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ORIGINAL ARTICLE

Lifestyles characteristics and prevalence of anaemia among men living in deprived community, Ghana

F. Vuvor[1], M. Steiner-Asiedu[1] and F. K. Saalia[1]

[1]*Department of Nutrition and Food Science, School of Biological Sciences, College of Basic and Applied Sciences, University of Ghana*

Anaemia is a reduction in circulating red blood cells which directly affect the concentrations of haemoglobin. The most common form dietary anaemia is known to be iron deficiency. Many factors such as socioeconomic status, and lifestyles contribute to anaemia. Studies are done on children and women but scanty information aree available on men. It was relevant to find out such information on men. This problem persists in the world especially, in the underdeveloped countries. A cross-sectional study in a peri urban community in Ghana enrolled 1449 healthy men aged ≥18 years. The study assessed their lifestyle, nutrient adequacy ratio (NAR), body mass index (BMI), haemoglobin (Hb) level. risks of developing anaemia and binary logistic regression analysis with significance set at $p<0.05$. Biochemical and clinical examinations revealed that 18.8% of the participants were anaemic (Hb ≤13b/dL). Their dietary status was below the cutoff of 60% NAR for all nutrients except iron (84%) and protein (55%). The binary logistic regression indicated that participants who used tobacco were about 16 (Odds ratio: 16.39, $p<0.01$) times more likely to be anaemic compared with nonusers. In the same model men whose intake of protein was (<60% NAR) were 3 (Odds ratio: 3.44, $p<0.01$) time more likely to be anaemic. In conclusion, tobacco smoking and mainly plant -base sources of protein and iron did not guarantee their availability for optimum utilization for Hb synthesis to lower incidence of high risk of among participating men in the study in Ghana.
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Keywords: Anaemia; Nicotine; Haemoglobin; Protoporphyrin

INTRODUCTION

Anaemia is a reduction in circulating red blood cells which directly affect the concentrations of haemoglobin. This adversely affects cognitive, motor development, cause fatigue and low productivity (Stoltzfus, Mullany, & Black, 2004). The most common type of anaemia is nutrient deficiency anaemia (Nishida, Uauy, Kumanyika, & Shetty). Factors such as unhealthy lifestyle also contribute to incidence of anaemia (Killip, Bennett, & Chambers, 2007).

Iron deficiency anaemia persists in both developed and underdeveloped countries (Miranda et al., 2003). In iron deficiency, Hb concentrations fall and hypochromic, microcytic anaemia ensured; this affects over 1 million people worldwide. Anaemia can be defined as a condition in which the haemoglobin (Hb) levels are lower than normal (<14g/dl) for men (Fairweather-Tait, Wawer, Gillings, Jennings, & Myint, 2014), (Fleming et al., 1998). A study involving Danish men and women evaluating iron status and its relationship with diet and supplement use, reported a direct correlation between serum ferritin and intakes of dietary iron (p=0.03), meat (p=0.013), alcohol ($p<0.001$), and BMI (in men only, p=0.025), and a negative correlation with tea consumption (p=0.017) (Milman, Pedersen, Ovesen, & Schroll, 2004).

Men do not usually suffer from anaemia as frequently as children and women in their reproductive ages. This is because of the physiological and anatomical make up of men. Literature reveals that men's nutrition and health studies are not major concerns for most researchers. Nevertheless, men are known to have higher mortality rates and shorter life span (Wang, Schumacher, Levitz, Mokdad, & Murray, 2013). In Ghana, life expectancy at birth is 63.38 years for men and 66.19 years for women

Correspondence: *Vuvor F., Department of Nutrition and Food Science, School of Biological Sciences, College of Basic and Applied Sciences, University of Ghana*
Email: fredvuvor@yahoo.com

(GSS & Macro, 2009). Therefore it is essential to know critical nutrition and health matters concerning men. Globally, 'the millennium development goals (MDGs) and post-2015 global development agenda (Awortwi, 2012) were basically set for women and children. Out of the eight MDGs, none was set to address any issue concerning men. Nationally, 'the Ghana Demographic and Health Survey' conducted every five years does not take men's nutrition and health so seriously (GSS & Macro, 2009).

It is documented that chronic ingestion of ethanol alters the hematopoietic system resulting in folate deficiency (Maruyama et al., 2001). Although the mechanisms by which alcohol causes anemia have been well described, a study indicates that alcoholics tend to have high iron stores (Kohgo, Ikuta, Ohtake, Torimoto, & Kato, 2008). Teetotalers who were compared to volunteers drinking small amounts of alcohol showed significant increase in indices of iron stores, such as ferritin (Milman & Pedersen, 2009). A large study in 2008 has found that moderate drinkers (after adjusting for several factors) preserve their high longevity benefit over alcohol abstainer (Lee et al., 2009).

In almost all populations studies, men smoke more than women and that, among smokers, men have more dangerous smoking habits than women (Lundberg, Hemmingsson, & Hogstedt, 2007). Studies have revealed that inhaling, irrespective of how little tobacco smoke may be, can be harmful. Tobacco smoke contains more than 7,000 chemicals and at least 250 are known to be detrimental, such as carbon monoxide, hydrogen cyanide and ammonia (Control & Prevention, 2011). Nicotine is` one of those chemical compounds in tobacco that is biologically accountable for addictive property of tobacco products to consumers (Hatsukami, Stead, & Gupta, 2008). Many societies view tobacco smoking as a desired masculine norm. Globally, 48% of adult men smoke compared to 12% of women. Smoking prevalence among the adults in Greater Accra (both urban and rural) stood at 10.8% males, and 4% female (Al-Bedah, Qureshi, Al-Guhaimani, & Basahi, 2010). In Ghana smoking is banned in many areas such as restaurants, bars, in government buildings (including work sites), private work sites, educational facilities and health care facilities. It is also banned to sell any tobacco products to minors. It is restricted in advertisements in media and in public locations. It is however, not regulated in its accessibility and availability but free products on the market (Blons et al., 2006).

It was also noted that relatively little attention has been placed on peri-urban communities in terms of nutrition and health research. There is an obvious knowledge gap that needs to be fill in these communities. It has also been predicted that members of peri-urban communities could be socio-economically and nutritionally poorer than both rural and urban communities (Maxwell et al., 2000).

MATERIALS AND METHODS

Study design

It was a population-based research comprising adult men aged ≥ 18 years and living in a peri-urban community in Ghana. A house-to-house visits were conducted 7161 eligible men were enlisted out of which 1449 men were willing and participated in the study.

Ethics

The study was approved by the Institutiona Review Board of Noguchi Memorial Institute for Medical Research Legon, with the approval code:**#036/14-15**.

Data collection and measurements

The WHO stepwise questionnaires were modified were used to collect information on demographic, socio-economic, lifestyles behaviours, dietary, anthropometry and clinical data. HemoCue Hb 201+ (Manufactured by HemoCue AB, SE-262 233 Angelholm, Sweden and distributed by HemoCue Inc. 40 Empire Drive, Lake Forest, CA 92630 USA) device was used to measure the haemoglobin. The acceptable cut-off level of haemoglobin for adult man is >13g/dl and deficiency is ≤13g/dl (Nkrumah et al., 2011).

Nutrient adequacy and Mean adequacy

To estimate the value of nutrient intake NAR was calculated for 9 nutrients (Kvaavik et al.; Madden, Goodman, & Guthrie, 1976; Torheim et al., 2004).

The NAR was based on the ratio of the RDA for each nutrient (from all "n" different foods) calculated from the formula:

$$\mathrm{NAR}_i = 100/\mathrm{n} * \sum_{p=1}^{p=n} \left(\mathrm{Intake}_{\ p} / \mathrm{RDA}_{\ p}\right)$$

Where p was daily intake of each nutrient (mean of all daily food intake) NAR*i* is the real total sum of the daily intake of a nutrient calculated (Hatluy, Torheim, & Oshaug, 1998).

As an overall measure of the nutrient adequacy, the MAR was calculated as described by Madden and colleagues (Madden et al., 1976):

$$MAR = \frac{\sum \ NAR(each\ truncated\ at\ 1)}{Number\ of\ nutriets}$$

The NAR for protein, calories, carbohydrates, fat, sodium, calcium, iron, vitamin B_1 and vitamin B_{12} consumed were used for MAR.

Definitions of variables in the binary regression model

Dependent variables: **Haemoglobin (Hb):** > 13g/dL= normal and ≤13g/dL=anaemia for men. Independent variables: **Age**: >40 years; ≤40 years; **Alcohol**: yes or no; **Tobacco use**: yes or no; **Dietary Protein**: ≥60% NAR=normal; <60%NAR= deficiency; **Dietary iron**: ≥60% NAR=normal; <60% NAR= deficiency

Data analysis

The food data were broken down into nutrients (Eyeson & Ankrah, 1975). RDA for each nutrients were calculated (Kvaavik, Meyer, & Tverdal) from which NAR and Mean nutrient Adequacy Ratio (MAR) were determined. Data management were done by SPSS version 16 (SPSS Inc, Chicago, IL). Proportions for qualitative variables and descriptive statistics were computed for continuous data. Binary logistic regression analysis was done assess the association between independent and outcome variables. The significance was set at an alpha level of 5%.

RESULTS

The participanting subjects were made up of 1449 men with a mean age of 40±14.3, ranging from 19

Table 1: Background characteristics of men participants (N=1449)

Variable	[1]Age in years; n (%)					
Age (Years)	**18-30**	**31-40**	**41-50**	**51-60**	**>60**	**Total n(%)**
Education						
<SHS	203 (54.7)	294(68.9)	252 (80)	147(70)	63 (50)	959(66.2)
≥SHS	168 (45.3)	133(31.1)	63 (20.0)	63(30)	63 (50)	490 (33.8)
Alcohol use						
Users	182(49.1)	322 (75.4)	252 (80)	189 (90)	84 (66.7)	1029(71.0)
Tobacco user						
Users	21 (5.7)	70 (16.4)	42 (13.3)	126 (60)	63 (50)	322 (22.2)
Physical Activity Score						
Inactive	42 (11.3)	84 (19.7)	126 (40)	42 (20)	21 (16.7)	315 (31.9)
Moderate	245 (66)	259 (60.7)	147 (46.7)	147 (70)	105 (83.3)	903 (66.7)
Active	84 (22.6)	84 (19.7)	42 (13.3)	21 (10)	0	231 (1.4)
Nutrient Adequacy Ratio ([2]NAR) by Age Distribution						
NAR ≥60%						
Calories	63 (17)	63 (14.8)	42(13.3)	42(20)	63(50)	273 (24.3)
Protein	203 (54.7)	252 (59)	147 (46.7)	126 (60)	63(50)	791(54.6)
Fat	84(22.6)	105 (24.6)	84 (26.7)	63 (30)	63 (50)	399(27.5)
Carbohydrate	84(22.6)	84 (19.7)	63(20)	63(30)	63(50)	357(24.6)
Dietary Iron	350(94.3)	364(85.2)	231(73.3)	168 (80)	105(83.3)	1218 (84.1)
Dietary Calcium	203(54.7)	168 (39.3)	210(66.7)	84(40)	42(33.3)	707(48.8)
Dietary Sodium	63 (17)	105 (24.6)	63 (20)	84 (40)	84(66.7)	399(27.5)
Vitamin B_1	63(17)	126(29.5)	63 (20)	42 (20)	21 (16.7)	315 (21.7)
Vitamin B_{12}	21 (5.7)	63 (14.8)	21 (6.6)	84 (40)	21 (16.7)	210(14.5)
[3]MAR ≥60%	168(45.3)	147 (34.4)	147 (46.7)	105(50)	63 (50)	630(43.5)

to 95 years. About a third (33.8%) of the participants had completed Senior High Secondary (SHS) education and above. More than three-quarter (71.0%) of the participating men in the community were alcohol users. An appreciable number (22.2%) of them also used tobacco. Older subjects had the higher rate of tobacco smoking than the younger groups. The participants were largely physically active (98.6%). Lesser number (<40%) of the participants met the cut-off of >60% NAR for all the nutrients intakes except iron (84.1%) and protein (54.6%) and only 43.5% of the study population met ≥60% of the overall nutrients need (Table 1).

About three fourth of the men were within the normal BMI ranges of (18.24-24.9 kg/m²) (68.1%). However, about 25% were overweight with their BMI ≥25kg/m² whiles 7.2% were underweight (BMI<18.5kg/m²). Clinically, there are various percentages of ailments especially severe body pains (60.4%) and headache (52.2%). Measured systolic blood pressures (≥140mmHg) showing about 26% of men being hypertensive and biochemical examinations of Hb ≤13g/dL indicating 18.8% of anaemic status (Table 2).

Binary logistic regression was used to examine the risk factors for Anaemia. The data showed significant association between anaemia and tobacco use (OR=16.39; 95%CI: 6.33-41.67) and the levels of dietary protein intake (OR=3.44; 95%CI: 1.53-7.69) (Table 3).

Table 2: Anthropometric, medical history and clinical indices (N=1449)

Variable	18-30	31-40	41-50	51-60	>60	Total n(%)
BMI (kg/m2)						
<18.5 (underweight)	0(0)	63 (14.8)	21 (6.7)	21 (10)	0(0)	105(7.2)
18.5-24.9 (normal)	350(94.3)	217(50.8)	189(60)	147(70)	84(66.7)	987(68.1)
≥25 (overweight)	21 (5.7)	147(34.4)	105(33.3)	42 (20)	42 (33.3)	357(24.6)
Clinical examinations						
Abdominal	119(32.1)	231(54.1)	126(40)	84(40)	42(33.3)	602(41.5)
Anaemia	35(9.4)	0(0)	21(6.7)	21(10)	0(0)	11(5.3)
Body pain	203(54.7)	273(63.9)	147(46.7)	189(90)	63(50)	875 (60.4)
URI	189(50.9)	231(54.1)	84(26.7)	84(40)	42(33.3)	630(43.5)
ENT	0(0)	147(34.4)	42(13.3)	63(30)	21(16.7)	273(18.8)
Eye	35(9.4)	147(34.4)	42(13.3)	105(50)	42(33.3)	53(25.6)
Malaria	161(43.4)	217(50.8)	147(26.7)	42(20)	21(16.7)	588(40.6)
Oral	63(17)	42(9.8)	42(13.3)	63(30)	0(0)	210(14.5)
Headache	161(43.4)	259(60/7)	168(53.3)	147(70)	21(16.7)	756(52.2)
UTI	77(20.8)	84(19.7)	21(6.7)	21(10)	21(16.7)	224(15.5)
Skin	63(17)	63(14.8)	21(6.7)	63(30)	0(0)	210(14.5)
SBP (mmHg)						
≥140	21(5.7)	105(24.6)	42(13.3)	126(60)	84(66.7)	378(26.1)
Haemoglobin level						
Hb ≤13 (mg/dl)	63(17)	84(19.7)	21(6.7)	63(30)	42(33.3)	273(18.8)

BMI= Body Mass Index; UTI= Urinary Tract Infection; ENT= Ear Nose and Throat infections; URI=Upper Respiratory Infections; SBP=Systolic Blood Pressure; Hb=Haemoglobin

Table 3: Binary Logistic Regression for Anaemia

Variable	n	OR	95%Cl	P-value	aOR	95%Cl	P-value
Age							
>40	651	1.06	0.47-1.89				
≤40	798	1.00	Ref	0.86			
Alcohol							
Yes	1029	1.44	0.31-1.55		1.44	0.30-1.58	
No	420	1.00	Ref	0.37	1.00	Ref	0.38
Tobacco							
Yes	**322**	**10.64**	**3.70-23.26**		**16.39**	**6.33-41.67**	
No	**1127**	**1.00**	**Ref**	**<0.01**	**1.00**	**Ref**	**<0.01**
Protein							
<60%	**791**	**3.41**	**1.53-7.63**		**3.44**	**1.53-7.69**	
≥60%	**658**	**1.00**	**Ref**	**<0.01**	**1.00**	**Ref**	**<0.01**
Iron							
<60%	1218	1.05	0.36-2.49		1.08	0.35-2.48	
≥60%	231	1.00	Ref	0.92	1	Ref	0.90

Hb >13g/dl=normal; ≤13g/dl=anaemia for men
****The multivariate logistic regression analyses model was adjusted for age, education, and all dietary nutrients assessed except iron and protein intakes.***

DISCUSSION

There is scanty information about haematological status of men in Ghana and over the world men health research are less important to researchers. This study indicated that about 18.8% of the participants were anaemic. Globally men prevalence of anaemia stood at 5% (De Benoist, McLean, Egli, & Cogswell, 2008).

A study done in Malawi also showed that about 16.1% of the men were anaemic which conforms to this study (Adamu *et al.*, 2017). The anaemia prevalence found in this study was far higher than global prevalence. The dietary data indicated that about 84% of the men had sufficient iron in their diet and more than 54% had satisfactory intake of protein. These dietary data did not reflect in the men's haemoglobin levels since research has shown that adequate consumption of protein and iron improves hemoglobin level (Lopez *et al.*, 2016).

This information shows limitation in the use of dietary analyses alone to determine the nutritional status of any individual or population. It implies that any effort to assess nutritional status by assessing dietary intake should be complemented with clinical and biochemical data. Another possible confounding factor could be that plant-based could prevent the availability of iron in the diet as well as the essential amino acids.

In the same model men whose intake of protein were <60% NAR were about 3 (Odds ratio: 3.44, p<0.01) times more likely to be anaemic compared with protein intake ≥60% NAR. It is a consequential that deficiency of protein would be followed by anaemia. Protein is one of the main raw materials needed for synthesis of haemoglobin and the blood cells. It is also needed for transportation of iron in the form of transferrin, ferritin and haemosiderin. Protein is needed for protoporphyrin or porphyrin and globin which are required for synthesis of haemoglobin.

The logistic regression to determine the risk factors for anaemia indicated that participants who used tobacco were about 16 times more likely to be anaemic compared with nonusers (Odds ratio:16.39, p<0.01). The poisonous alkaloid, nicotine, found in tobacco smoke is an inhibitor to many ions in diet including iron. It also inhibits the absorption of many other digested nutrients in the gastro-intestinal tracts such as amino acids. These actions of nicotine may affect negatively the bioavailability of both iron and amino acids leading to anaemic conditions. Cigarette smoking causes numerous diseases that are associated with anaemia but the resulting low haemoglobin levels may be counterbalanced by increased red blood cell production caused by chronic exposure to carbon monoxide from cigarette smoke. Diverse mechanisms are involved in influencing the development or the course of anaemic disease in smokers (Leifert, 2008).

A study has discovered no significant difference in the mean hemoglobin levels between smokers and nonsmokers. In that study, the mean hemoglobin levels rather increased progressively with the number of cigarettes consumed per day. Therefore, cigarette smoking appears to have caused a generalized upward shift of the haemoglobin levels, which decreases the usefulness of haemoglobin level to detect anemia in smokers. The study concludes that average haemoglobin values should be corrected for smokers to compensate for the concealing effect of smoking on the diagnosis of anemia among smokers (Nordenberg, Yip, & Binkin, 1990).

In another study, men did not show any difference in haemoglobin levels between smokers and nonsmokers, but women smokers' haemoglobin levels significantly increased with age. It was revealed that people who smoke more than 10 cigarettes per day had significantly greater haemoglobin (1.4% higher in men, 3.5% higher in women) than nonsmokers. The study concluded that tobacco smoking has an accumulative effect on haemoglobin levels in both sexes, which is proportionate to the amount of tobacco smoked per time. The effects seem to be more marked in females than males (Milman & Pedersen, 2009).

CONCLUSION

Lifestyle factors (tobacco smoking) and low intake of protein are risk factors for the incidence of anaemia in participating men. These findings raised important questions on the implications of tobacco use and habitual low protein intakes on erythropoiesis in poor communities. The need for nutrition and health advocacy to halt at least tobacco use in poor communities may be a step towards alleviating anaemia and promoting national development.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS CONTRIBUTION

FV: designed the study, collected the data, analyzed and interpreted the data, drafted the manuscript and revision the paper. MSA: analyzed and interpreted the data and revision of the paper. FKS contributed to the interpreted of data and revision of the paper. All authors read and approved the final manuscript.

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