ASSOCIATION OF ANEMIA WITH PARASITIC INFESTATION IN PREGNANT NEPALESE WOMEN: RESULTS FROM A HOSPITAL-BASED STUDY DONE IN EASTERN NEPAL

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Background: Anemia is a major contributor to maternal deaths in developing countries. Association of anaemia with helminthic infestations has been seen in the world and by eliminating it, anemia may be reduced with positive effects on maternal outcome. **Methodology:** A comparative cross-sectional study was done to assess the association of anemia with parasitic infestation, and other significant risk factors in eastern Nepal. One hundred and twelve pregnant women with and without anemia were enrolled in the study at the antenatal clinic at Dhankuta District Hospital, Nepal from May 2001 to July 2001. The data on social and demographic variables was collected through a structured questionnaire. Hemoglobin estimation and stool examination for parasitic infestation was done for all these women. **Results:** Anemia was found in 66 (58.9%) women and 52 (46.5%) had helminthic infestation. Anemia was significantly related to hookworm infestation. There was a highly significant relationship between education and the knowledge of women regarding effect of helminthic infestations ($P<0.000$), transmission and spread of infestations ($P<0.000$). The knowledge of women regarding effect of helminthic infestation was significantly ($P<0.001$) related to the occurrence of parasitic infestations but its association with anaemia was not significant. **Conclusion:** Hookworm infestation in pregnancy was significantly related with anaemia. Hence all women coming to antenatal clinics should be screened for hookworm infestation. The antenatal care should include de-worming with correction and prevention of anaemia.

Key Words: hookworm infestation, anaemia, pregnancy

INTRODUCTION

Anemia is the commonest nutritional problem worldwide with its highest prevalence among young children and pregnant women[1]. It is especially more common in developing countries because of poor nutrition and high prevalence of parasitic infestation. Prevalence of anemia among pregnant women in developing countries averages 56% with a range of 35% to 100% among various regions of the world[2]. South Asian regional anemia prevalence has been estimated to be 75% among pregnant women, the highest in the world[3]. A study by Dreyfuss et al. showed the prevalence of anemia to be 73% in the plains of Nepal with 88.9% women infected with helminths[4]. Presence of parasitic infestation and its relationship with anaemia and foetal outcomes was also studied by Stratton et al. in United States[5]. They found that, there was a three-fold increase in the incidence of significant neonatal hyperbilirubinemia in the mothers that had the presence of helminthes in the stool[5].

Anemia in pregnancy is considered one of the major risk factors contributing to maternal deaths in developing countries,[6] hemorrhage, eclampsia and infections being the three major causes of maternal deaths in Nepal[7]. Since it reduces resistance to blood loss, death may occur from bleeding associated with normal delivery. Association of anemia with adverse maternal outcome such as puerperal sepsis, antepartum haemorrhage, postpartum haemorrhage and maternal mortality is no longer a debatable issue[8]. That is why early diagnosis and treatment of anemia is very important in pregnant women.

Though there are many studies on anemia in pregnancy in Nepal showing high prevalence, there are relatively few studies done in the eastern region of the country.[4, 9, 10] A particularly important study carried out by Shah and Gupta[11] showed that prevalence of anemia in adolescent girls in Dharan, a town in eastern region of the country was 68.8%. Association of anaemia with Malaria and hookworm infestations has been seen earlier in various studies done across the globe.[12-15] A study in Egypt found Fasciola infection among children to be significantly associated with low levels of haemoglobin ($p < 0.0001$) [16]. Another study in Niger found a significant correlation between anaemia and Schistosoma haematobium proving that helminthic infestations are a cause of significant morbidity directly related to anaemia[17].

A study done by Hawdon and Hotez showed that Hookworms cause severe anemia and malnutrition in developing countries of the tropics, with an estimated one billion people infected worldwide[15]. The World Health Organization has emphasized the need of epidemiological studies where up-to-date information is not available[18].

Keeping all this in view, this study was undertaken to find out the proportion of anemic women suffering from helminthic infestation and its association with other related risk factors in pregnant women attending antenatal clinic in a district hospital in the eastern part of Nepal.

MATERIAL AND METHODS

This comparative cross-sectional study was conducted in Dhankuta District Hospital, Nepal from May 2001 to July 2001. Dhankuta is a small foothill town located more than 500 km east of Kathmandu. The main objective of the study was to assess the relationship of anaemia with helminthic infestations, and other social and demographic variables, and also find the proportion of pregnant women with anemia reporting to the hospital. The knowledge of women regarding mode of transmission and prevention of parasitic infestation was also assessed. The questions related to knowledge of women regarding mode of transmission, prevention and effect of infestation on the human body were open ended. The questions on transmission were on faeco-oral and urinary-oral spread, contact through intact skin, intercourse, and entry through intact skin. The questions on effect included effect on gastro-intestinal tract, skin, genitor-urinary tract, lungs and liver. The questions on prevention included prevention through use of safe drinking water, clean food, flies control, safe sex and observing universal precautions in human contact. All those who knew three out of four answers were labeled as correct and the rest were placed in the incorrect knowledge category based on their responses. Informed consent was taken from women before enrollment and any women refusing to answer any questions or give stools for examination were neither forced nor enrolled in the study. The questionnaire was pre-tested in a sample of pregnant women coming to the same antenatal clinic and then finalized before starting the study.

The Dhankuta District Hospital caters to families from lower-middle and middle socioeconomic group. All pregnant women (n=112) coming for their first antenatal visit during the two months period were enrolled for the study. Women who had already received any iron supplementation were excluded from the study.

The pregnant women were interviewed by the first author using a coded and structured questionnaire. Venous blood samples were collected under strict aseptic precautions by laboratory technicians after obtaining informed consent and hemoglobin (Hb) was measured by Cyanmethhemoglobin method. Stool samples of the subjects were examined by light microscopy by experienced laboratory technicians.

Anemia was defined as hemoglobin (HB) of <11g/dl, as per WHO criteria[3]. Any women with HB of 11g/dl or more was considered normal according to the WHO criteria. Hemoglobin between 9g/dl to 10.9g/dl was considered as mild anemia, between 7g/dl to 8.9g/dl moderate and HB less than 7g/dl was severe anemia[3]. Data was entered and analyzed on SPSS statistical package 10. Chi square test was used to assess association between categorical variables.

For ascertaining association the women were divided in two groups vis-à-vis the pregnant women with normal HB (HB =< 11g/dl) and pregnant women with anemia (HB of <11g/dl). For determining significant association chi-square (goodness of fit) was used as the data was qualitative and proportions in the various categories were compared in a comparative cross-sectional study.

RESULTS

A total of 112 women at various stages of pregnancy were interviewed. The average haemoglobin of the women was 10.4 $\pm$ 1.48 gm% and the average age was 22.8 $\pm$ 3.04 years and all of them were non-vegetarians Out of 112 women 66 (58.9%) were anaemic (HB <11g/dl) and out of these 8 (7.1%) had moderate to severe anaemia. Out of these 66 anemic women 34 (51.5%) had one or the other kind of helminthic infestation and 16 (24.2%of all anemic women and 47% of all the anemic women with helminthic infestation) had hookworm infestation. Out of 18 women that had hookworm infestation 16 (89%) were anemic. Hookworm infestation alone was significantly associated with anemia in pregnant women ($p<0.005$).

There was a significant relationship of anemia with hookworm infestations ($P<0.001$) (refer to table 1). Anaemia had no relationship with education, trimester of pregnancy, family size, occupation of women and husband and age group of the pregnant women.

There was a highly significant relationship between education and the knowledge of women regarding effect of helminthic infestations ($P<0.000$), transmission and spread of infections ($P<0.000$) and method of prevention of helminthic infestations ($P<0.001$). (Refer to table 2). However the knowledge of women had no relationship with the severity and occurrence of anemia during pregnancy (refer to table 1). The knowledge of women regarding effect of helminthic infestation was significantly ($P<0.001$) related to the occurrence of parasitic infestations although the knowledge of the prevention and transmission of infestation had no effect on the occurrence of parasitic infestation (refer to table 3).

Table-1: Association of Anaemia in Pregnancy with Social and Demographic Variables

Risk factors for anaemia	**Normal (N=46)**		**Anemia (N=46)**		**P- Value**
	N	**%**	**N**	**%**	
Age group					
• <=25 years (N=92)	36	39.1	56	60.8	0.371
• > 25 years (N=20)	10	50	10	50	
Type Of Parasite					
• Hookworm (N=18)	02	11.1	16	88.9	0.063
• Ascaris (N=24)	10	41.7	14	58.4	
• Trichuris (N=05)	03	60	02	40	
• Giardia (N=05)	03	60	02	40	
Educational status					
• Illiterate (N=18)	07	38.9	11	61.1	0.857

• <high school (N=77)	31	40.3	46	59.7	
• >=High school (N=17)	08	47.1	09	52.9	
Source of water Tap (N=107)	43	40.2	64	59.8	0.379
Gravida					
• First (N=62)	22	35.5	40	64..5	0.355
• Second (N=43)	20	46.5	23	53..5	
• More than two (N=07)	04	57.1	03	42.9	
Type of House					
• Katcha (mud house) (N=90)	38	42.2	52	57.8	0.617
• Pukka (cemented) (N=22)	08	36.4	14	63.6	
Occupation of women					
• Housewife (N=96)	40	41.7	56	58.3	0.176
• Skilled worker (N=10)	02	20	08	80	
• Unskilled worker (N=06)	04	66.7	02	33.3	
Husband's Occupation					
• Farmer (N=50)	19	38.0	31	62.0	0.732
• Skilled worker (N=61)	26	42.6	35	57.4	
• Unemployed (N=01)	01	100	00		
Trimester of pregnancy					
• First (N=29)	09	31.0	20	69	0.237
• Second (N=46)	23	50.0	23	50	
• Third (N=37)	14	37.8	23	62.2	
Toilet present in house (N=107)	45	42.1	62	57.9	0.327
Family size					
• 2 or less (N=06)	00		06	100	
• 3 to 4 members (N=27)	09	33.3	18	66.7	0.106
• 5 to 8 members (N=51)	23	45.1	28	54.9	
• 9 or more (N=28)	14	50.0	14	50	
Knowledge of women regarding					
Effect of helminthic infestations (N = 87)	38	43.7	49	56.3	0.536

Transmission of worms (N = 62)	27	43.5	35	56.5	0.192
Prevention of infestation (N = 77)	35	45.5	42	54.5	0.232

Table 2 Knowledge of women regarding helminthic infestations and its relationship with education

Correct Knowledge of women regarding: **(N = 112)**	Education						P-Value
	Illiterate		Not completed high school		Completed High school or more		
	N	%	N	%	N	%	
Effect of helminthic infestations on the body (N = 87)	07	08.0	63	72.4	17	19.5	0.000
Transmission of worms and spread of infestations (N = 62)	02	03.2	44	71.0	16	25.8	0.000
Prevention of helminthic infestations (N = 77)	08	10.4	53	68.8	16	20.8	0.001

Table-3: Relationship of Correct Knowledge of women regarding helminthic infestations with occurrence of parasitic infestation

Correct Knowledge of women regarding: **(N = 112)**	**Parasitic Infestation**										**P-Value**
	Hook Worm		**Ascaris**		**Trichuris**		**Giardia**		**None**		
	N	%	N	%	N	%	N	%	N	%	
Effect of helminthic infestations on the body (N= 87)	12	13.8	18	20.7	3	03.4	2	02.3	52	59.8	0.001
Transmission of worms and spread of infestation (N=62)	8	12.9	16	25.8	2	03.2	1	01.6	35	56.5	0.066
Prevention of helminthic infestations (N = 77)	11	14.3	16	20.8	2	02.6	2	02.6	46	59.7	0.426

DISCUSSION

In our study the proportion of women with anaemia was 60%, which is lower than the prevalence figures reported by previous authors.[3,4,10,18] It has been seen around the world that micronutrient deficiency, parasitic infestations and stunting are significantly related problems[19]. A similar study in Nepal found high prevalence of parasitic infestations where the associated morbidities like anemia and reduced resistance due to other nutritional disorders made the condition worse and helminthic infestation further aggravated anaemia[20]. The study done by Shah and Gupta in the eastern region of the country also showed a 68.8% prevalence of anaemia in adolescent girls[11]. Most studies done in the Nepal have also shown a much higher prevalence of anaemia compared to our study. The probable reason for low proportion of women with anemia in our study is due to the fact that this study was done in the hospital setting, which is located in the city. The women who come for antenatal care to the hospital are slightly better informed with good health awareness. Although we can not generalize the results of this study to the overall prevalence of anemia in this region but can envisage that the real prevalence of anemia in this area could be much higher.

A study done in Nepal by Curtale et al. showed a significant relationship of anemia with helminthic infestation in school children[21]. We also found a strong association between anaemia and helminthic infestations, which is similar to the results of earlier studies elsewhere.[12, 13, 17]

The parasite most commonly associated with anemia was Hookworm followed by Ascaris ($P<0.06$). When hookworm infestation was compared with the rest of pregnant women with helminthic infestations and absence of any it was found to be significantly associated ($p<0.005$). The degree of severity of anaemia was also higher with Hookworm compared to Ascaris (N = 6, 33.3% of women with hookworm infestation were severely anemic with hemoglobin less than 9 g/dl as per, WHO criteria[3]). This result is in conformity with earlier studies done worldwide where Hookworm infestation was significantly related to anaemia[5, 14, 15, 16, 21]. Study done by Bauerfeind et al. in Papua New Guinea showed a significant linear correlation between the intensity of hookworm infestation and blood haemoglobin level[22]. This result is further conforming to the fact that Hookworm infestation can cause anaemia. It is a proven fact that Anaemia can cause major complications in pregnancy and lead to a bad maternal and foetal outcome of pregnancy[6, 7, 8].

Several studies have been done in the developing countries, have shown that by giving iron in the pregnancy and reducing anaemia some of these fatalities can be averted[24]. Various strategies have been tried in the world including Nepal where cooking in Iron pots was tried which showed a significant reduction of iron deficiency in women[23]. Therefore in any pregnant lady de-worming should be considered (preferably after a thorough stool examination) with iron supplementation especially in regions of the world where Hookworm infestation is prevalent.

Our study also found that women who had higher educational status knew more about the mode of infestation, transmission and prevention of parasitic infestations (refer to table 2). Surprisingly the educational status had no effect on the proportion of women with anemia and the knowledge of helminthes was related to decrease in occurrence of helminthic infestation and anemia. As can be seen from the results more than 50% of the women with correct knowledge of helminthes had absence of any kind of parasite in their stools (refer to table 3). This means that if women were educated, and had knowledge regarding the effect of helminthes, then indirectly this could protect them from helminthic infestations. This means that if in schools, colleges, and other similar teaching institutions the curriculum includes knowledge on helminthic infestations then it might help in reduction of helminthic infestation and anaemia. Similarly in other clinical and primary health care settings if health education regarding helminthes is improved then women can be protected from helminthic infestations. This aspect of health education should be given special importance in antenatal clinics and primary healthcare settings where women come during and after pregnancy. Another opportunity of this health education are places where family planning

and child health care services are provided. These concerted efforts can lead to better health of women and prevent anaemia and morbid outcomes of pregnancy.

CONCLUSION

Hookworm infestation in pregnancy is significantly related with anaemia. Hence all women coming to antenatal clinics should be screened for hookworm infestation. The antenatal care should include de-worming with correction and prevention of anaemia. We suggest that in the antenatal clinics the health education should include causes of anaemia with emphasis on helminthic infestations specifically the mode of transmission and prevention of Hookworm infestation.

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