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ORIGINAL ARTICLE

The Ophthalmic status manifestations of nutritional and lifestyle disorders of men in a peri urban community in Ghana

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Unhealthy conditions of eye/ sight in poor communities in South-Saharan African countries are many and becoming a global concern. The aim of the study is to determine the lifestyle variables and their associations with unhealthy ophthalmic conditions of men in a peri-urban community in Ghana. The study was a cross-sectional; involving men aged ≥18 years of age. Data were gathered using WHO Stepwise questionnaires. Analyses included frequencies, Chi-squares, correlations and regressions. The participants were made up of 1449 men. The dietary intakes of vitamin A rich food were so low that they could not be represented quantitatively. About 71.0% of the men were habitual users of alcoholic beverages and 22.0% smoked tobacco. About 21.7% of men had *Bitot's spot* while 4.3% had *keratomalacia*. The logistic regression analysis predicted that alcohol users were about twice more likely to suffer *Bitot's spot* ($p=0.20$) while tobacco smokers were about 3 times and 13 times more likely to suffer from *Bitot's spot* ($p<0.01$) and *Keratomalacia* ($p<0.01$) respectively, compared with nonsmokers in the study group. The prevalence of ophthalmic was considerable high. The lifestyle behaviours such as smoking were strongly correlated with Bitot's spots and keratomalacia among the participating men**.**
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INTRODUCTION

Indicators of health such as conditions of eye and sight for men in deprived communities are many and have important to investigate. Information on causes and risk especially diet related factors are scarce. Men's health studies are of less significant for most researchers. One of the reasons why men health issues are so important to Ghanaians is that, more than 65% of households in Ghana are headed by men (GSS and Macro, 2009). Nonetheless, men have shorter life span than their women counterparts (Lynch, 2013; Wang *et al.*, 2013; White *et al.*, 2013).

There is therefore the need to search for their health matters including that of the eye/sight. The millennium development goals for instance were essentially set for children and women only (Economic, 2008; Poverty, 2015). There are more studies done in both rural and urban centres than those in the peri-urban areas in Ghana. It has also been perceived that peri-urban areas could be socioeconomically and nutritionally inferior to either urban or rural areas (Maxwell *et al.*, 2000). African countries are rapidly developing, both economically and socially, they are achieving a higher income standing, and many are assuming unhealthy lifestyles (Tong *et al.*, 2011). While people in industrialized nations are achieving healthier status, developing countries are beginning to face serious chronic double burden of diseases, particularly men who have poorer health (Rahman and Liu, 2000; White *et al.*, 2013). There is therefore information gap that requires to be bridged especially men in peri-urban communities. The main objective was to study the lifestyles variables and their associations with unhealthy ophthalmic conditions of men in a peri-urban community in Ghana.

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MATERIALS AND METHODS

The study was a community-based cross-sectional study involving adult men in a peri-urban community of Ghana. It involved the assessment of men's nutrition and health conditions. The rest of the study involved the socio-demographic and econom-

ic. Information on lifestyle behaviours were collected using WHO Stepwise questionnaires. A total of 2890 men were enlisted based only on age ≥18 years. However, 1449 men were willing to participate and were recruited into the study.

Determination of the association between the lifestyle behaviours and the health of the eyes was done. The community was selected using three-stage sampling approach. The first stage was the decision to do the study in the Greater Accra Region of Ghana. The second involved the random selection of one district out of the eight districts in the Greater Accra Region. The final stage also involved simple random selection of one of the twelve peri-urban communities in the selected District. The population consisted largely of farmers, construction workers and few others who were involved in skilled labour.

Ethical Considerations

Ethical approval for the conduct of the study was granted by the Noguchi Memorial Institute for Medical Research, (Ethical clearance: RE: Our Study #: 036/14-15). Each recruited man provided a signed informed consent form. They were assured of strict confidentiality of any information obtained from them.

In determining the participants' dietary intakes, Diet History method was used to gather dietary data. The food data were broken down into nutrients, using the ESHA Food Processor software (ESHA Research, 2012w, 4747 Skyline Rd s, Suite 100, Salem. OR 97306 USA) and MS Excel 2013 (Microsoft Corp, Redmond, WA) and Ghanaian Food Composition Table (Eyeson and Ankrah, 1975). Various nutrients consumed per person per day were calculated and compared with the Recommended Dietary Allowance (RDA) from which Nutrient Adequacy Ratio (NAR) was calculated for each participant. The ESHA Food Processor takes into account the age, BMI, type of usual work as well as exercise the participants does in determining the subject's RDA before generating the NAR for each individual. Based on the NAR, the overall nutritional status for each man was also determined using Mean nutrient Adequacy Ratio (MAR).

To estimate the nutrient adequacy of the diet, a NAR (for 9 nutrients) and the MAR (for overall nutritional status) were calculated. The NAR is the actual nutrient intake divided by the (RDA) and expressed as a percent for an individual subject. RDAs are often used to compare dietary quality among population subgroups (Torheim *et al.*, 2004). RDAs represent the amounts of nutrients required to meet the needs of almost all healthy people (97%). The NAR is based on the mean percentage of the recommended intakes for nutrients from the entire "n" different foods taken per day and is calculated as follows:

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

Where Intake p is the daily intake of each nutrient p, (from all food taken in a day) and RDA p is the Recommended Dietary Allowance for a day and "n" is the list and reference value for the "n" recommended nutrients, but in this case "n" is one nutrient. NAR *i* is the actual amount of a nutrient intake per/RDA/ day, calculated for the whole diet but excluding alcoholic beverages, tea, coffee, and drinking water. The NAR for a given nutrient is the ratio of a subject's intake/day to the current recommended allowance for each age category (Hatluy *et al.*, 1998). To estimate the nutrient adequacy of the diet, NAR was calculated for all relevance nutrients intake from all food taken per day. There are several approaches for determination of adequacy of diets. The most widely used method is the cutoff method, which estimates the intake of nutrient below a given value of the RDAs. Many different cutoff points have been used such as 80%, 66%, 50%. In this report we used 60% cutoff point as presented (Hatluy *et al.*, 1998; Gibson, 2005).

A value of 77% of the RDA is a value that represent the mean requirement for a given age and sex group. If the RDA is considered to represent the mean requirement +2SD and the SD is 15% of the mean in most biological measure, then RDA equals

130% of the mean. The mean requirement is represented by 77% of the RDA (100/130). The requirement of half the population is below 77% of the RDAs. It is not appropriate to consider that levels falling below the RDs or any value of RDA indicate dietary deficiencies, although it is appropriate to consider levels well below the RDAs to indicate risks to dietary adequacy.

The existence of deficiencies must be confirmed or rejected on the basis of biochemistry, anthropometric or clinical data (Gibson, 2005). Since the adequacy of the diet is a function of the extent to which contribution of particular nutrients meets our best estimate of the need for nutrients, it is helpful to calculate an NAR for nutrient. When NAR is equal or greater than 1, the requirement is met. If it falls below 1 it may still be sufficient, since the RDA is set at the mean requirement of 77% RDAs. The farther the NAR falls below 1 the higher the probability that the diet will fail to meet the needs of the individual. Only by determining some biochemical markers of dietary adequacy, however, can a judgment be made as to whether the intake of a particular nutrient is adequate or not data (Gibson, 2005).As an overall measure of the nutrient adequacy (nutritional dietary status), the MAR was calculated as described by Torheim et al., (2004) (Madden *et al.*, 1976).

$$MAR = \frac{\sum \ NAR(eachtruncated\ at\ 1)}{Numberof\ nutriets}$$

The average of 9 NARs for calories, protein, fat, carbohydrates, iron, calcium, sodium, vitamin B1 and vitamin B12 consumed by the men were used to arrive at MAR. NAR was truncate at 1 so that a nutrient with a high NAR could not compensate for a nutrient with a low NAR. Clinical assessment included total clinical examinations for signs and symptoms of any medical importance of the eye.

Statistical analysis

Data entry and management system were designed using SPSS version 16 (SPSS Inc, Chicago, IL). Descriptive statistics were calculated for continuous variables and proportions for qualitative variables. Means of continuous variables were compared between various levels of other variables using ANOVA. To assess the association between outcome variables and independent variables, logistic regression analysis was carried out.

RESULTS

Table 1 shows the background characteristics and life style profiles. The study participants were made up of 1449 men. About 71.0% were habitual users of various kinds of alcoholic beverages about 22.0% of them smoked tobacco.

Table 1: Background Characteristics of the Participants (N=1449)

Variable	Age (Years); n (%)					
	18-30	31-40	41-50	51-60	>60	Total n(%)
Marital status						
Married	84 (22.6)	385(90.2)	273(86.7)	126(60)	126(100)	994(68.6)
Single	287(77.4)	42(9.8)	42(20)	84(40)	0	455(31.4)
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(22.3)

Data is presented as number and percentages

Adequacy of Nutrient Intakes

The amount of nutrients intake of the study men was compared to their respective RDA. Table 2 indicates in exception of iron (84.1%) and protein (54.1%) more than 70% of men fell below the cut-off of (≥60% of NAR) of the all nutrients intakes.

Clinical Indices

Clinical examination of the eyes revealed that about 22.0% of men had *Bitot's spot* and some had *keratomalacia* (4.3%) (Table 3).

Determinants of Risk Factors for Bitot's Spots

Table 4 indicates that tobacco use and sedentary lifestyle were significant risk factors for the development of Bitot's spot.

Table 2: Nutrient Adequacy Ratio (NAR) Distribution

Variable	Age (Years); n (%)					
NAR ≥60%	**18-30**	**31-40**	**41-50**	**51-60**	**>60**	**Total n(%)**
Calories	9(17)	9(14.8)	6(13.3)	6(20)	9(50)	39(24.3)
Protein	29(54.7)	36(59)	21(46.7)	18(60)	9(50)	113(54.6)
Fat	12(22.6)	15(24.6)	12(26.7)	9(30)	9(50)	57(27.5)
Carbohydrate	12(22.6)	12(19.7)	9(20)	9(30)	9(50)	51(24.6)
Dietary Iron	50(94.3)	52(85.2)	33(73.3)	24(80)	15(83.3)	174(84.1)
Dietary Calcium	29(54.7)	24(39.3)	30(66.7)	12(40)	6(33.3)	101(48.8)
Dietary Sodium	9(17)	15(24.6)	9(20)	12(40)	12(66.7)	57(27.5)
Vitamin B1	9(17)	18(29.5)	9(20)	6(20)	3(16.7)	45(21.7)
Vitamin B12	3(5.7)	9(14.8)	3(6.6)	12(40)	3(16.7)	30(14.5)
1MAR ≥60%	24(45.3)	21(34.4)	21(46.7)	15(50)	9(50)	90(43.5)

Data is presented as number and percentages, [1]MAR=Mean of all the 9 NARs each truncated at 1. Other nutrient of total percentage < 10% were not represented in the table including vitamin A.

Table 3: Clinical Indices stratified by age

	Age (Years); n (%)					
Variable	**18-30**	**31-40**	**41-50**	**51-60**	**>60**	**Total n(%)**
Ophthalmic Exams						
Bitot's spot	21(5.7)	126(26.2)	63(20)	42(20)	63(50)	315(21.7)
Keratomalacia	0(0)	42(9.8)	0(0)	21(10)	0(0)	63(4.3)
Blood pressure						
[1]SBP (mmHg)						
≥140	21(5.7)	105(24.6)	42(13.3)	126(60)	84(66.7)	378(26.1)

[1]SBP=Systolic Blood Pressure, Data is presented as number and percentages

Table 4: Multivariate Regression for Bitot's Spots

		Unadjusted			Adjusted		
Variable	n	Odds Ratio	95%Cl	P-value	Odds Ratio	95%Cl	P-value
***Age**							
>40	93	1.54	0.79-3.00	0.2			
≤40	114	1	Ref				
Alcohol							
Yes	147	1.84	0.82-4.10	0.14	1.71	0.76-3.87	0.2
No	60	1	Ref		1	Ref	
Tobacco							
Yes	46	3.19	1.55-6.57	<0.01	3.05	1.43-6.51	<0.01
No	161	1	Ref		1	Ref	

****The multivariate logistic regression analyses model was adjusted for age and all dietary nutrients assessed.***

Determinants of Risk Factors for Keratomalacia
Table 5 portrays that there was significant risk in the study population to develop Keratomalacia if the men use tobacco.

Table 5: Multivariate Regression for Keratomalacia

	Unadjusted				Adjusted		
Variable	n	Odds Ratio	95%Cl	P-value	Odds Ratio	95%Cl	P-value
***Age**							
>40	93	0.6	0.15-2.47	0.48			
≤40	114	1					
Tobacco							
Yes	46	7.9	1.89-32.97	<0.01	13.26	2.80-62.64	<0.01
No	161	1	Ref		1	Ref	

****The multivariate logistic regression analyses model was adjusted for age and all dietary nutrients assessed***

DISCUSSION

About 71.0% of the participating men drank alcoholic beverages while about 22.0% smoked cigarettes. Dietary assessment showed that more than 70% of the total study group did not meet the average dietary intake. However, more than 75% of the population had adequate iron intake. The MAR was adequate for only 44.0% of the study participants.

Examinations of cornea revealed that 22% and 4.3% of the subjects had *Bitot's spot* and *keratomalacia* respectively. *Bitot's spot* is an early manifestation of severe vitamin-A deficiency (Bitot, 1863). If the vitamin-A deficiency remains unresolved it goes through stages such as *Keratomalacia* and ends with *xerophthalmia* which is a permanent blindness. *Xerophthalmia* is responsible for over 70% of blindness in unindustrialized countries (Resnikoff *et al.*, 2004). Information on men's vitamin-A status in Ghana is scanty. There is however, an annual vitamin-A supplementation given to children in Ghana as preventive measure, while some adults may be suffering from the vitamin A deficiency as shown in this study.

In some developed countries, for example, the UK where vitamin-A deficiency is presumed to be under controlled, *Bitot's spot* and *xerophthalmia* are more usually linked with alcoholism or hepatic cirrhosis, or people of refugee status (Sommer *et al.*, 1981). In this study logistic regression analysis predicted that alcohol users were about twice more likely to suffer from *Bitot's spot* (p=0.20) even though it was not statistically significant. The model predicted that tobacco smokers were about 3 times and 13 times more likely to suffer from *Bitot's spot* (p<0.01) and *Keratomalacia* (p<0.01) respectively, compared with nonsmokers in the study group.

The World Health Organization categorized the ocular manifestations of vitamin A deficiency as night blindness (XN), conjunctiva *xerosis* (X1A), *Bitot's spot* (X1B), corneal *xerosis* (X2), corneal ulceration or *keratomalacia* (X3A) involving one third or less of the cornea, corneal scar (XS) and *xerophthalmia* fundus (XF) (Thylefors *et al.*, 1995). While this classification describes the usual pattern of progression of the disease, *Bitot's spot* is an important clinical sign that should prompt a careful dietary intervention which may enable victims to avert the devastating permanent consequences of *xerophthalmia* (Bishara *et al.*, 1982). It may not be a surprise to observe such percentage of vitamin A related deficiency disorders.

Existing indication suggests that social determinants such as trauma, forfeiture of social roles and cultural bond, poverty, and joblessness may have momentous adverse nutrition and health consequences on men. Very high number of habitual alcoholic beverages drinkers and tobacco smoking habit were found to be in line with traditional lifestyle behaviours in peri-urban communities in most developing countries (BeLue *et al.*, 2009). The vitamin A food intakes was so low that the NAR cannot be represented in the table and was rendered

zero which did not at the end surprised the high outcomes of ophthalmic disorder among the men.

CONCLUSION

The extremely low dietary vitamin A intake was strongly related to vitamin A deficiency related disorders (Bitot's spots and keratomalacia) observed among the men. We recommend that further studies with larger samples across ecological zones of Ghana would be appropriate to help early nutrition interventions.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

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