Advances in Biochemistry
2023; 11(3): 29-33
http://www.sciencepublishinggroup.com/j/ab
doi: 10.11648/j.ab.20231103.11
ISSN: 2329-0870 (Print); ISSN: 2329-0862 (Online)

Homocysteinemia Level Determination Among Retired People in Bobo Dioulasso, Burkina Faso

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To cite this article:

Ollo Da, Souleymane Fofana, Emmanuel Zongo, Arnaud Kouraogo, Dieudonne Sanon, Adama Hermann Traore, Fatou Gueye Tall, Sanata Bamba, Georges Anicet Ouedraogo. Homocysteinemia Level Determination Among Retired People in Bobo Dioulasso, Burkina Faso. *Advances in Biochemistry*. Vol. 11, No. 3, 2023, pp. 29-33. doi: 10.11648/j.ab.20231103.11

Received: May 30, 2023; **Accepted**: June 25, 2023; **Published**: July 11, 2023

Abstract: Hyperhomocysteinemia, currently a public health problem, has been associated with the onset of critical diseases among elderly persons. Our aim in this study was to determine homocysteinemia levels in retired people. A cross sectional study was carried out among retired people in Bobo Dioulasso. Sociodemographic and clinico-biological variables were collected. Quantitative determination of total homocysteinemia in serum was carried out by a chemiluminescence microparticle immunoassay (CMIA). Three homocysteinemia levels were considered: moderate (16-30 µmol/L), intermediate (31-100 µmol/L), and severe (>100 µmol/L). Fisher's exact test was used to examine the significance of the association with a p-value of 0.05. We included a total of 71 retired people, with a median age of 64 years [minimum - maximum: 45 - 92 years], Hyperhomocysteinemia between [16-30 µmol/L [was observed in 16.90% (12/71) with a median homocysteinemia value equal to 18.71 µmol/L [minimum - maximum = 16.57 - 26.60 µmol/L]. Hyperhomocysteinemia was not significantly associated with increased blood pressure (p = 0.817), age group (p = 0.958), sex (p = 0.106), body mass index (0.053), estimated GFR (p = 0.590). A low frequency of moderate hyperhomocysteinemia was recorded in retired persons in Bobo-Dioulasso. An investigation of genetic polymorphisms associated with hyperhomocysteinemia could be considered.

Keywords: Homocysteinemia, Retired Persons, Burkina Faso

1. Introduction

Among elderly people, hyperhomocysteinemia, currently considered as a public health problem, has long been associated with the occurrence of neurodegenerative diseases [1], cognitive decline and dementia [2], and cardiovascular diseases [3]. Previous work by Simporé et al. in 2000 showed that homocysteinemia was low in general population in Burkina Faso. Plasma homocysteine levels were lower in black adults and children, particularly women, compared to white subjects [4]. Older postmenopausal women had higher mean homocysteine levels (16.4±6.6 mmol/L) than fertile women (6.8±1.2 mmol/L) [5]. Hyperhomocysteinemia can occur from

genetic enzymatic deficiencies in 5, 10-methylenetetrahydrofolate reductase (MTHFR) or cystathionine-β-synthase (CBS) [6] or nutritional deficiencies in B vitamins [7]. One therapeutic strategy to address homocysteine excesses is vitamin B supplementation with drugs to treat the deficiency frequently present in elderly people [8]. Among retired elderly people in Bobo Dioulasso, often subject to a very precarious socioeconomic life, we found a high frequency of acute denutrition [9]. Regarding the significant association of hyperhomocysteinemia with the occurrence of major pathologies, we aimed to determine the homocysteinemia levels in retired people in Bobo Dioulasso.

2. Methodology

2.1. Study Population

This is a cross-sectional study. Study population consisted of retired persons. An exhaustive sampling was carried out following inclusion criteria: being a retired person from the public or private sector; being a volunteer and signed an informed consent; resident in Bobo dioulasso in the western part of Burkina Faso.

2.2. Data Collection and Variables

Sociodemographic and clinical variables were collected: age, sex, blood pressure, body mass index (BMI), professional activity sector, previous pathology, general condition, and consciousness Biochemical parameters were: homocysteinemia, lipoproteinemia (a) (Lp (a)), prealbuminemia, C-reactive protein (CRP), Cystatinemia C.

2.3. Blood Samples and Biochemical Parameters

Retired persons were fasting for at least 12 hours. Whole blood, collected in a dry tube, was centrifuged to collect serum for total homocysteinemia determination by a microparticle chemiluminescence immunoassay (CMIA); immunoturbidimetric determination for Lp (a), cystatin C, prealbumin and CRP using Architect Ci4100® (Abbott Diagnostics, USA).

2.4. Data Analysis

Data were analyzed with XLSTAT 2016.02.27444 (Lumivero, Colorado, USA). Fisher's exact test was used to assess the significance of associations with a p value < 0.05. Three homocysteine levels were considered: moderate (16-30 µmol/L), intermediate (31-100 µmol/L), and severe (>100 µmol/L) [10]. Frequency of moderate (prealbuminemia = 0.15 - 0.25 g/L) and severe (prealbuminemia <0.15g/L) denutrition were determined considering CRP values <15 mg/L. Lp (a) values above 75 nmol/L are considered high-risk cut-off values for cardiovascular disease [11]. For glomerular filtration rate (GFR) estimation, the formula using cystatin C (1), is used:

$$GFR\ (ml/min/1.73m^2) = 71 / [Cystatin\ C\ (mg/L)]\ 1.28 \quad (1)$$

Chronic kidney disease (CKD) is positive if GFR is < 60 ml/min/1.73 m^2.

2.5. Ethical Considerations

Informed consent was obtained from all retired persons included in this study. They were alerted about the risk factors for hyperhomocysteinemia and its outcomes, including cardiovascular disease and dementia. Their participation was completely voluntary. Biological samples were well labeled and all data were processed in anonymity.

3. Results

3.1. General Characteristics of the Study Population

We included 71 retired persons, consisting of 13 women and 58 men, with a sex ratio of 4.46. Their median age was 64 years [minimum - maximum: 45 - 92 years]. They had a normal general condition and a normal state of consciousness.

3.2. Homocysteinemia and Associated Variables

Frequency of retired persons, with homocysteinaemia between [5-15 µmol/L [was 83.10% (59/71) with a median homocysteinemia value 10.13 µmol/L [minimum - maximum = 5.55-14.96 µmol/L]. Hyperhomocysteinemia ranging from [16-30 µmol/L [was observed in 16.90% (12/71) of retired persons, with a median homocysteinemia value 18.71 µmol/L [minimum - maximum = 16.57 - 26.60 µmol/L]. Severe denutrition was observed in frequency 91.66% (11/12) and not significantly associated (p=0.724) with hyperhomocysteinemia. Median lipoproteinemia (a) was 56.99 nmol/L [minimum - maximum = 0.00 - 192.38 µmol/L] in retired persons with hyperhomocysteinemia. Hyperlipoproteinemia (a) above 75 nmol/L was not associated with hyperhomocysteinemia (p=0.457). Among retired people, 47.14% (n=33/71) had a GFR between [30-59 ml/min/1.73 m^2]. Hyperhomocysteinemia was not significantly associated with GFR (p=0.590), Lp (a) (p=0.457) and severe denutrition (p=0.724) (Table 1).

Table 1. *Association Between Biochemical Parameters Versus Homocysteinemia Levels.*

Biochemical parameters	Study population	Homocysteinemia (µmol/L)		p value
		[16-30]	[5-15]	
Prealbumin (g/L)*				
[0, 15 – 0, 25]	8 (11.27)	1 (1.41)	7 (9.86)	0.724
< 0.15	63 (88.73)	11 (15.49)	52 (73.24)	
Lp (a) (nmol/L)				
<75	44 (70.97)	6 (9.68)	38 (61.29)	0.457

Biochemical parameters	Study population	Homocysteinemia (µmol/L)		p value
>75	18 (29.03)	4 (6.45)	14 (22.58)	
GFR (ml/min/1, 73 m^2)				
≥90	6 (8.57)	0 (0.00)	6 (8.57)	0.590
[60-89]	31 (44.29)	5 (7.14)	26 (37.14)	
[30-59]	33 (47.14)	7 (10.00)	26 (37.14)	

* = with CRP < 15 mg/L; GFR = glomerular filtration rate

Hyperhomocysteinemia was observed only in retired male persons with median age 63 years [minimum - maximum = 57- 76 years]. Hyperhomocysteinemia was not significantly associated with age group (p = 0.958), sex (p = 0.106), and professional activity sector (p = 0.532) (Table 2).

Table 2. *Association Between Sociodemographic Characteristics Versus Homocysteinaemia Levels.*

Sociodemographic characteristics	Study population	Homocysteinemia (µmol/L)		p value
		[16-30]	[5-15]	
Professional activity sector				
Public	31 (43.66)	4 (5.63)	27 (38.03)	0.532
Private	40 (56.33)	8 (11.27)	32 (45.07)	
Age group				
[40-50]	1 (1.41)	0 (0.00)	1 (1.41)	
[50-60]	8 (11.27)	2 (2.82)	6 (8.45)	
[60-70]	46 (64.79)	8 (11.27)	38 (53.52)	0.958
[70-80]	14 (19.72)	2 (2.82)	12 (16.90)	
[80-90]	1 (1.41)	0 (0.00)	1 (1.41)	
[90-100]	1 (1.41)	0 (0.00)	1 (1.41)	
Sex				
Female	13 (18.31)	0 (0.00)	13 (18.31)	0.106
Male	58 (81.69)	12 (16.90)	46 (64.79)	

Among retired persons with hyperhomocysteinemia, hypertension (7.04%), alcoholism (1.41%) and diabetes (1.41%) were observed as being history of pathology. Their BMI showed 11.27% normal weight. Hyperhomocysteinemia was not significantly associated with blood pressure increase (p = 0.817), BMI (p = 0.053), history of pathology (p = 0.827) (Table 3).

Table 3. *Association Between Body Constants and History of Pathologies Versus Homocysteinaemia Levels.*

Body constants and history of pathologies	Study population	Homocysteinemia (µmol/L)		p value
		[16-30]	[5-15]	
Blood pressure				
High	49 (69.01)	8 (11.27)	41 (57.75)	0.817
Low	2 (2.82)	0 (0.00)	2 (2.82)	
Normal	20 (28.17)	4 (5.63)	16 (22.53)	
BMI				
Underweight	3 (4.23)	2 (2.82)	1 (1.41)	0.053
Normal weight	38 (53.52)	8 (11.27)	30 (42.25)	
Obesity	8 (11.27)	0 (0.00)	8 (11.27)	
Overweight	22 (30.99)	2 (2.82)	20 (28.17)	
History of pathology				
Arterial hypertension	19 (26.76)	3 (4.22)	16 (22.53)	
Arterial hypertension +Gout	4 (5.63)	1 (1.41)	3 (4.22)	
Diabetes	3 (4.22)	0 (0.00)	3 (4.22)	
Alcoholism	2 (2.82)	1 (1.41)	1 (1.41)	
Arterial hypertension + Alcoholism	2 (2.82)	0 (0.00)	2 (2.82)	
Arterial hypertension + gastroduodenal ulcer	2 (2.82)	1 (1.41)	1 (1.41)	
Tabagism	2 (2.82)	0 (0.00)	2 (2.82)	
Alcoholism + Tabagism	1 (1.41)	0 (0.00)	1 (1.41)	
Diabetes + Lumbosciatic pain	1 (1.41)	0 (00.0)	1 (1.41)	0.827
Diabetes + Trauma injury	1 (1.41)	1 (1.41)	0 (0.00)	
Sickle cell disease	1 (1.41)	0 (0.00)	1 (1.41)	
Gout+ Sinusitis	1 (1.41)	0 (0.00)	1 (1.41)	
Arterial hypertension + Diabetes	1 (1.41)	0 (0.00)	1 (1.41)	
Arterial hypertension + Trauma injury	1 (1.41)	0 (0.00)	1 (1.41)	
Lumbosciatic pain	1 (1.41)	0 (0.00)	1 (1.41)	
Gastroduodenal ulcer	1 (1.41)	0 (0.00)	1 (1.41)	
VIH infection	1 (1.41)	0 (0.00))	1 (1.41)	

4. Discussion

This study might be limited by its cross-sectional design and bias in qualitative data collection from retired seniors. There is a relatively low frequency of 16.90% of moderate hyperhomocysteinemia in our study population. Moderate hyperhomocysteinemia frequencies of 62.3% and 29.4% were recorded in Togo and Benin respectively [12]. Among elderly persons with median age of 55 years in China, hyperhomocysteinemia had a frequency of 35.4% (45.4% versus 28.5% for men and women, respectively) [13]. Moderate hyperhomocysteinemia was not significantly associated with sex, age, denutritional status, or glomerular filtration rate. Similarly, in West Africa, particularly in Togo and Benin, moderate hyperhomocysteinemia was not significantly associated with sex or age [12].

Yang et al, (2021) in a cross-sectional study, revealed a significant association between active smoking, male sex, age, alcohol consumption and high BMI and the risk of hyperhomocysteinemia. However, he nuanced these results by suggesting cohort studies to further confirm these findings [13]. Risk of hyperhomocysteinemia increasing with age had been previously discussed [14].

A median homocysteinaemia value in our study was 18.71 µmol/L for those with hyperhomocysteinemia. Studies report an association between the onset of dementia, cardiovascular disease and increased homocysteinemia over 14 µmol/L [15]. Overall, our study population was apparently mentally healthy and somewhat more at risk for cardiovascular disease. Compared to white adults, Simporé et al. (2000) reported lower homocysteinemia usual values, as determined by high performance liquid chromatography, in black adults. In addition, limits for usual homocysteinemia values were higher in black men than in black women [4].

Risk of hyperhomocysteinemia is significantly associated with male sex [13, 15]. Testosterone control of cystathionine β-synthase (CBS) enzymatic activity, an enzyme involved in homocysteine catabolism in kidney, would explain this in humans [16]. Severe denutrition frequency was observed at 91.66% (11/12) but not significantly associated (p=0.882) with hyperhomocysteinemia. Wang et al. (2013) reported that a BMI $\geq$ 25kg/m^2 is significantly associated with a risk of hyperhomocysteinemia. Median age for hyperhomocysteinemia cases was significantly higher (48.00 years) compared to median age (45.00 years) for control group [17]. Smokers were significantly higher in hyperhomocysteinemia cases than in control group [17]. However, in previous studies conducted in Burkina Faso by Rosa et al (2005), [5] mean homocysteinemia in postmenopausal women aged 50 to 90 years were higher (16.4±6.6 µmol/L) than in fertile women (6.8±1.2 µmol/L). Moderate hyperhomocysteinemia, which may be due to a deficiency of group B vitamins in adult persons [18]. These molecules are all associated with homocysteine metabolism.

Furthermore, genetic hyperhomocysteinemias are most severe. Djaara et al., (2019) [19] showed a highly significant association of moderate hyperhomocysteinemia related to male sex and C677T polymorphism of MTHFR gene in an Algerian healthy population. Meanwhile, A1298C polymorphism was not significantly associated with moderate hyperhomocysteinemia [19]. Yameogo et al. (2017) [20], in Burkina Faso, had detected C677T, A1298C, A2756G and A66G polymorphism of the MTHFR gene in malaria patients.

5. Conclusion

This study revealed a relatively low frequency of moderate hyperhomocysteinemia in retired people in Bobo Dioulasso. Neither modifiable nor non-modifiable risk factors were significantly associated with hyperhomocysteinemia. Genetic polymorphisms associated with hyperhomocysteinemia could be investigated to prevent severe forms.

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