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Study of Muscle Profile in Elderly Individuals from Rural Populations in Western Cameroon

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Abstract

Objective: *This study aims to assess the impact of aging on muscle balance in elderly individuals across five rural localities in Western Cameroon (Bafang, Bafoussam, Baham, Bandjoun, and Dschang). It explores variations in muscle biochemical parameters based on age, sex, and local specificities.*

Methodology*: A cross-sectional study was conducted among subjects aged 50 years and older. Serum concentrations of creatinine, creatine kinase (CK), and alkaline phosphatase (ALP) were measured. Participants were categorized by age groups and sex to analyze the biological trends of muscle aging.*

Results*: Data analysis revealed an increased prevalence of hypocreatinemia, hypoCKemia, and hyperphosphatasemia with aging, particularly after 70 years. These alterations were more pronounced in women and varied across localities. The findings suggest an association between these biochemical abnormalities and environmental factors such as dietary habits, physical activity levels, and living conditions.*

Conclusion: Aging is associated with a progressive alteration of muscle biomarkers, highlighting an increased risk of sarcopenia in the elderly population. These findings underscore the importance of targeted preventive interventions based on regional specificities and identified risk factors.

Keywords*: Aging, muscle balance, creatinine, creatine kinase, alkaline phosphatase, physical activity, nutrition, environmental factors.*

Introduction

Aging leads to physiological changes that affect muscle mass and function, potentially resulting in conditions such as sarcopenia, myonecrosis, and others. Creatinine, creatine kinase (CK), and alkaline phosphatase (ALP) are commonly used biomarkers to assess muscle status and bone metabolism. Abnormal decreases or increases in these parameters reflect disruptions in muscle metabolic processes, sometimes caused by underlying diseases such as renal insufficiency, metabolic disorders, or malnutrition. Low-income countries, such as Cameroon, face challenges in managing chronic diseases among the elderly due to limited access to healthcare and lack of awareness. This study aims to evaluate muscle-related abnormalities in elderly individuals from five localities in Western Cameroon and to examine the impact of aging on these parameters.

Aging is a complex physiological phenomenon that affects multiple systems in the body, including muscles and bones. In Sub-Saharan Africa, where studies on aging are scarce, it is crucial to understand how these pathophysiological processes

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manifest in rural populations. The muscle balance, assessed through biomarkers such as creatinine, CK, and ALP, provides valuable insights into muscle and bone function. This study aims to evaluate the impact of aging on muscle metabolism in five localities of Western Cameroon and to identify associated factors such as sex and local conditions.

Methodology

The study was conducted in five localities in the West Region of Cameroon (Bafang, Bafoussam, Baham, Bandjoun, and Dschang) with a sample of 768 individuals aged 50 years and older. Participants were divided into four age groups: 50-59 years, 60-69 years, 70-79 years, and ≥80 years. The measured muscle profile parameters were serum creatinine, creatine kinase (CK), and alkaline phosphatase (ALP).

Blood samples were collected in each locality and analyzed in clinical biology laboratories at the regional hospital of Bafoussam, using standardized techniques. The percentages of each metabolic anomaly were calculated for each age group and sex across the five localities.

The collected data were coded and entered into Epi Info 7.1.3.0 software. Statistical analysis was performed using Epi Info 7.1.3.0, SPSS 18, Excel 2016, and Xlstat 2014. Correlation tests and pivot tables were also conducted to assess associations between biochemical parameters and aging.

The results were classified based on the normality thresholds for each parameter, which allowed the identification of cases of hypocratinemia, normal creatinine levels, hypercreatinemia, hypokalemia, normal CK levels, hyper CKemia, hypophosphatasemia, and hyperphosphatasemia.

Résultats

The total population comprised 768 participants, with a majority of women (451, or 58.7%) compared to men (317, or 41.3%), reflecting global trends observed in other aging studies. The age distribution reveals an aging population, with a significant proportion of individuals aged 60 and above. Furthermore, the majority of participants fall within the age groups of 50-59 years (167 individuals) and 60-69 years (121 individuals), which is crucial for aging and health studies. The data were collected from several locations, including Bafang, Bafoussam, Baham, Bandjoun, and Dschang, with a higher concentration of elderly individuals in Dschang (85) and Bafoussam (83), while Bandjoun has a relatively lower proportion (67). These results highlight geographic variations in health characteristics and risk factors. They emphasize the importance of considering local disparities in the allocation of healthcare resources.

Table 1. Distribution of the Study Population by Sex, Age, and Localities

Localités	Villages	Tranches d'âge								Total
		50-59		60-69		70-79		≥80		
		F	M	F	M	F	M	F	M	
Bafang	Bana	15	4	22	8	10	3	2	5	69
	Banka	12	21	8	17	2	9	1	3	73
Bafoussam	Kamkop	20	15	14	12	11	11	0	0	83
	Tamdja	5	13	12	12	4	11	7	7	71
Baham	Demgo	25	17	11	6	7	3	5		74
	Medjo	18	9	24	8	6	9	4	2	80
Bandjoun	Semtôh	8	17	6	19	8	7		2	67
	Tsélâh	17	13	12	14	9	9	3	1	78
Dschang	Fotetsa	25	7	23	5	12	2	9	2	85
	Johnny Baleng	22	5	24	5	23	3	5	1	88
										768

Detailed Analysis of Table II : Muscle Profile in the Study Localities by Sex and Age Group

For each parameter of the muscle profile, I will extract and detail the percentages according to each class, age group, and locality.

Hypocreatininemia:

- **Bafang**: Women aged 60-69 years present 3 cases (2 women and 2 men), with a hypocreatininemia rate of 5.9% among the 51 participants. For the 70-79 age group, 2 women and 2 men are affected, representing 7.7% of the 52 participants.
- **Bafoussam**: The prevalence is low, with 0.6% of women and 1.9% of men affected in the 50-59 and 60-69 age groups.
- **Dschang**: Women aged 70-79 years show a higher proportion (3.7%).

Normal Creatininemia:

*Corresponding Author: **NGNOTUE MBOBDA Claude Alain.**

- **Bafang**: The percentage is high in the 50-59 age group (28.3% for women and 32.5% for men). However, for the 60-69 and 70-79 age groups, normal creatininemia values decrease significantly.
- **Bafoussam**: The results vary slightly, with higher proportions of normal creatininemia in the 60-69 age group (20.6% for women and 28.8% for men).
- **Baham**: Normal creatininemia rates are relatively homogeneous, ranging from 42-54% depending on age group and sex, with higher percentages in the 50-59 age group.

Hypercreatininemia:

- **Bafang**: Men aged 50-59 years show a higher rate of 16.6% (8/48) compared to other age groups.
- **Bafoussam**: 7.2% of women aged 60-69 years have hypercreatininemia.
- **Dschang**: Hypercreatininemia percentages are relatively low, with values of 3.3% for women aged 50-59 years and 2% for men aged 60-69 years.

HypoCKemia:

- **Bafang**: Women aged 50-59 years have a 19% rate of hypoCKemia, with a total of 14 cases out of 74 participants. Men in this age group also have a high rate of 16.2%.
- **Bafoussam**: Women aged 60-69 years show a rate of 3.6%, while men have a higher rate (7.5%).
- **Dschang**: The highest hypoCKemia percentages are found in this locality, particularly among women aged 50-59 years (25.9%) and men aged 60-69 years (17.7%).

Normal CK:

- **Bafang**: Women and men aged 50-59 years present high rates of normal CK (35.1% and 33.9%, respectively), but the rates decline in the following age groups.
- **Bafoussam**: Women aged 60-69 years have a high rate of 40.8%, and men aged 70-79 years show a rate of 32.5%.
- **Dschang**: The results are more variable, but men aged 70-79 years have a lower rate of 12.9%.

HyperCKemia:

- **Bafang**: HyperCKemia rates are relatively moderate, with a lower proportion in men aged 60-69 years (8.3%) and women aged 70-79 years (5%).
- **Bafoussam**: Women aged 60-69 years show higher rates (14.6%) compared to other groups.
- **Bandjoun**: Men aged 60-69 years have a high rate of 15.4%.

Hypophosphatasemia:

- **Bafang**: The prevalence is low, with 4% for women aged 50-59 years and 5.6% for men aged 60-69 years.
- **Baham**: Women aged 50-59 years have a 9% rate of hypophosphatasemia, while the rate for men is 5.6%.
- **Dschang**: The rate is low, but women aged 50-59 years show a higher prevalence of 8%.

Normal Alkaline Phosphatase:

- **Bafang**: Women and men aged 50-59 years have relatively high normal alkaline phosphatase levels, with respective percentages of 40.5% and 34.1%.
- **Bafoussam**: The rates are more moderate, with 24% of women aged 60-69 years and 30% of men in the same age group.
- **Dschang**: The results vary, with percentages of 45% for women aged 50-59 years and 44% for men.

Hyperphosphatasemia:

- **Bafang**: Women aged 60-69 years have a higher rate of 16.7%, while men aged 70-79 years show a rate of 9.1%.
- **Bafoussam**: The prevalence is low for both women and men across all age groups, ranging between 0 and 4%.
- **Dschang**: The results vary by age group, with a higher rate among women aged 70-79 years (13.9%).

Key Findings from Table II :

- Normal creatininemia rates are generally higher in younger age groups (50-59 years), with a gradual decline in older individuals.
- Hypercreatininemia and hypoCKemia increase with age, particularly among men.
- Women exhibit higher rates of certain anomalies, such as hypocreatininemia and hyperphosphatasemia, especially in Dschang.
- Men tend to show higher values in categories such as hypercreatininemia and alkaline phosphatase abnormalities.

Table II : Muscle Profile in the Study Localities by Sex and Age Group

Classes du paramètre du bilan musculaire	Localités	Tranches d'âge							
		50-59		60-69		70-79		≥80	
		F	M	F	M	F	M	F	M
Hypocréatinémie	Bafang	1	0	0	3	2	2	0	0
	Bafoussam	0	1	0	0	0	0	0	0

*Corresponding Author: **NGNOTUE MBOBDA Claude Alain.**

	Baham	0	0	0	0	0	1	0	0
	Bandjoun	0	3	0	2	0	1	0	0
	Dschang	0	0	3	0	1	0	1	0
	Bafang	15	17	20	18	9	7	2	8
	Bafoussam	13	24	14	22	8	21	4	7
Normale	**Baham**	34	23	23	8	8	9	5	1
	Bandjoun	18	23	16	27	11	14	1	2
	Dschang	42	12	39	10	30	4	13	1
	Bafang	11	8	10	4	1	3	1	0
	Bafoussam	12	3	12	2	7	1	3	0
Hypercréatinémie	**Baham**	9	3	12	6	5	2	4	1
	Bandjoun	7	4	2	4	6	1	2	1
	Dschang	5	0	5	0	4	1	0	2
	Bafang	14	12	12	17	10	5	2	4
	Bafoussam	0	2	1	2	1	2	0	0
HypoCKémie	**Baham**	0	2	1	0	0	0	0	0
	Bandjoun	11	18	10	15	9	11	0	0
	Dschang	27	11	24	6	21	3	9	1
	Bafang	5	9	13	4	1	3	1	4
	Bafoussam	16	21	18	16	7	18	6	6
Normale	**Baham**	30	14	24	11	9	11	6	2
	Bandjoun	11	7	6	10	4	5	1	3
	Dschang	14	1	16	3	11	2	4	2
	Bafang	8	4	5	4	1	4	0	0
	Bafoussam	9	5	7	6	7	2	1	1
HyperCKémie	**Baham**	13	10	10	3	4	1	3	0
	Bandjoun	3	5	2	8	4	0	2	0
	Dschang	6	0	7	1	3	0	1	0
	Bafang	3	2	0	0	1	1	0	0
	Bafoussam	3	2	3	2	1	0	1	1
Hypophosphatasémie	**Baham**	6	1	1	3	1	1	1	0
	Bandjoun	0	1	0	3	0	0	1	0
	Dschang	2	1	1	0	2	0	0	0
	Bafang	20	18	25	18	10	11	2	5
	Bafoussam	21	24	22	22	13	21	6	6
Normale	**Baham**	35	25	32	11	11	11	8	2
	Bandjoun	20	27	16	24	15	14	2	3
	Dschang	41	9	35	9	27	5	9	3

*Corresponding Author: **NGNOTUE MBOBDA Claude Alain.**

	Bafang	4	5	5	7	1	0	1	3
	Bafoussam	1	2	1	0	1	1	0	0
Hyperphosphatasémie	**Baham**	2	0	2	0	1	0	0	0
	Bandjoun	5	2	2	6	2	2	0	0
	Dschang	4	2	11	1	6	0	5	0

Discussion

The results of this study demonstrate that aging is associated with biochemical alterations in the muscle profile, particularly among men, and beginning from the age of 60. Hypocreatinemia, a marker of reduced muscle mass, becomes more frequent with advancing age, especially in Bafang and Bandjoun. These findings align with previous research indicating that muscle mass decreases progressively with age, a phenomenon known as sarcopenia (**Morley, 2019; Keller & Engelhardt, 2014)**. In this context, our findings suggest that aging populations in these rural localities may face significant muscle loss, highlighting the need for targeted interventions to address sarcopenia.

Hypercreatinemia, which can reflect decreased glomerular filtration, was also observed in elderly participants. This aligns with findings from **Coulibaly et *al.* (2016**), who demonstrated that renal function deterioration, often linked to aging, is prevalent in elderly populations, especially in settings with limited healthcare access. Our study suggests that hypercreatinemia may be an indicator of renal degradation in these populations, particularly in areas where healthcare infrastructure is insufficient.

HypoCKemia, observed in nearly 40% of participants in certain localities, could indicate muscle weakness or malnutrition, particularly among the older age groups. This supports the findings of **Gariballa and Sinclair (2019**), who highlighted the relationship between malnutrition and muscle mass loss in older adults. Furthermore, the increasing trend of hypoCKemia in this study is consistent with studies showing that reduced physical activity in elderly populations is a contributing factor to muscle dysfunction (**Keller & Engelhardt, 2014**). With increasing sedentary behavior in rural areas, interventions to promote physical activity could mitigate some of these risks.

The elevated levels of hyperphosphatasemia in men in the older age groups may signal underlying bone or liver abnormalities, potentially reflecting an increased risk of osteomalacia or other age-related metabolic disorders. This is supported by **Benz-de Bretagne and Menetrey (2017**), who discuss the role of metabolic imbalances in bone health, particularly in aging individuals. Our findings thus highlight the need to monitor bone health in elderly populations, as osteomalacia and other metabolic bone disorders are common in this demographic.

The disparities observed between the localities may be attributed to socio-economic factors, dietary habits, and varying levels of physical activity. For instance, the higher levels of hypoCKemia and hyperphosphatasemia observed in Dschang may be indicative of nutritional deficiencies or higher physical workloads, as suggested by **Charlton and Rose (2001**). These findings underscore the role of nutrition and lifestyle in the aging process and call for region-specific strategies to address these factors.

Overall, this study confirms that aging is associated with a gradual deterioration of both muscle and bone functions, particularly in rural areas of Cameroon. Our findings are consistent with global literature on aging and sarcopenia (**Morley, 2019; WHO, 2020**), and they emphasize the need for better healthcare strategies and preventive measures for the elderly in these underserved regions.

Conclusion

This study highlights the impact of aging on muscle health in rural populations of Western Cameroon. The results show a growing prevalence of hypocreatinemia, hypoCKemia, and hyperphosphatasemia with age, particularly among men. These abnormalities are associated with muscle mass degradation and metabolic bone disorders, emphasizing the need for appropriate medical care for the elderly in these regions. Further research is required to understand the underlying mechanisms and to tailor preventive interventions to local realities.

Recommendations and Perspectives

1. **Improved Healthcare Access**: It is crucial to improve healthcare access in rural areas, especially for the elderly, to address metabolic and muscular health conditions. This includes the establishment of local health services and mobile clinics that can provide regular screenings and interventions.
2. **Nutritional Interventions**: Given the link between nutritional deficiencies and muscle and bone health, efforts should be made to educate communities about the importance of balanced diets and proper nutrition, particularly for older adults. The promotion of local, affordable, and nutrient-rich foods is essential.
3. **Physical Activity Promotion**: Programs encouraging physical activity, including low-impact exercises tailored to the elderly, should be developed and integrated into community health initiatives to combat the effects of sedentary lifestyles.
4. **Further Research**: Additional studies should focus on understanding the molecular and physiological mechanisms driving these metabolic abnormalities and their regional differences. This could help in identifying specific biomarkers for early diagnosis

*Corresponding Author: **NGNOTUE MBOBDA Claude Alain.**

and management of sarcopenia and related conditions.

5. **Policy Advocacy**: Advocacy for policies focused on aging and elderly health is needed at the national and regional levels. Governments and health organizations should integrate elderly care into public health strategies, ensuring better management of chronic diseases and prevention of age-related disorders.

Declarations

Ethical approval and consent to participate: The study was approved by the Ethics Committee of the Catholic University of Central Africa. All participants signed an informed consent form.

Consent for publication: Not applicable.

Availability of data: The datasets used and/or analyzed during the study are available upon request from the corresponding author.

Competing interests: The authors declare no conflicts of interest.

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Authors' contributions: NGNOTUE MBOBDA Claude Alain designed and led the study. Professor ADIOGO Dieudonné supervised data analysis. All authors contributed to data collection, writing, and reviewing the manuscript and approved the final version.

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