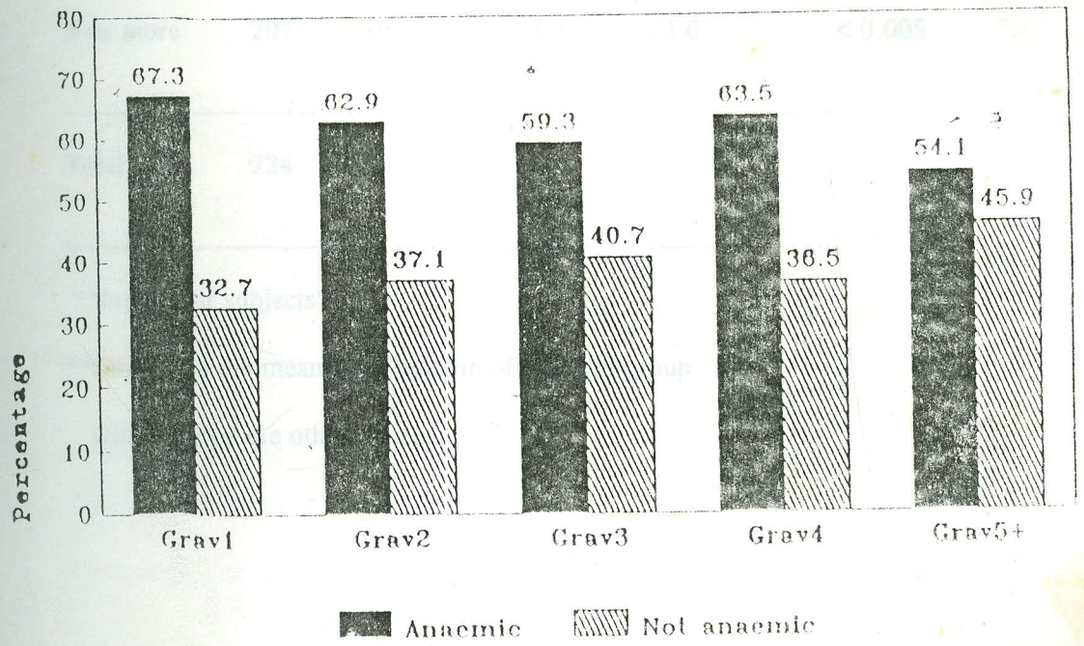


Table 4: Mean haemoglobin by gravidity, Mpwapwa district, 1992.

Gravidity	No*.	Mean Hb	SD	t-statistic	P-value**
1	165	10.2	2.1	-	
2-4	352	10.5	2.0	1.5	<0.1
5 or more	207	10.8	1.8	3.0	<0.005
Total	724	10.5	2.0		

*Number of subjects

**Compares the mean haemoglobin of the first group with each of the other groups.

Table 5: Prevalence of anaemia in relation to gestation age, Mpwapwa district, 1992

	Haemoglobin (g/dl)					
	<11		11+		Total	
Gestation age (weeks)	No*	%**	No	%	No	%
<=12	18	62.1	11	37.9	29	4.0
13-26	226	60.1	150	39.9	376	51.9
27 or more	197	61.8	122	38.2	319	44.1
Total	441	60.9	283	39.1	724	100.0

*Number of subjects.

**Percentage of subjects.

women seen in the first trimester compared with those seen at second or third trimester.

Distribution of parity in the study population is given in Table 6. Subjects who were para zero were 23.5%(170/724) and para one were 23.3%(169/724). Grand multiparity (defined as para 5 or above) contributed about 19.3%(140/724) of the study subjects.

Figure 4 gives the distribution of anaemia in relation to parity. There was a gradual decline in prevalence of anaemia with increasing parity except in para 3 and 5.

Table 7 shows the prevalence of anaemia in relation to pregnancy spacing interval. Except for age group 24-35 years, there was a gradual increase in prevalence of anaemia with increasing pregnancy spacing interval.

The distribution of booking gestation age is shown in Table 8. Gestation age at first booking ranged between 8 and 32 weeks, with a mean of 19 weeks. About 28% of the study population were not attending antenatal clinic, 7.3% booked in the first trimester, 59.5% in the second and 5.4% in the third.

Prevalence of anaemia in relation to booking gestation age is given in Table 9. Subjects who booked at a gestation age of less than 20 weeks were relatively more anaemic than those who booked late.

Table 6: Distribution of parity in the study population, Mpwapwa district, 1992.

Parity	No.*	%**
0	170	23.5
1	169	23.3
2-4	245	33.8
5 or more	140	19.3
Total	724	99.9

*Number of subjects.

**Percentage of subjects.

Figure 4: Prevalence of anaemia in relation to parity, Mpwapwa district, 1992

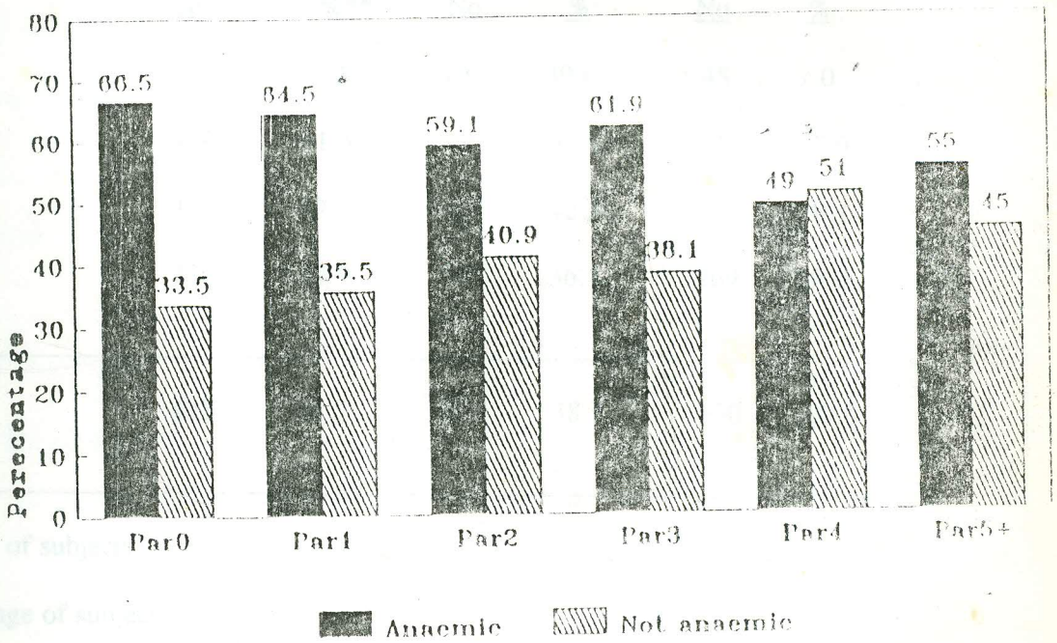


Table 7: Prevalence of anaemia in relation to pregnancy spacing interval, Mpwapwa district, 1992.

Pregnancy spacing interval (months)	Haemoglobin (g/dl)					
	<11		11+		Total	
	No.*	%**	No	%	No	%
<12	29	60.4	19	39.6	48	7.0
12-23	110	61.5	69	38.5	179	25.9
24-35	112	57.7	82	42.3	194	28.1
36+	172	63.9	97	36.1	269	39.0
Total	423	61.3	267	38.7	690	100.0

*Number of subjects

**Percentage of subjects

Missing subjects 301 were primigravidas and primiparas

Table 8: Distribution of booking gestation age, Mpwapwa district, 1992.

Gestation age(weeks)	No.*	%**
4-12	53	7.3
13-26	431	59.5
27 or more	39	5.4
Not booked	201	27.8
Total	724	100.0

*Number of subjects.

**Percentage of subjects.

Table 9: Prevalence of anaemia in relation to booking gestation age, Mpwapwa district, 1992.

	haemoglobin (g/dl)					
	<11		11+		Total	
Booking age(weeks)	No*	%**	No	%	No	%
<20	26	65.0	14	35.0	40	7.6
20-28	165	54.5	138	45.5	303	57.9
29 or more	108	60.0	72	40.0	180	34.4
Total	299	57.2	224	42.8	523	100.0

*Number of subjects.

**Percentage of subjects.

The association between maternal socio-economic status and anaemia is shown in Table 10. Women with formal education had slightly higher prevalence of anaemia (63.7%) than those without (56.7%). The difference (7%), however, was not statistically significant (M-H Chi-square test = 0.2; P-value = 0.5; df = 1).

Employed women also had slightly higher prevalence of anaemia (72.4%) than those who were not employed (60.4%). The difference 12% was not statistically significant (M-H Chi-square test = 0.7; P-value = 0.4; df = 1).

Figure 5 shows the prevalence of anaemia in relation to antenatal clinic booking. The prevalence of anaemia was higher among women who had not booked (70.6%) than among those who had booked (57.2%). The difference 13.4% was statistically significant (95% CI = 5.8%, 21%; M-H Chi-square test = 11.1; P-value = 0.001; df = 1).

The frequency distribution of parasitic infections is given in Table 11. Multiple parasitic infections were recorded in 6.4% of the study population, malaria in 15.6% and hookworm in 13.5%.

The age specific prevalence rate of malaria is given in Table 12. The prevalence of malaria decreased with increase in age, with the age group of 15-19 years having the highest prevalence of 20%. There was no clear pattern of infection in all age groups.

Table 10: **Prevalence of anaemia in relation to maternal socioeconomic status, Mpwapwa district, 1992.**

Category	Anaemic		Not Anaemic		M-H Chi-square	p-value*
	No.**	%***	No	%		
Educated	276	63.7	157	36.3		
Not Educated	165	56.7	126	43.3	3.6	0.06
Married	335	59.9	224	40.1		
Not Married	57	61.3	36	38.7	0.3	0.6
Employed	21	72.4	8	27.6		
Not Employed	420	60.4	275	39.6	1.7	0.2

*Compares the mean haemoglobin in level each pair of the groups.

**Number of subjects.

***Percentage of subjects.

Figure 5: Prevalence of anaemia in relation to antenatal clinic booking, Mpwapwa district, 1992

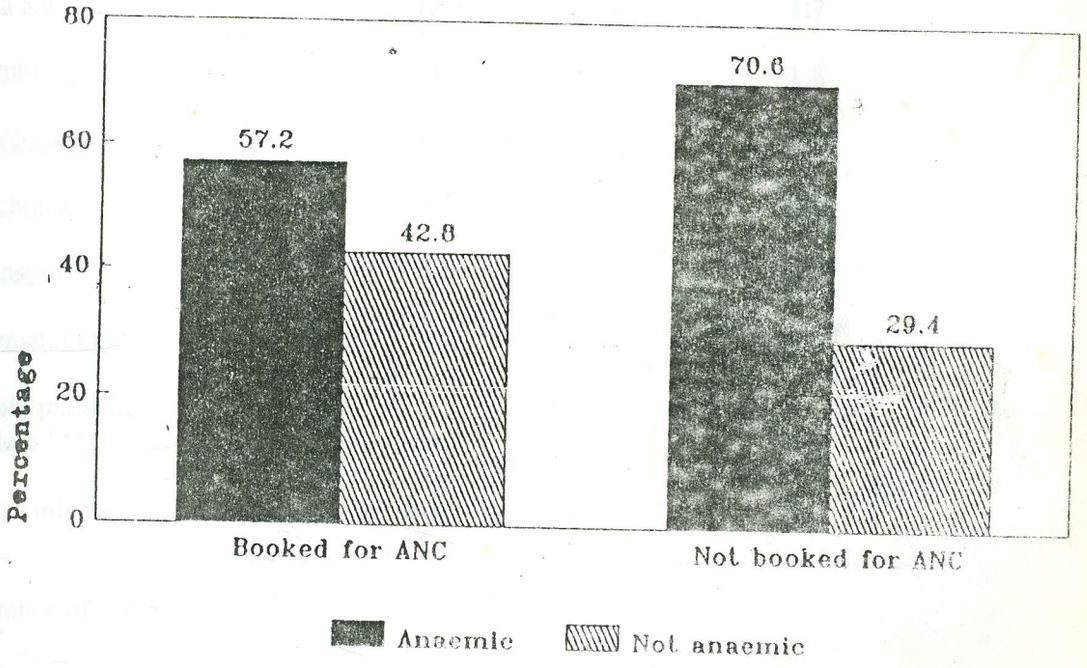


Table 11: Frequency distribution of parasitic infections, Mpwapwa district, 1992.

Infection	No.*	%**
Malaria	113	15.6
Hookworm	99	13.4
Taenia spp	13	1.7
A. lumbricoides	13	1.8
S. stercoralis	6	0.8
T. trichiura	5	0.7
S. mansoni	5	0.7
S. haematobium	3	0.4
Multiple parasitic infections***	46	6.4
Without infection	468	71.0

*Number of subjects.

**Percentage of subjects.

***Helminths and malaria

Table 12: Age Specific prevalence rate of malaria among pregnant women, Mpwapwa district, 1992

	Blood slide					
Age (years)	+ve		-ve		Total	
	No*	%**	No	%	No	%
< =14	-	-	2	100	2	0.3
15-19	29	20.0	116	80	145	20.0
20-24	37	15.9	196	84.1	233	32.2
25-29	22	14.9	126	85.1	148	20.4
30-34	17	13.8	106	86.2	123	17.0
35+	8	11.0	65	89.0	73	10.1
Total	113	15.6	611	84.4	724	100.0

*Number of subjects

**Percentage of subjects

Table 13 gives the age specific prevalence rate of hookworm infestation. Statistical analysis showed that overall prevalence of hookworm infection increased with maternal age.

Table 14 shows the prevalence of anaemia in relation to malaria. Analysis of data showed that there was association between malaria and anaemia in pregnancy. Among pregnant women who reported that they were not using chloroquine chemoprophylaxis, prevalence of anaemia was higher in subjects who were malaria parasites positive (87.8%) than in those who were malaria parasites negative (55.1%). The difference 32.7% was statistically significant (95% CI = 24.9%, 40.5%; M-H Chi-square test = 28.7; p-value = 0.000; df = 1). Overall analysis of data showed that the prevalence of anaemia was more among pregnant women who reported that they were using chloroquine chemoprophylaxis than in those who didn't report, their respective prevalences were 70.8% and 59.1%. The difference 11.7% was statistically significant (95% CI = 1.9%, 21.5%; M-H Chi-square test = 5.5; p-value = 0.01; df = 1) (see Figure 6).

Further analysis of data showed that the prevalence of malaria was higher among pregnant women who reported that they were using chloroquine chemoprophylaxis (34.5%) than among those who didn't(12.1%). The difference 22.4% was statistically significant (95% CI = 12.6%, 32.2%; M-H = Chi-square test = 36.3; p-value = 0.000; df = 1).

Table 13: Age specific rate of hookworm among pregnant women, Mpwapwa district, 1992

Age (years)	Hookworm ova +ve		Hookworm ova -ve		Total	
	No*	%**	No	%	No	%
<=14	-	-	2	100	2	0.3
15-19	18	12.4	127	87.6	145	20.0
20-24	26	11.2	207	88.8	233	32.2
25-29	24	16.2	124	83.8	148	20.4
30-34	18	14.6	105	85.4	123	17.0
35+	13	17.8	60	82.2	73	10.1
Total	99	13.7	625	86.3	724	100.0

*Number of subjects

**Percentage of subjects

Table 14: Prevalence of anaemia in relation to malaria, while controlling for chloroquine chemoprophylaxis, Mpwapwa district, 1992.

Hb(g/dl)	Reported using chloroquine							Reported not using chloroquine						
	B/S +ve		B/S -ve		Total			B/S +ve		B/S -ve		Total		
	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	
< 11	29	74.4	51	68.9	80	70.8		65	87.8	296	55.1	361	59.1	
= > 11	10	25.6	23	31.1	33	29.2		9	12.2	241	44.9	250	40.9	
Total	39	34.5	74	65.5	113	100.0		74	12.1	537	87.9	611	100.0	

Subjects reported using chloroquine chemoprophylaxis.
Difference between percentage of anaemic subjects who were malaria parasites positive versus negative cases.
Difference = 5.5%
95%CI = -12.1%, 23.1%
Mantel-Haenszel Chi-square test = 0.36;
p-value = 0.5; df = 1

Subjects reported not using chloroquine chemoprophylaxis.
Difference between percentage of anaemic subjects who were malaria parasites positive versus negative cases.
Differnce = 32.7%
95% CI = 24.9%, 40.5%
M-H Chi-square test = 28.7;
p-value = 0.0000; df = 1

Figure 6: Effect of chloroquine chemoprophylaxis during pregnancy, Mpwapwa district, 1992

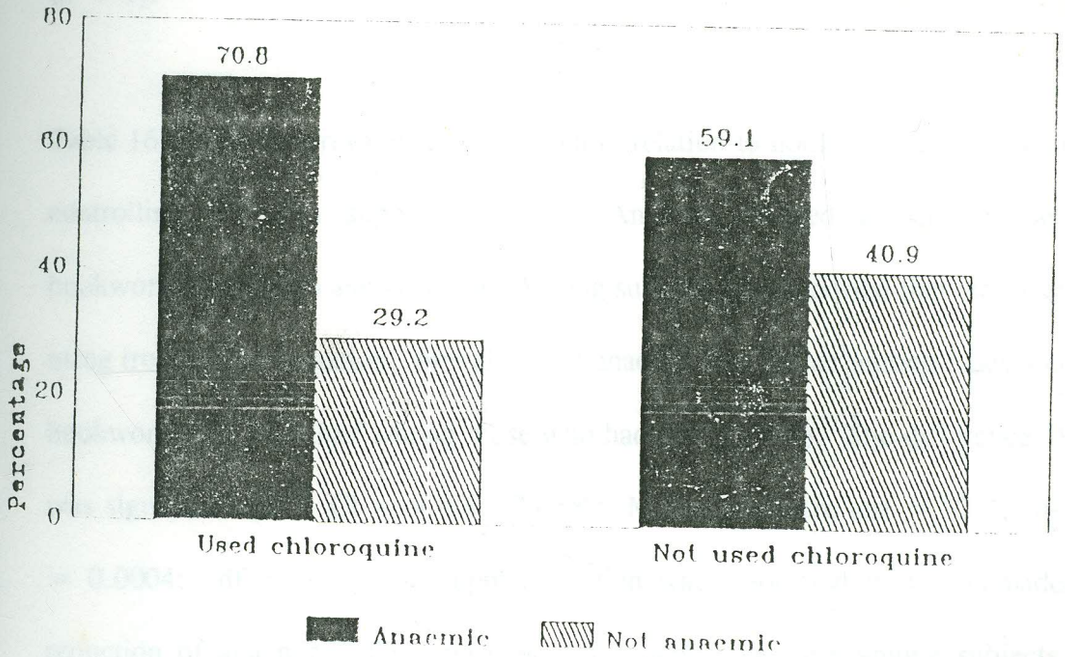


Table 15 gives the prevalence of malaria in relation to iron supplementation. The prevalence of malaria was higher among subjects who reported that they were using iron supplements (17.9%) than in those who didn't (15%). However, the difference (2.9%) was not statistically significant (M-H Chi-square test = 0.8, p-value = 0.4, df = 1).

Table 16 shows the prevalence of anaemia in relation to hookworm infection, while controlling for iron supplementation. Analysis showed association between hookworm infestation and anaemia. Among subjects who reported that they were not using iron supplementation, prevalence of anaemia was higher among cases who had hookworm (80.7%) than among those who had not (61.0%). The difference 19.7% was significant (95% CI = 9.9%, 29.5%; M-H Chi-square test = 12.4; p-value = 0.0004; df = 1). Iron supplementation was associated with a considerable reduction of anaemia. The prevalence of anaemia was less among subjects who reported that they were using iron (47.4%) than among those who didn't (64.1%). The difference 14.7% was statistically significant (95% CI = 6.9%, 22.5%; M-H Chi-square test = 11; p-value = 0.001; df = 1), (see Figure 7).

Iron supplementation showed less effect in reducing anaemia in subjects with hookworm infestation. Among subjects who had hookworm, the prevalence of anaemia was 63.6% versus 48.3% among those who had no hookworm infestation. The difference (15.3%) was not statistically significant (95% CI = - 0.4%, 31%; M-H Chi-square test = 1; p-value = 0.3; df = 1.

Table 15: Prevalence of malaria in relation to iron supplementation, Mpwapwa district, 1992.

	Reported using iron						Reported not usingd iron					
	Hb < 11		Hb = > 11		Total		Hb < 11		Hb = > 11		Total	
B/s	No*	%**	No	%	No	%	No	%	No	%	No	%
+ve	24	31.2	4	5.1	28	17.9	70	19.2	15	7.4	85	15.0
-ve	53	68.8	75	94.9	128	82.1	294	80.8	189	92.6	483	85.0
Total	77	49.4	79	50.6	156	100.0	364	64.1	204	35.9	568	100.0

*Number of subjects.

*Percentage of subjects.

Table 16: Prevalence of anaemia in relation to hookworm, while controlling for iron supplementation, Mpwapwa district, 1992

	Reported Using iron tablets						Reported not using iron					
	Stool examination						Stool Examination					
	Positive		Negative		Total		Positive		Negative		Total	
Hb (g/dl)	No*	%**	No	%	No	%	No	%	No	%	No	%
<11	7	63.6	70	48.3	77	49.4	71	80.7	293	61.0	364	64.1
=>11	4	36.4	75	51.7	79	50.6	17	19.3	187	39.0	204	35.9
Total	11	49.4	79	50.6	156	100.0	364	64.1	204	35.9	568	100.0

Subjects reported using Iron supplements
Difference between percentage of
anaemic subjects who were hookworms
Positive, versus negative cases
Difference 15.3%
95% CI = -0.4%, 31%
Fishers Exact test = 1;
p-value = 0.3

Subject reported not using iron supplements
Difference between percentage of
anaemic subjects who were hookworm
positive, versus negative case
Difference = 19.7%;
95% CI = 9.9%, 29.5%
Mantel-Haenszel Chi-square test = 28.7;
p-value = 0.0000; df = 1

Figure 7: Effect of iron supplementation during pregnancy, Mpwapwa district, 1992

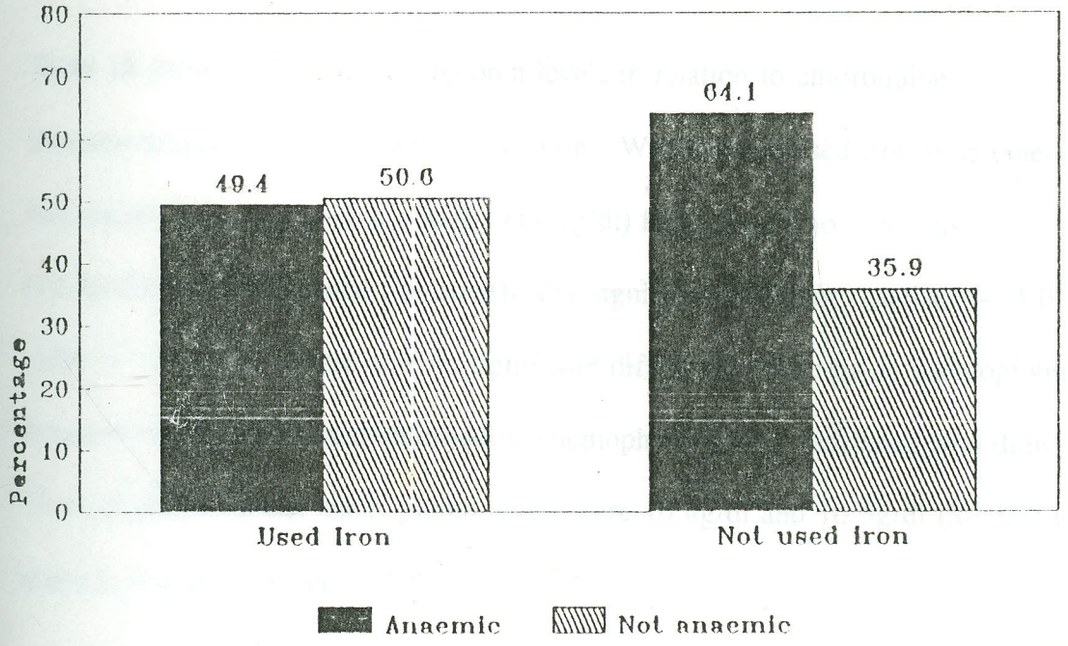


Table 17 shows the mean haemoglobin levels in relation to parasitic infections. Women who where infected with malaria or hookworm had lower mean haemoglobin levels than those who were not infected. Their mean haemoglobin levels were (9.8g/dl, SD = 2.0; 9.6g/dl, SD = 2.0) (10.8g/dl, SD = 1.5).

Table 18 shows the mean haemoglobin levels in relation to chloroquine chemoprophylaxis and iron supplementation. Women who used iron supplements had higher mean haemoglobin levels (11.1g/dl) than those who didn't use (10.3g/dl). The difference was statistically significant (Student t-statistic = 4.0; p-value = <0.001). There was no significant difference in the mean haemoglobin between subjects who used chloroquine chemophrophylaxis and those who didn't. Their respective mean haemoglobin levels were 10.4g/dl and 10.5g/dl (Student t-statistic = 0.05; p-value = 0.5).

The frequency distribution of reported maternal morbidity is given in Table 19. Pregnancy related nausea and vomiting and history of fever were reported, respectively, by 45% and 28% of the studied subjects.

Figure 8 shows the prevalence of anaemia in relation to reported pregnancy related nausea/vomiting. Women who reported that they experienced nausea/vomiting were more anaemic (65.2%) than those who didn't (57.3%).

Table 17: **Mean haemoglobin by parasitic infections among pregnant women, Mpwapwa district, 1992**

Infection	No*.	%	Mean	SD.	t-statistic	p-value**
None	468	71.0	10.8	1.9		
Malaria	69	9.5	9.8	2.0	4.0	<0.001
Hookworm	97	13.4	9.6	2.1	5.0	<0.001
T. trichiura	5	0.7	9.2	1.1	4.0	<0.001
S. Mansoni	5	0.7	10.7	2.2	0.1	>0.5
Taenia spp	12	1.7	9.4	2.4	2.0	>0.05
A. lumbricoides	13	1.8	11.1	2.0	2.0	>0.05
S. haematobium	3	0.4	10.4	1.7	0.4	>0.5
S. stercoralis	6	0.8	9.7	0.9	2.8	>0.01

*Subjects who had the indicated parasite only

**Compares the mean haemoglobin of the first group with each of the other group

Table 18: Mean haemoglobin in relation to iron supplementation and chloroquine chemoprophylaxis among pregnant women, Mpwapwa district, 1992

	No*	Mean Hb	SD	t-statistic	p-value**
Used iron	156	11.1	1.8		
Not used iron	568	10.3	2.0	4.0	<0.001
Used chloroquine	113	10.4	1.8	-	
Not used chloroquine	611	10.5	2.0	0.05	>0.5

*Number of subjects

**Compares the mean haemoglobin of the two groups in each pair

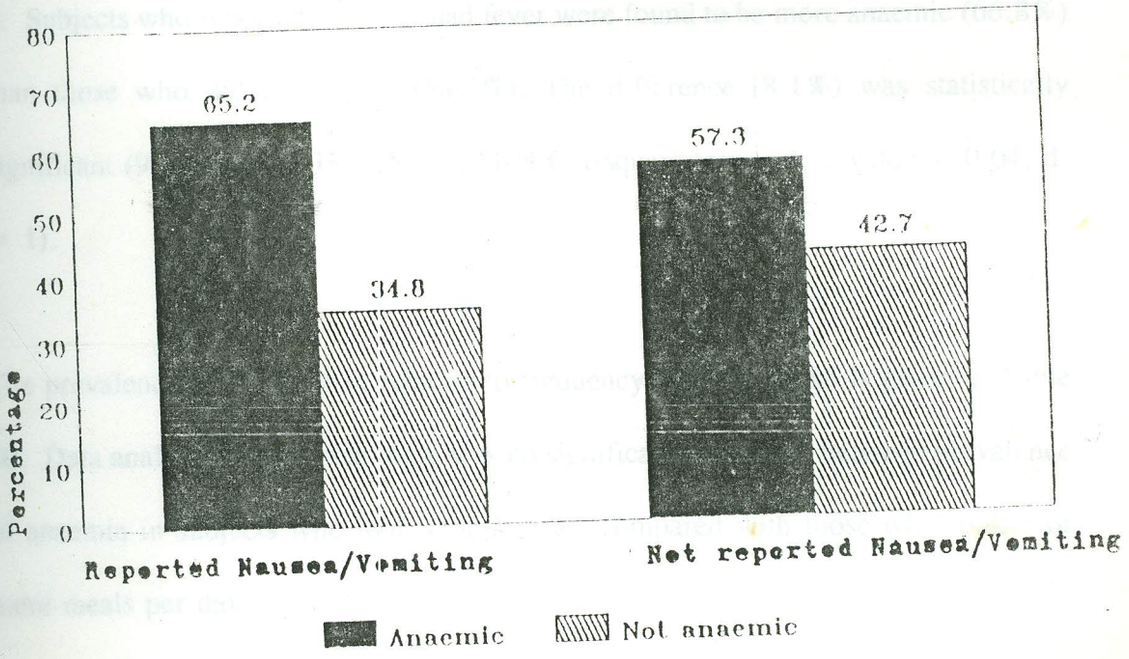
Table 19: Frequency distribution of reported maternal morbidity, Mpwapwa district, 1992

Morbidity symptoms	Symptoms reported		Symptoms not reported	
	No.*	%*	No	%
Nausea/vomiting	328	45.3	396	54.7
Fever	199	27.5	525	72.5
Diarrhoea	55	7.6	669	92.4
Vaginal bleeding	12	1.7	712	98.3

*Number of subjects

**Percentage of subjects

Figure 8: Prevalence of anaemia in relation to pregnancy related nausea and vomiting, Mpwapwa district, 1992



The difference (7.9%) was statistically significant (95% CI = 0.1%, 15.7%; M-H Chi-square test = 4.7; P-value = 0.03; df = 1).

The prevalence of anaemia in relation to reported attack of fever is given in Figure 9. Subjects who reported that they had fever were found to be more anaemic (66.8%) than those who did not report (58.7%). The difference (8.1%) was statistically significant (95% CI = 0.3%, 15.9%; M-H Chi-square test = 4; p-value = 0.04; df = 1).

The prevalence of anaemia in relation to frequency of food intake is given in Table 20. Data analysis showed that there was no significant difference between prevalence of anaemia in subjects who took 1 or 2 meals compared with those who took 3 or more meals per day.

Table 21 gives the prevalence of anaemia in relation to diet. Data analysis showed that there was no significant difference in prevalence of anaemia between subjects who took food items which are rich in iron than those who did not.

The crude and adjusted odds ratio of anaemia among pregnant women in Mpwapwa district, while controlling for potential confounders is given in Table 22. Factors associated with the risk of anaemia were age below 20 years (OR = 2.0, 95% CI = 1.3, 3.0), hookworm infection (OR = 2.3, 95% CI = 1.3, 3.8), positive malaria

parasitemia (OR = 2.7, 95% CI = 1.7, 5.1), chloroquine chemoprophylaxis (OR = 2.2, 95% CI = 1.1%, 6.2%) compared with subjects without the risk factor. Antenatal clinic booking and iron supplementation were associated with the reduction in the risk of anaemia by 30% and 57% respectively.

Figure 9: Prevalence of anaemia in relation to attacks of fever during pregnancy, Mpwapwa district, 1992

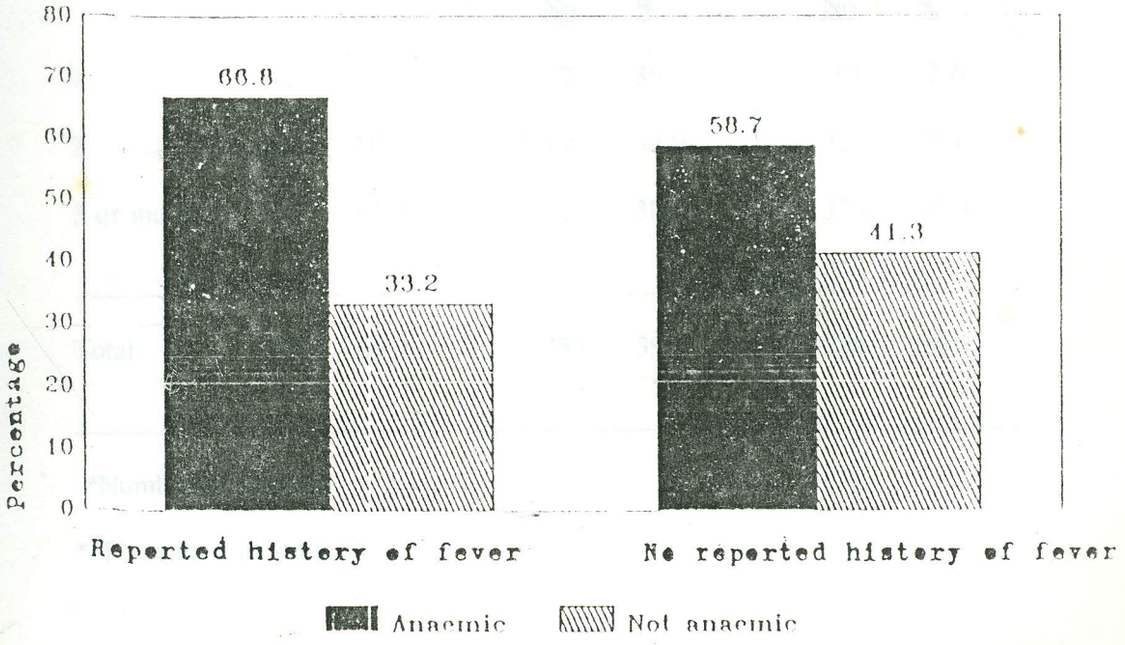


Table 20: Prevalence of anaemia in relation to frequency of food intake among pregnant women, Mpwapwa district, 1992

	Haemoglobin (g/dl)					
	≤11		11+		Total	
No of meals						
	No*	%**	No	%	No	%
1	12	63.2	7	36.8	19	2.6
2	196	60.1	130	39.9	326	45.0
3 or more	233	61.5	146	38.5	379	52.3
Total	441	60.9	283	39.1	724	99.9

*Number of subjects

**Percentage of subjects

Table 21: Prevalence of anaemia in relation to diet among pregnant women, Mpwapwa district, 1992

	Haemoglobin (g/dl)					
	<11		11+		Total	
Food item	No*	%**	No	%	No	%
Meat/fish	40	66.7	20	33.3	60	8.3
Fruits/vegitables/ legumes/milk	15	71.4	6	28.6	21	2.9
Vegitable/legumes/milk	354	60.7	229	39.3	583	80.5
None***	32	53.3	28	46.7	60	8.3
Total	441	60.9	283	38.1	724	100.0

*Number of subjects

**Percentage of subjects

***Reported to have not taken meat/fish, fruits, vegetables (kisamvu, mchicha, matembele), legumes and milk.

Table 22: Crude and adjusted relative risk of anaemia among pregnant women, Mpwapwa district, 1992

Factor	Crude	Adjusted
	Odds Ratio (95% CI)	Odds Ratio* (95% CI)
Hookworm	2.7 (1.6, 4.5)	2.3 (1.3, 3.8)
Malaria	3.8 (2.3, 6.4)	2.7 (1.7, 5.1)
Age <20 years	1.5 (1.0, 2.2)	2.0 (1.3, 3.0)
Iron supplementation	0.6 (0.4, 0.9)	0.43 (0.3, 0.7)
Chloroquine chemoprophylaxis	1.7 (1.1, 2.6)	2.2 (1.3, 3.7)
Other helminths	3.1 (1.3, 7.1)	2.6 (1.1, 6.2)
ANC booking	0.6 (0.4, 0.9)	0.7 (0.5, 1.0)
Gr, par, fev & N**	1.7 (1.2, 2.3)	2.6 (1.9, 3.6)

*Calculated by logistic regression model

**Gr= Gravidity, par = parity, fev = fever and n/v = nausea/vomiting

Variables: gravidity (1 = 1, 2+ = 0), parity (1-4 = 1, 5+ = 0), hookworm (positive = 1, negative = 0), malaria (positive = 1, negative = 0), iron supplementation (yes = 1, no = 0), fever (yes = 1, no = 0), age (<20 years = 1, >20 = 0), nausea and vomiting (yes = 1, no = 0), chloroquine chemoprophylaxis (yes = 1, no = 0) other intestinal

helminths (positive = 1, negative = 0), antenatal clinic booking (yes = 1, no = 0), gravidity = 1, parity = 1, fever = yes and nausea/vomiting = yes (Gr, par, n/v & fev = 1, gravidity = 2+, parity = 5+, Fever = no, Nausea/vomiting = no (Gr, par, fev and n/v = 0).

6.0. DISCUSSION

This study was conducted to determine the prevalence of maternal anaemia in Mpwapwa district and identify its associated factors. There is no report of a similar study conducted in the area before. Anaemia was recorded in 60.9% of the study population. When a cut-off point of 12g/dl was used, the prevalence of anaemia was 71%. This prevalence rate was lower than that of 100% recorded by Nhonoli[31], who used a similar definition. The observed difference between these findings may be attributed to the fact that the study reported by Nhonoli was a hospital based. As anaemia is known to be the underlying cause of most of the hospital attendance, such prevalence rate may not present the actual situation. Also when a cut-off point of 8.5g/dl was used, 16.5% of the studied women were classified as anaemic. This prevalence rate is less than the national estimate of 80% which was based on hospital data and same cut-off point[34].

Contrary to the previous report, the present study showed that the problem of anaemia in Mpwapwa district is severe as six per cent of the study population had haemoglobin level less than 7g/dl. According to Kavishe, the problem of anaemia in a community is severe if 5% or more of the pregnant women have haemoglobin level less than 7g/dl. The severity of the problem in the district may partly be explained by the fact that the central plateau differs from the others in that it gets little and unreliable rain-fall. This results in recurrent food shortages and less development in the area.

About 30% of the studied women were in a risk childbearing age (below 20 or above 34 years). When the risk childbearing age was defined by age below 16 or above 35 years, a definition which was used by Kapiga, 7.8% of the study population were in risk childbearing age versus that of 10.8% reported by Kapiga[56]. The difference was not significant. This may partly be attributed by the fact that the latter study was a hospital based. It has been reported that more young pregnant women attend antenatal clinic as they frequently get health problems than the older ones.

Twenty eight per cent of the studied women had not booked for antenatal clinic. Of those who had booked, only 10% booked in the first trimester. The majority, (60%), booked in the second trimester. The mean booking gestation age was 19 weeks which differ from those of 21 and 25 weeks reported by Kihwele[62] and Malangalila[63] respectively. Although these findings indicated that more pregnant women book for antenatal clinic relatively early, few of them booked in the first trimester. The author learned, through discussions with the women, that most of them did not prefer booking in the first trimester unless they had pregnancy complications. This is in agreement with previous finding reported by Kapiga in 1988 [56].

This study showed that gestation age and pregnancy spacing are not associated with anaemia. The lack of association between pregnancy spacing and maternal anaemia should be taken with caution as data analysis based on the last pregnancy spacing interval. Closely spaced previous pregnancies, which were not considered, might have influenced the results.

As for the association between maternal age and anaemia, the results showed that prevalence of anaemia was more in subjects aged below 20 years than in those aged 20 years or above and significantly decreased with age. This finding may be explained by the high demand for iron and folic acid in young age and the fact that malaria is common and severe in in primigradae.

When the hypothesis that parity is associated with anaemia during pregnancy was tested, the results did not support it. The prevalence of anaemia, however, was more in nulliparas and decreased with parity. This is in agreement with the findings reported by DeMaeyer[22], Isah[40] and Fleming[45]. Isah also found out that iron deficiency increased with parity, while the prevalence of anaemia decreased with parity[40]. This indicated that iron deficiency is not the main cause of anaemia in primigravidae.

The present study also showed that malaria is associated with maternal anaemia. This finding, however, was in contrast with that of Nhonoli reported in Dar es Salaam[31]. The author could not give plausible explanation as to why these studies which were conducted in malaria endemic areas gave different results. On the other hand, the study showed association between hookworm infection and maternal anaemia a finding which was in agreement with other previous studies[35,64].

This study showed that iron supplementation was associated with a reduction in risk of anaemia. However, the effect of iron supplementation was less among subjects who had hookworm infestation. This suggests that hookworm infestation limits the impact

of iron supplementation. Chloroquine chemoprophylaxis, on the other hand, showed association with risk of anaemia in pregnancy. The risk of both amalria and anaemia increased among subjects who who reported that they were using chloroquine chemoprophylaxis than in those didn't. This finding suggests that chloroquine chemoprophylaxis was not being used regularly. It is likely that this resulted in increased attacks and severity of malaria following period of protection. For studies have shown that chloroquine chemoprophylaxis affects the natural immunity to malaria[65].

Among the maternal diseases, fever and pregnancy related nausea and vomiting, were found to be associated with anaemia. Nausea and vomiting limit the intake of food and consequently that of dietary iron. It is also known that most of the fevers, in countries where malaria is endemic, are caused by malaria. This emphasizes the need of including malaria control if we want to reduce the problem of anaemia in the district.

There is no doubt that the quantity and quality of food a pregnant woman eats is important in preventing anaemia. Contrary to the above fact, the study showed that neither the number of meals nor the quality of food had association with increase of haemoglobin levels in the study population. This finding, however, should be taken with caution as it based on 24 hour dietary recall.

With regards to the importance of antenatal clinic booking, the study showed that there was 30% reduction in risk of anaemia in subjects who had booked for antenatal clinic.

The study however, did not show that women who booked for antenatal clinic early (at gestation age less than 20 weeks) had less risk of anaemia than those who booked late. This may be due to the fact that most of the women who book early have health problems which contribute to anaemia[56]. Some of the women who booked earlier actually had made few visits as they had just booked or did not attend regularly.

Socio-economic status did not show any influence on maternal anaemia. The observed negative association between education and anaemia might partly be due to the presence of more subjects aged below 20 years (66%) and primigravidae (71%) in the educated group. Further data analysis, while adjusting for potential confounding factors, showed that age below 20 years, malaria, hookworm, other intestinal worms and chloroquine chemoprophylaxis were associated with risk of anaemia. When gravidity, parity, fever and nausea/vomiting were entered as one variable, they had interactive negative effect. Antenatal clinic booking and iron supplementation during pregnancy were associated with reduction in the risk of anaemia.

7:0. SUMMARY

The main findings of the study were:

1. The prevalence of maternal anaemia in Mpwapwa district is 60.9% and contrary to previous reports, the problem of anaemia in the district is severe.

2. About 30% of the study population were in risk childbearing age.

3. Among the study population, 6.4% had multiple parasitic infections, 15.6% had malaria alone while 13.7% had hookworm alone.

4. The determinants of anaemia were: age below 20 years, hookworm, malaria, other intestinal helminths and maternal morbidity during pregnancy (eg. vaginal bleeding, nausea/vomiting and fever).

5. Antenatal clinic booking and iron supplementation were associated with a reduction of the risk of anaemia by 30% and 57% respectively.

8.0. CONCLUSION AND RECOMMENDATIONS

Pregnacy anaemia in Mpwapwa district is a public health problem and results from interaction of various factors. Its control therefore, needs a combined approach which should include the following:

1. Continuous effort should be made by the health personnel to educate people about the problem of anaemia, its risk factors and the measures for its prevention and control.

2. The government should provide adequate drugs for the treatment of malaria, intestinal helminths and urinary schistosomiasis in peripheral health units.

3. Iron supplementation to pregnant women should be improved through increasing population coverage, drug supply and user compliance.

4. Health personnel should be more vigilant in screening risk factors among pregnant women and encourage them to attend antenatal clinic.

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