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# INTESTINAL HELMINTH INFECTIONS AMONG PREGNANT CAMEROONIAN WOMEN

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## ABSTRACT

***Objectives*: To investigate the prevalence and intensity of intestinal helminth infections in pregnant Cameroonian women and assess their anaemic status.**
***Design*: Longitudinal study.**
***Setting*: Buea Integrated Health Centre, Muea Health Centre, Mutengene Integrated Health Centre and the University of Buea Life Sciences Laboratory.**
***Subjects*: Two hundred and six pregnant women.**
***Interventions*: Stool and blood samples were collected from 206 pregnant women during three consecutive visits of each participant to the clinic, and used for identification and quantification of eggs of soil -transmitted nematodes and determination of packed cell volume respectively. The pregnant women received mebendazole and iron tablets on the day of enrollment at the antenatal clinic to control helminth infections and anaemia.**
***Main outcome measures*: The impact of antenatal clinical visits on the prevalence of helminth infections and the anaemic status of the women during pregnancy were assessed.**
***Results*: The results revealed that infection rate of intestinal nematodes was 47.10/0 during the first antenatal visit. This dropped to 27.2% during the second visit and 8.70/0 during the third visit. The prevalence was significantly higher in primigravidae than multigravidae during the first (P<0.001) and second (P<0.03) antenatal visits. More single women than married women were found infected with intestinal nematodes during the three visits, the difference being significant only during the first visit (P<0.01). Most of the infected women were those who attended clinic at Muea, a semi-urban community. At the first antenatal visit, multigravidae had a heavier load of all three nematode species than primigravidae while single women carried a heavier burden of *A. lumbricoide*s and *T. trichiura* than married women. At the second visit, primigravidae and single women carried a heavier burden of Ascaris and hookworm than multigravidae and married women respectively. Overall, the intensity of helminth infection increased after the first visit while prevalence dropped, but both had dropped by the third visit. The *Ascaris*/*Trichuris* combination was the most prevalent in mixed species infections, while *A. lumbricoides* was the most prevalent in single species infection. The prevalence of anaemia (PCV<31%) was 53.4% on the first antenatal visit, 50.0% on the second and 28.2% on the third antenatal visit. Significantly more primigravidae than multigravidae were anaemic on the first and second visits (P<0.003 and P<0.001 respectively). More anaemic cases were recorded among women attending clinic in Mutengene than in Muea and Buea (P<0.05).**
***Conclusion*: Prevalence of soil-transmitted helminth infections in pregnant Cameroonian women was 47.1 %, with single and mixed species infections present at 28.6% and 18.5% respectively. Primigravidae and single women were more vulnerable to helminth infections than multigravidae and married women. The results provide evidence in support of anthelmintic treatment in prenatal programmes.**

## INTRODUCTION

Infections caused by *Ascaris lumbricoides, Trichuris trichiura* and hookworm are estimated to affect approximately one billion persons, and these are among the most common and widespread human infections (1,2). Intestinal parasitic infections, particularly from helminths, are often associated with malnutrition, vitamin A deficiency, diarrhoea and iron-deficiency anaemia (3,1). Pregnant women and schoolage children are particularly at risk (4-7).

Previous studies in Fako Division of Cameroon (8) demonstrated a 69% prevalence of anaemia in pregnant women. Fifty percent of these anaemic cases were attributed to malaria parasitaemia, suggesting that anaemia in this area may be due to other causes, probably geohelminth infections. Helminths may cause anaemia by consuming blood and causing plasma leakages (9-11), resulting in iron loss. Given the low nutritional status and poor hygienic conditions predominant in most developing countries, intestinal helminths may contribute to the degree of anaemia (12).

This study sought to investigate the prevalence and intensity of intestinal helminth infections in pregnant Cameroonian women and assess their anaemic status

## MATERIALS AND METHODS

*Study area*: The study was carried out between August 2006 and August 2007 in Muea, Buea and Mutengene, situated at the foot of mount Cameroon in the South West Region of Cameroon. These areas experience two seasons: the dry season (November to March) and the rainy season (April to October). The poor hygienic conditions existing in Muea and Mutengene, both semi-urban areas, expose the population to high risk of soil-transmitted helminth infections. Buea, on the other hand, is an urban area with comparatively improved sanitary conditions.

*Study population*: Women who came for antenatal care were recruited into the study on the first day of their registration. Informed consent to participate in the study was obtained from 206 women (73 from Mutengene Integrated Health Centre, 60 from Muea Health Centre and 73 from Buea Integrated Health Centre). Ethical clearance was obtained from the Regional Delegation of Public Health, South West of Cameroon.

*Control measures put in by the Government of Cameroon*: In compliance with Government health policy, all pregnant women who enrolled at these health centres were given mebendazole (vermox) and iron tablets on the day of enrollment. The mebendazole was to be taken at a dose of 100mg twice per day for three days while the iron tablets and folate were to be taken daily during the whole period of pregnancy as safe guard against anaemia.

*Sample collection*: The 206 women recruited into the study were examined on the days of their appointment given by the midwives, up to three consecutive visits. Stool samples were collected from the participants in clean plastic bottles for the determination of helminth infection. Blood samples were collected by venopuncture into heparinized capillary tubes for determination of packed cell volume. The samples were transported to the laboratory and analysed within 12 hours of collection. The Kato- Katz thick-smear technique (12) was used for the quantitative estimation of the characteristic eggs of *T. trichiura, A. lumbricoides* and hookworm per gram of faeces. Packed cell volume was determined by microcentrifigation of the blood samples in microcapillary tubes (13).

*Statistical analysis*: The chi-square analysis or Fisher's exact test was used to compare the prevalence of infection with respect to gravidity status, marital status and antenatal clinic attended. The Student's t-test or analysis of variance was used as appropriate to compare the geometric mean egg count. A log transformation of egg counts was done to ensure a normal distribution.

## RESULTS

*Prevalence of infection*: The prevalence of helminth infection in the study population during the period of study is shown in Table 1. Out of the 206 pregnant women examined during their first antenatal clinical visit, 97 (47.1 %) harboured intestinal nematodes, with primigravidae having a significantly (P<0.00 1) higher prevalence (58.6%) than multigravidae (36.4%). There were more single women (56.3%) infected with intestinal helminths than married women (37.9%), the difference being very significant (P<0.01). Women who attended clinic in Muea had a higherprevalence of intestinal helminths (70.0%) than women who attended clinic in Buea (39.7%) and Mutengene (35.6%), the difference being significant (P<0.00l).

The infection rates of the different helminths at the first antenatal visit were 44.2% for *A. lumbricoides*, 4.9% for hookworm and 9.7% for *T. trichiura.* On the second antenatal visit, there were still more primigravidae (34.3%) than multigravidae (20.6%) infected with intestinal helminths, the difference being significant (P<0.03). Furthermore, more single women (29.1%) than married women (25.2%) were infected, but the difference was not significant. Most of the infected women came from Muea (36.7%), followed by Mutengene (31.5%) and then Buea (15.1 %). The difference in infection rate between these areas was ignificant (P<0.0l). The infection rates of the different helminths at the second antenatal visit were 26.2% for *A. lumbricoides*, 3.9% for hookworm and 4.9% for *T. trichiura.*

**Table 1**
*Effect of gravidity status, marital status and clinic attended on helminth prevalence in pregnant women*

| Period | Description | No. examined | Helminth prevalence n(%) | Level of significance |
|---|---|---|---|---|
| 1st visit | Gravidity | | | |
| | Primigravidae | 99 | 58 (58.6) | $X^2$ =10.11 |
| | Multigravidae | 107 | 39 (36.4) | P = 0.001 |
| | Marital status | | | |
| | Married | 103 | 39 (37.9) | $X^2$ =7.03 |
| | Single | 103 | 58 (56.3) | P =0.008 |
| | Antenatal Clinic | | | |
| | Buea | 73 | 29 (39.7) | $X^2$ =18.01 |
| | Mutengene | 60 | 26 (35.6) | P <0.001 |
| | Muea | 73 | 42 (70.0) | |
| 2nd visit Gravidity | | | | |
| | Primigravidae | 99 | 34 (34.3) | $X^2$ =4.94 |
| | Multigravidae | 107 | 22 (20.6) | P = 0.026 |
| | Marital status | | | |
| | Married | 103 | 26 (25.2) | $X^2$ = 0.39 |
| | Single | 103 | 30 (29.1) | P = 0.53 |
| | Antenatal Clinic | | | |
| | Buea | 73 | 11 (15.1) | $X^2$ = 8.83 |
| | Mutengene | 60 | 23 (31.5) | P = 0.012 |
| | Muea | 73 | 24 (36.7) | |
| 3rd visit Gravidity | | | | |
| | Primigravidae | 99 | 9 (9.1) | $X^2$ =0.03 |
| | Multigravidae | 107 | 9 (8.4) | P = 0.86 |
| | Marital status | | | |
| | Married | 103 | 7 (6.8) | $X^2$=0.97 |
| | Single | 103 | 11 (10.7) | P = 0.32 |
| | Antenatal Clinic | | | |
| | Buea | 73 | 1 (1.4) | |
| | Mutengene | 60 | 12 (16.4) | PFisher=0.005 |
| | Muea | 73 | 5 (8.3) | 7 |

On the third antenatal visit, the prevalence of infection in primigravidae was not significantly different from that in multigravidae. There were still more single women infected than married women, but the difference was not significant. Most of the infected women were those attending antenatal clinic in Mutengene. The infection rates for the different helminths at the third antenatal visit were 7.8% for *A. lumbricoides*, 1.5% for hookworm and 1.0% for *T. trichiura*.

Infection rates in primigravidae and multigravidae, married and single women, and in women attending clinic at the different health centres witnessed a significant reduction by the third visit compared to the prevalence at the first visit (P<0.001).

*Intensity of infection*: The intensity of helminth infection in the study population is shown in Table 2. At the first antenatal visit, multigravidae were more heavily infected with *A. lumbricoides*, *T. trichiura* and hookworm than primigravidae (Table 2).

Married women were more heavily infected with hookworm than single women, but single women carried a heavier burden of *A. lumbricoides and T. trichiura* than married women. Women attending clinic in Buea were more heavily infected with all three types of helminths than those from Muea and Mutengene. The differences were, however, not significant.

At the second antenatal visit, primigravidae carried a heavier burden of *Ascaris* and hookworms than multigravidae, while multigravidae had a heavier burden of *Trichuris*. Single women carried a heavier burden of *Ascaris* and hookworm than married women. Pregnant women attending clinic in Muea had a heavier burden of *Trichuris* and hookworm than women from Mutengene and Buea. These differences

were again not significant.

On the third antenatal visit, primigravidae were still more heavily infected than multigravidae, married women had a heavier burden of *Ascaris* than single women, and women who attended clinic in Muea had a heavier burden of all three helminth types than women who came for clinic in Buea and Mutengene. The differences were not significant.

*A. lumbricoides* had the highest prevalence, followed by *T.trichiura* and then hookworm. The difference in infection rate between *A. lumbricoides*, *T. trichiura* and hookworm was significant, both in primigravidae (P<0.00 1) and multigravidae (P<0.0 1).

Of the mixed species infections, the combination *Ascaris*/*Trichuris* had the highest prevalence. Overall, more primigravid than multigravid women were

**Table 2**

*Effect of gravidity status, marital status and clinic attended on helminth species densities in pregnant women*

| Period | Description | Helminth density (Geometric mean faeces) | | | |
|---|---|---|---|---|---|
| | | Total | Ascaris | Hookworm | Trichuris |
| 1st visit | Gravidity | | | | |
| | Primigravidae | 379 | 206 | 66 | 107 |
| | Multigravidae | 520 | 207 | 205 | 108 |
| | Marital status | | | | |
| | Married | 452 | 205 | 160 | 87 |
| | Single | 416 | 207 | 81 | 128 |
| | Antenatal clinic | | | | |
| | Buea | 603 | 345 | 119 | 139 |
| | Mutengene | 223 | 144 | 24 | 55 |
| | Muea | 401 | 186 | 88 | 127 |
| 2nd visit | Gravidity | | | | |
| | Primigravidae | 780 | 302 | 169 | 309 |
| | Multigravidae | 641 | 391 | 84 | 166 |
| | Marital status | | | | |
| | Married | 883 | 326 | 123 | 434 |
| | Single | 672 | 345 | 155 | 172 |
| | Antenatal clinic | | | | |
| | Buea | 736 | 318 | 00 | 418 |
| | Mutengene | 757 | 339 | 134 | 284 |
| | Muea | 690 | 342 | 156 | 192 |
| 3rd visit | Gravidity | | | | |
| | Primigravidae | 504 | 168 | 240 | 96 |
| | Multigravidae | 471 | 207 | 168 | 96 |
| | Marital status | | | | |
| | Married | 528 | 264 | 168 | 96 |
| | Single | 478 | 142 | 240 | 96 |
| | Antenatal clinic | | | | |
| | Buea | 96 | 96 | 00 | 00 |
| | Mutengene | 448 | 184 | 168 | 96 |
| | Muea | 558 | 222 | 240 | 96 |

Overall, the infection rate decreased progressively with each antenatal visit while the geometric mean egg count increased and only dropped at the third visit.

*Single versus mixed species infections*: At the first antenatal visit, 97 (47.1 %) of the 206 pregnant women examined harboured intestinal helminths. Fifty-nine (28.6%) of the pregnant women had single species infections, thirty (14.6%) had two species infections and eight (3.9%) were infected with all three nematode species (Table 3). Single species infections involving infected with both single and mixed species, the difference was significant (P<0.05) for single species infections.

Prevalence of anaemia in pregnant women: The prevalence of anaemia (PCV<31%) in pregnant women during the follow up period is shown in Table 4. The prevalence was 53.4% on the first antenatal visit, 50.0% on the second and 28.2% on the third antenatal visit. Significantly more primigravidae than multigravidae were anaemic on the first and second antenatal visits (P<0.003 and P<0.001 respectively).

The anaemic cases were comparatively fewer on the third visit. More single women than married women were anaemic on the first and second antenatal visits but the difference was not significant. There were significantly more anaemic cases among women attending antenatal clinic in Mutengene than in Muea and Buea during the three antenatal visits (P<0.05)

**Table 3**
*Prevalence of single and mixed helminth species infections in pregnant women*

| Species combination | Primigravidae (n=99) | | Multigravidae (n=107) | | Overall | |
|---|---|---|---|---|---|---|
| | No. infected | Infection rate (%) | No. infected | Infection rate (%) | No. infected | Infection rate (%) |
| Single species infections | | | | | | |
| *Ascaris lumbricoides* | 21 | 21.2 | 13 | 12.1 | 34 | 16.5 |
| *Trichuris trichiura* | 08 | 8.1 | 07 | 6.5 | 15 | 7.3 |
| Hookworm | 07 | 7.1 | 03 | 2.8 | 10 | 4.9 |
| Mixed species infections | | | | | | |
| *Ascaris*/*Trichuris* | 08 | 8.1 | 06 | 5.6 | 14 | 6.8 |
| *Ascaris*/hookworm | 07 | 7.1 | 01 | 0.9 | 8 | 3.9 |
| *Trichuris*/hookworm | 05 | 5.1 | 03 | 2.8 | 8 | 3.9 |
| *Ascaris*/*Trichuris*/hookworm | 02 | 2.0 | 06 | 5.6 | 8 | 3.9 |
| Overall | 58 | 58.6 | 39 | 36.4 | 97 | 47.1 |

**Table 4**
*Effect of gravidity status, marital status and clinic of antenatal visits on anaemia in pregnant women*

| Description | Number examined | Anaemia [n (%)] | | |
|---|---|---|---|---|
| | | 1st visit | 2nd visit | 3rd visit |
| Gravidity | | | | |
| Primigravidae | 99 | 64 (64.6) | 56 (62.9) | 27 (40.3) |
| Multigravidae | 107 | 46 (43.8) | 47 (45.6) | 31 (40.8) |
| Level of Significance | $X^2$=8.90 P < 0.003 | $X^2$ = 5.74 P <0.010 | $X^2$=0.004 P = 0.95 | |
| Marital status | | | | |
| Married | 103 | 48 (47.5) | 53 (45.7) | 34 (44.7) |
| Single | 103 | 62 (60.2) | 56 (54.3) | 24 (35.8) |
| Level of significance | $X^2$ = 3.29 P = 0.07 | $X^2$ = 0.04 P = 0.852 | $X^2$= 1.17 P = 0.279 | |
| Antenatal Clinic | | | | |
| Buea | 73 | 34 (47.2) | 24 (34.3) | 13 (20.6) |
| Mutengene | 73 | 47 (65.3) | 47 (67.1) | 36 (66.7) |
| Muea | 60 | 29 (48.3) | 32 (61.5) | 9 (34.6) |
| Level of significance | $X^2$= 5.79 P < 0.001 | $X^2$ 16.98 P < 0.001 | $X^2$ = 26.02 P < 0.001 | |

## DISCUSSION

Soil-transmitted helminths are highly prevalent in rural communities. This study recorded an overall prevalence of 47.1 % in pregnant women, with primigravidae and single women being more vulnerable to these infections than multigravidae and married women. A similar prevalence rate of helminths (48.3%) was found in pregnant Nigerian women (14). The infection rate decreased with each antenatal visit. This can be explained by the fact that the women were given vermox (mebendazole) on their first antenatal visit. However, some 27% of the pregnant women were still carrying heavy infections and this accounted for the increased geometric mean egg count at the second visit. The high prevalence

of helminth infection in Muea could be attributed to inadequate sanitation, open sewers, crowded living conditions and lack of proper health care in this community. Overall, *A. Iumbricoides* had the highest prevalence, followed in decreasing order by *T. trichuira* and hookworm. Studies by Egwunyenga *et al.* (14) in Nigeria recorded the prevalence of *A. Iumbricoides*, hookworm and *T. trichiura* as 19.1%, 14.2% and 7% espectively.

The study recorded both single and mixed helminth species infections. Of the single infections, those due to *A. Iumbricoides* recorded the highest prevalence, The highest combination of mixed species infection was between *A. Iumbricoides* and *T. trichiura*. This reflects the similar mode of transmission of these parasites and might indicate a synergistic relationship between the two species. The population dynamics of *A. Iumbricoides* and *T. trichiura* are similar. Both species are transmitted via the faecal-oral route and infections reflect the poor sanitary / hygienic conditions of a community. In contrast, the low prevalence of mixed species infections involving hookworm indicates that infection with hookworm is largely independent of the other two species. Needham *et al*. (15), Ndamukong *et al*. (4) and Adio *et al*. (16) in separate studies recorded similar observations.

Among the pregnant women in the present study, 53.7%, 1.0% and 0.0% had mild, moderate and severe anaemia respectively. This indicates that the majority of the pregnant women in the community had mild to moderate anaemia. There was a significant difference in the prevalence of anaemia between primigravidae and multigravidae, which agrees with previous studies by Arstey *et al*. (17). Also, the higher prevalence of anaemia in single women than married women agrees with the findings of Larocque *et al*. (18) in Peru. Anaemia in pregnancy has been associated with poor birth outcome, such as low birth weight (19) and increased maternal morbidity and mortality (20).

Anaemia in pregnant women is usually caused by iron deficiency, which is the most common nutrient deficiency in the world (18). In developing countries, both nutritional deficiencies and parasite infections, specifically hookworm and malaria infection, contribute most of the anaemia. In fact, hookworm infections are recognised as the leading cause of pathogenic blood loss in tropical and subtropical countries (21). Heavy intensity *Trichuris* infection, which is associated with decreased food intake and blood loss, has been associated with anaemia (22,23).

The number of anaemic cases decreased progressively with each successive antenatal visit, with the third visit recording the least number of such cases. This may be related to the prophylactic treatment, including iron tablets that were given to pregnant women who came for antenatal clinic, which significantly controlled any helminth and malaria infections.

In conclusion, the results presented here revealed that the prevalence of soil- transmitted helminth infections was 47.1%, with single and mixed species infections common. Primigravidae and single women were more vulnerable to helminth infections than multigravidae and married women. Infections with helminths and malaria parasites appear to have a significant effect on anaemia in pregnant women. Chemoprophylaxis given to women during antenatal visits appear to play a significant role in the control of both helminths and malaria. These results provide evidence in support of anthelmintic treatment in prenatal programmes in areas where helminthiasis is endemic.

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