ASSESSMENT OF ANAEMIA AND WORK OUTPUT AMONG WOMEN EMPLOYEES AND ENTREPRENEURS IN AMAC FCT, ABUJA, NIGERIA

OKOROIWU, I.A.G.[1]*, UBOSI, N.I.[1] AND BOLAJOKO, O.O.[2]
[1]Department of Public Health Science, Faculty of Health Sciences,
National Open University of Nigeria, [2]Department of Nutrition & Dietetics,
Federal University of Agriculture, Abeokuta, Nigeria.

ABSTRACT

Anaemia in Women of productive age is a major public health challenge and has a tremendous effect on the women such as loss of productivity due to reduced work capacity. A cross-sectional descriptive study was conducted to assess the impact of anaemia on food security status and work output among 385 women employees and entrepreneurs in Abuja Municipal Area Council, Federal Capital Territory Abuja. Using Heigh-to-meter and Bathroom scales, Haemoglobinometer and Household Food Insecurity Access Scale, as well as Semi-Structured Self-administered questionnaire. The data collected was analysed using simple frequencies, percentages, mean values and standard deviation. Chi-square and correlation analysis were used to test for association among variables. The result showed that haemoglobin (Hb) and Packed Cell Volume (PCV) levels do have relative impact on the job performance of the women participants but showed a weak positive correlation between PCV range and Workers' performance at a significance level of 0.403 with significance level of 0.000 of overall performance and 0.000 of comparing performance. Implying that PCV and Hb range increase result into concurrent increase in the wokers' performance and overall performance. This correlates widely with acknowledged stance that anaemia causes food insecurity and low work output. Government and employers of labour should try as much as possible to improve on the welfare and pay of their workers especially women folk to enable them afford nutritive and balance feeding, improving the overall health status of women entrepreneurs.

Keywords: Abuja, Anaemia, Employees, Entrepreneurs, Haemoglobin, Women
***Correspondence:** okoroiwugia@yahoo.com, 08036677539

INTRODUCTION

The World Health Organization (WHO) defines anaemia as a condition in which the number of healthy red blood cells/haemoglobin level (and consequently their oxygen-carrying capacity) is insufficient to meet the body's physiological needs [1, 2]. Anaemia is a common health and nutritional problem worldwide [3] and can also be defined as a reduction in hemoglobin concentration, red-cell count, or packed-cell volume below established cutoff levels. Moreover, according to World Health Organization (WHO), anemia among women is defined as a hemoglobin concentration of <12.0 g/dl (less than) for non-pregnant women aged 18 years and above, and a hemoglobin concentration of <11.0 g/dl (less than) for pregnant women [4]. Anemia in women of productive age has a tremendous effect on the women such as; loss of productivity due to reduced work capacity, cognitive impairment, increased susceptibility to infections due to its effect on immunity, stillbirth/miscarriage, and maternal mortality. Besides, anemia in women of reproductive age, can result to poor feto-neonatal outcomes such as preterm birth, low birth weight, depletion of the iron stores of the newborn, and in general, it may end up with infant/child mortality [2]. Women with even mild anemia experience fatigue and reduced work capacity [5].

Anemia in women of productive age is a major public health challenge for low- and middle-income countries with a long-term negative impact on the health of women, their children, and the economic growth of the society. Even though the world health organization targeted a 50% global reduction of anemia among women of productive age by 2025, with the current trend, it is unlikely to achieve this goal [2]. The most common type of anemia worldwide is nutritional anemia mainly due to iron, folate, and vitamin B12 deficiencies. Iron deficiency anemia is the one the common cause of anemia, with over 50% being secondary to iron deficiency. The plasma volume increases more than the red cell mass leading to a fall in the concentration of hemoglobin in the blood, despite the increase in the total number of red cells, this drop in hemoglobin concentration decreases the blood viscosity [6].

In Africa, anaemia is reaching extremely high levels in the Sahel and West Africa. Fourteen countries in the region including Nigeria have a prevalence of over 40%(severe) among women of productive age and twelve West African countries feature among the twenty countries with the highest prevalence in the world, namely Nigeria 50%; Burkina Faso 50%; Senegal 50%; Mali 50%; Guinea 51%; Cote d'Ivoire 53% [7]. According to the 2017 Global Nutrition Report, anaemia is increasing among women of productive age since

2012 and no country is on track to meet the set target. Moreover, [8], quoting the President of Nutrition Society of Nigeria, reported that 49% of productive women in Nigeria are anaemic positing that this rate is hampering Nigeria's growth and development. Moreover, anaemia affects the health and quality of life of women, threaten future generation and has a negative effect on their development, ability to learn and economic productivity. Furthermore, reduced productivity due to iron deficiency anaemia represents an average of 4% of Gross Domestic Product (GDP) among low-income countries [9] and this is a major health challenge in Africa including Nigeria.

Food security is defined as the state "when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food which meets their dietary needs and food preferences for an active and healthy life [10]. It outlines our interrelated elements for food security: availability, access, utilization and stability. Food security is an indicator of family and individual health; it can be a precursor of health and nutritional problems [11]. Poverty and income inequality exert a direct influence on the two main pillars of food security: accessibility and availability, and their individual or combined effects are likely to present hard tradeoffs between food and other household and personal necessities, and thus set the conditions for food vulnerability and increased susceptibility to micronutrient deficiency diseases, especially anemia [12].

Food insecurity has been identified as a key underlying cause of child malnutrition and defined as "a household-level economic and social condition of limited or uncertain access to adequate food" [13]. Food insecurity could affect nutritional quality of the diet [14] and results in malnutrition, including iron-deficiency anemia. According to [15], the occurrence of anemia is associated to Asocio-environmental and economic conditions, prenatal care, behavioral aspects and nutritional factors, especially the anthropometric nutritional state and food consumption (namely dietary sources of iron or dietary sources that improve bioavailability) [16, 17].

Anemia is associated with various physiological consequences including impaired tissue oxygen delivery, weakness, fatigue; and loss of productivity from reduced work capacity, cognitive impairment and increased susceptibility to infections which also imposes a substantial economic burden on an individual [18, 2]. Women with even mild anemia experience fatigue and reduced work capacity [5].

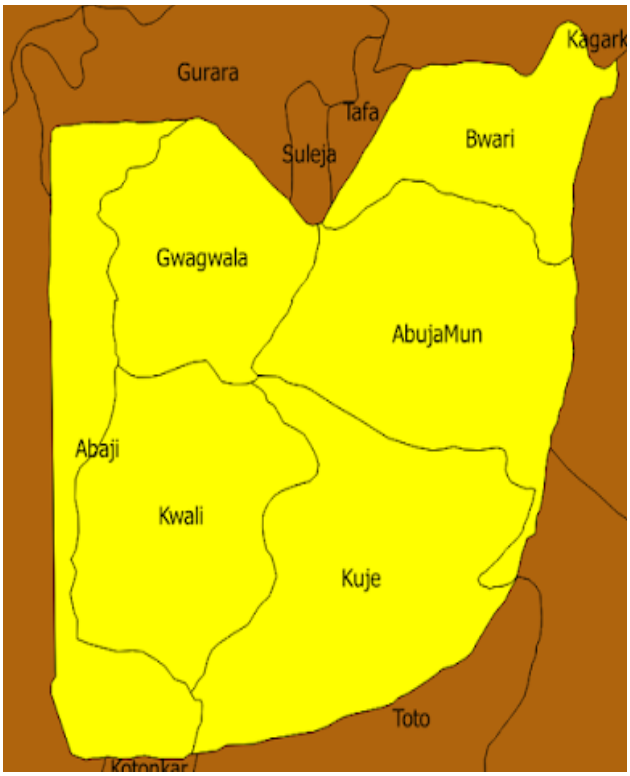
Food insecurity have been found to affect the nutritional quality of diet and has also been associated with anemia, especially among children and women [19, 14]. According to Moradi *et al.* [11], previous study has shown that household food insecurity was associated with anemia, and it was suggested that programs to reduce household food insecurity may be effective at reducing the risk of anemia.

Productivity is an average measure of the efficiency of a worker or group of workers and Anemia has been implicated in being a contributing factor in reduced productivity and work capacity, especially among children and women of productive age [2, 5, 18, 20]. However, few studies have been conducted on the relationship between anaemia, food security and productivity in women in this region. It is therefore necessary to investigate the relationship between anemia, food security and productivity among women workers in order to determine the prevalence of anaemia among women workers/entrepreneurs in AMAC, FCT, Abuja and assess the factors associated with anaemia among them as well as determine the effects of anaemia among women workers/entrepreneurs to work productivity.

METHODOLOGY

Study area/location

Abuja is the capital city of Nigeria and lies in the central part of it. The Federal Capital Territory created in 1976 is approximately 300 miles (480 km) northeast of Lagos, the former capital (until 1991). During the 1980s the new capital city was built and developed on the grass-covered Chukuku Hills. Federal Capital Territory (FCT), also known as Abuja Federal Capital Territory is administrative territory. The territory is located north of the confluence of the Niger and Benue rivers. It is bordered by the states of Niger to the west and northwest, Kaduna to the northeast, Nasarawa to the east and south, and Kogi to the southwest. Abuja, the federal capital and a planned modern city, is located near the centre of the territory. The region is underlain by crystalline rocks consisting of granites and gneisses. The vegetation is mainly savanna with limited forest areas. Agriculture, the economic mainstay, produces yams, millet, corn (maize), sorghum, and beans. The population comprises the Gwari, Koro, Ganagana, Gwandara, Afo, and Bassa ethnic groups, predominantly dairy farmers. Hausa and Fulani also live in the territory. Mineral resources include clay, tin, feldspar, gold, iron ore, lead, marble, and talc. Abuja has an airport and major road connections. Area of 2,824 square miles (7,315 square km). Population of (2006) 1,406,239 and (2016 estimate.) of 3,564,100.



Map of FCT, Abuja

Study design
A cross-sectional descriptive study of anaemia, food security status and work output among women employees and entrepreneurs in FCT, Nigeria. Abuja.

Study population
The study comprised women of ages 18-49 years working within the Federal Capital Territory, Abuja.

Inclusive criteria
Women of ages 18-49 years working within the Federal Capital Territory, Abuja were the eligible respondents/participants

Exclusive criteria
Excluded from the study were women younger than 18 years or older than 49 years. Also, excluded from the study were non-working women or working women not based in the Federal Capital Territory, Abuja.

Sample size determination
Because, the exact population of the study area is unknown and the study has not been done here before, the sample size was determined using the [21] Formula for Sample Size Determination
n= $\frac{Z^2pq}{e^2}$ Where: e is the desired level of precision (0.05); p is the estimated proportion of the population with the attribute in question. In this case, 50%; q is 1-p; z is constant (1.96)
Sample size = 385 Participants.

Sampling technique
Simple random sampling technique was used in selecting the respondents/participants.

Data collection
Socio-demographic and socio-economic data was obtained using a Semi-structured self-administered questionnaire. Anthropometric data, which included height and weight was collected using a heightometer and bathroom scales respectively. Clinical measurements such as hemoglobin status was measured using the hemoglobinometer. Food Security was assessed using the Household Food Insecurity Access Scale (HFIAS).

Ethical consideration
Ethical approval was obtained from the Ministry of Health while verbal consent was obtained from the female participants after explaining and informing them of the possible benefit derivable from the study.

Informed consent
Informed consent was taken from all respondents prior to data collection. The informed consent process included a verbal explanation describing the purpose of the study, procedures for maintaining confidentiality, and the respondents' right to refuse to participate.

Statistical analysis
Data was entered into Excel Sheet and was analyzed with Statistical Package for Social Sciences (SPSS) version 25 software. Socio-demographic and economic information was presented using frequencies and percentage, mean values and standard deviation were used to present the continuous variables. Chi-square and correlation analysis was used to test for association among variables.

RESULTS

Table 1 shows the majority of the respondents (188 out of 295) had a performance graded to be greater than 6 on a scale from 0 to 10, which implies that the majority of the respondents had a performance that is good enough. Similarly, the usual performance of the majority of the respondents (274 out of 295) had a usual performance graded as greater than 6 on a scale from 0 to 10 while overall performance after comparing the indices of the usual performance and the workers' performance was graded as greater than 6 for a majority of the respondents. Comparing performance now with the available indices of the overall performance and the

usual performance, 112 respondents of the total respondents had their performances graded as a lot better while only 9 respondents were graded as a little worse considering the indices of the performances.

Table 1: Job performance questions

Question (On a scale from 0 to 10)	Answer	Frequency	Percent
Worker's performance	No response	9	3.1
	1 to 3	6	2.0
	4 to 6	92	31.2
	>6	188	63.8
Your usual performance	No response	9	3.1
	1 to 3	2	0.7
	4 to 6	10	3.4
	>6	274	92.9
Your overall Performance	No response	11	3.7
	1 to 3	9	3.1
	4 to 6	21	7.1
	>6	254	86.2
Comparing Performance	No response	12	4.1
	A little better	48	16.3
	Somewhat better	53	18.0
	A lot better	112	38.0
	Average	61	20.7
	A little worse	9	3.1

Table 2: Sociodemographic information

Question	Answer	Frequency	Percent
What is your current marital status?	No response	8	2.7
	Married or cohabiting	183	62
	Separated	33	11.2
	Divorced	11	3.7
	Widowed	15	5.1
	Never married	45	15.3
How many children do you have?	No response	6	2.0
	None	55	18.6
	One	42	14.2
	Two	91	30.8
	Three	58	19.7
	>Four	43	14.6
What is your annual income from your job before taxes?	No response	9	3.1
	<100000	34	11.5
	100k-399k	38	12.9
	400k-599k	56	19.0

	600k-799k	43	14.6
	800k-999k	84	28.5
	>1m	31	10.5

In Table 2 above, sixty-two percent (62%) of the total respondents were reported to be married or cohabiting while thirty-eight (38%) are single for one reason or the other. 91 respondents out of a total of 295 have 2 children while 55 respondents do not have children however, 43 respondents reported having children greater than 4 in number. A majority of the respondents 264 out of 295 had an annual income of less than 1 million naira before the deduction of taxes.

Table 3: Anaemia status

Question	Answer	Frequency	Percent
Hemoglobin range	Not determined	46	15.6
	Low	126	42.7
	Normal	118	40.0
	High	5	1.7
Pack Cell Volume range	Not determined	46	15.6
	Low	112	38.0
	Normal	133	45.1
	High	4	1.4

A larger percentage of the respondents had a low hemoglobin range (42.7%), while 40% of the respondents had normal hemoglobin level, while 1.7% had high hemoglobin level. Meanwhile, a larger percentage of the respondents 45.1% which totaled 133 respondents out of 295 had a pack cell volume range of normal, 112 respondents had a pack cell volume range that was low with only 4 respondents reported to have high pack cell volume as reported on table 3. The mean hemoglobin level reported was 12.52 ± 6.508g/L while the mean reported PCV was 35.84 ± 9.459g/L as reported in table 4.

Table 4: Various indices

Indices	Mean ± SD
Hb	12.52 ± 6.508
PCV	35.84 ± 9.459

The mean haemoglobin level reported was 12.52±6.508g/L, while, the mean reported PCV was 35.84±9.459g/L.

Table 5: Effect of respondent's productivity on their income

Variable	Chi-square value	Df	p-value
Caregiver for your child(ren)	4.315	5	0.505
Full-time paying job	6.515	5	0.259
Working a part-time paying job	14.427	5	0.013
Self employed	15.575	5	0.008
Volunteer work	1.763	5	0.881
Full-time student	14.044	5	0.015
Part-time student	3.973	5	0.553
Housework/home maintenance	7.83	5	0.166
Job type/extent	124.573	40	0.000

Table 6: Association of respondent's anemia status on their income

Variable	Sub variable	Chi-square value	df	p-value
Hemoglobin status	HB range	8.004	10	0.628
	PCV range	9.531	10	0.483

Table 7: Effect of respondent's anemia status on their productivity

Productivity questions	**Anemia Status**	**Chi-square**	**Df**	**p-value**
Caregiver for your child(ren)	HB range	6.743	2	0.034
	PCV range	7.042	2	0.030
Full-time paying job	HB range	6.502	2	0.039
	PCV range	9.842	2	0.007
Working a part-time paying job	HB range	1.248	2	0.536
	PCV range	0.989	2	0.610
Self employed	HB range	0.795	2	0.672
	PCV range	2.611	2	0.271
Volunteer work	HB range	1.303	2	0.521
	PCV range	0.854	2	0.652
Full-time student	HB range	0.225	2	0.894
	PCV range	0.184	2	0.912
Part-time student	HB range	2.928	2	0.231
	PCV range	2.15	2	0.341
Housework/home maintenance	HB range	0.917	2	0.632
	PCV range	1.463	2	0.481
Job type/extent	HB range	25.051	16	0.069
	PCV range	31.287	16	0.012

Table 8: Correlation between job performance and anemia status

		Worker's performance	**Your usual performance**	**Your overall Performance**	**Comparing Performance**
PCV range	*R*	0.054	-0.107	0.277**	-0.263**
	Sig.	0.403	0.097	0.000	0.000
HB range	*R*	-0.001	-0.079	0.206**	-0.201**
	Sig.	0.987	0.221	0.001	0.002

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 5 shows that at a confidence interval of 95%, working a part-time paying job, being self-employed, and being a full-time student were found to be statistically significant among the different jobs reported by the respondents of the study. Meanwhile, there was no statistical significance observed between respondents' anemia status (level of hemoglobin and PCV) and their income as observed in Table 6.

The association of respondents' anemia status was assessed with their productivity; it was observed that only respondents who were working as a caregiver for their children had a statistically significant p-value

when correlated with both their hemoglobin level and the PCV levels at a confidence interval of 95% while other job types had no statistical significance when correlated in Table 7.

Table 8 elucidates the performance comparison between job performance and anemia status, and at the 0.01 level, correlation is significant between the two variables compared. PCV range was reported to have a significant correlation between overall performance and the performance compared, similarly, the Hemoglobin range was observed to be statistically significant, which implies that there is a relationship between both variables. A weak positive correlation was observed between PCV range and workers' performance at a significant level of 0.403, we accept the null hypothesis while we reject the alternative hypothesis while a weak negative correlation was observed between the PCV range and usual performance at a significant level of 0.097. A very weak correlation was observed between hemoglobin range and the workers' performance at a significant level of 0.987, we accept the null hypothesis and reject the alternative hypothesis, similarly, a weak negative correlation was observed between the hemoglobin range and the usual performance of the respondents. A positive correlation was observed between the PCV range and the hemoglobin range and the overall performance at a significant level of 0.000 and 0.001 respectively. This implies that we reject the null hypothesis and accept the alternative hypothesis.

DISCUSSION

Hemoglobin level and PCV level were reported not to have significant association on the job performance of the respondents in the study. A weak positive correlation was reported between PCV range and workers' performance at a significant level of 0.403 which implies that when the PCV and Hemoglobin range increases, there is expected to be a concurrent increase in the workers' performance and overall performance, this report correlates with a widely acknowledged stance that nutritional status has an impact on work performance and productivity [22].

Anemia is a common occurrence, especially in low- and middle-income countries and Iron deficiency is thought to be responsible for half of all anemia cases. Iron interventions have become central to global anemia treatment and prevention; however, despite their proven effectiveness, few iron interventions have been scaled up to the nutritional level. According to the World Health Organization, 42% of pregnant women and 30% of non-pregnant women are sexually active (aged 15-50 years). The reference ranges for hemoglobin (Hb) concentrations in adults are as follows: Male: 14-18 g/dL or 8.7-11.2 mmol/L (SI units) Female: 12-16 g/dL or 7.4-9.9 mmol/L, the study reported mean hemoglobin level to be 12.52 ± 6.508g/L while the mean reported PCV was 35.84 ± 9.459g/L which implies that the average woman is not anaemic.

A larger percentage of the respondents had a low hemoglobin range (42.7%), while 40% of the total respondents had a hemoglobin level that is normal while only 5 respondents had a high hemoglobin level; the prevalence of anaemia in the study population is 42.7%. In Burkina Faso, Ghana, Malawi, Namibia, Niger, Senegal, and Zambia, DHS surveys revealed that a higher proportion of mothers aged 15-19 and 40-49 suffer from chronic energy deficiency (CED). Women in the youngest age group (15-19) and women in the old age group (45-49) are the most affected by undernutrition, according to a local Ethiopian study [23].

In the surveys, low productivity was linked to low weight-for-height [24], small arm circumference [25, 26], low body weight [27], and small stature [28] in workers who performed heavy physical labor. James *et al.* [29] proposed a relationship between an anthropometrical indicator and overall energy expenditure. Individuals with a BMI of less than 18.5 have low energy expenditure, while those with a BMI of less than 17.0 risk their health and physical work capacity [29, 30]. Other nutritional factors, on the other hand, have an impact on work productivity. The negative impact of iron deficiency on work performance is one of the strongest and most well-documented relationships. Work output was reported to be lower in iron-deficient workers with low hemoglobin concentrations than in healthy workers [23, 25, 31, 32] while we reported a very weak correlation between hemoglobin range and the workers' performance at a significant level of 0.987.

Low levels of oxygen-carrying Hemoglobin are associated with anemia, resulting in less oxygenation of body tissues, according to [33, 34, 35], both brain and muscle tissues may be deprived of sufficient oxygen to function at maximum capacity, resulting in physical lethargy and possibly mental fatigue [36]. In India, a study was conducted to assess the iron status of women working on tea farms concerning their productivity. In addition to their daily base wage of 47.00 INR, the women in the study were paid an additional 1.50 Indian Rupees (INR) per kg of tea harvested above the quota (0.97 USD in 2009). It was recognized that some women's inability to meet their daily quotas may be due to a combination of factors including poor health and nutrition, as well as a lack of motivation. In the morning session alone, anemic women picked 2.02 kg less tea than non-anemic women, resulting in a bonus pay of 3.0 INR. Specifically, being anemic implies a loss of 13.3% of bonus pay or 4.3% of total pay from lower productivity in the morning plucking period alone [37].

Work productivity was significantly related to hemoglobin concentration in a study by Untoro *et al.* [38] to assess the association between BMI and hemoglobin and work productivity among female factory workers. Anemic subjects produced on average significantly less than non-anemic subjects. After accounting for the confounders of work experience and marital status, the relationship between work productivity and hemoglobin status remained significant. Other research looked at the relationship between hemoglobin concentration and work productivity in more physically demanding jobs. A 5.6 percent increase in productivity was linked to a 13 g/L increase in Hemoglobin among Kenyan road workers [39] while the study reported a mean hemoglobin level of 12.52 ± 6.508g/L while the mean reported PCV was 35.84 ± 9.459g/L. Indonesian rubber tappers who were anemic produced 18.7% less than their non-anemic counterparts [40]. Anemia was found to be significantly related to productivity even in physically less strenuous work in the current study; anemic subjects produced 4.9 percent less than non-anemic subjects [39].

In conclusion, In this study, haemoglobin level and PCV level were found not to have a major effect on the job performance of the respondents, however, a weak positive correlation was reported between PCV range and workers' performance at a significant level of 0.403 which implies that when the PCV and Hemoglobin range increases, there is expected to be a concurrent increase in the workers' performance and overall performance. Government and employers of labour should try as much as possible to improve on the welfare and pay of their workers especially women folk to enable them afford nutritive and balance feeding.

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