ISSN 2348-3156 (Print)
International Journal of Social Science and Humanities Research ISSN 2348-3164 (online)
Vol. 10, Issue 3, pp: (101-107), Month: July - September 2022, Available at: www.researchpublish.com

ASSESSMENT OF SERUM SODIUM, BICARBONATE AND POTASSIUM LEVELS IN GERIATRIC RESIDENTS IN EKPOMA AND ITS ENVIRON

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DOI: https://doi.org/10.5281/zenodo.6856373

Published Date: 18-July-2022

Abstract: **Generally, chronological age is used to measure aging, and an older person is often called elderly if he or she is 65 or over. The aim was to assess the serum sodium, bicarbonate and potassium levels of Geriatrics in Ekpoma Edo State. A total of one hundred (100) subjects was recruited for this study which will consists of fifty (50) non elderly subjects and fifty (50) apparently healthy elders subjects as control in Ekpoma, Edo State. Subjects data such as name, age and gender was obtained. Sodium, potassium and bicarbonate was estimated using Ion selective electrode . The mean and standard deviation of control group for sodium (mmol/L) was 124.5417±19.3704 and test was 128.9600±15.85739. For Potassium (mmol/l), the control was 4.1625±0.65129. For Bicarbonate (mmol/l), the control was 19.4583±9.98250 while for the test it was 21.760±11.801. However, a non statistical (P>0.05) significant was observed . However, a non significant was observed when compared to the control and there was no significant. In conclusion, the result from this study showed that no significant difference was observed in geriatric electrolytes levels and even in relation to sex. More studies can be carried out to confirm the result of this study. Elderly individuals should take more solutions to improve their electrolytes levels.**

Keywords: **chronological age, older person, serum sodium, bicarbonate and potassium levels, electrolytes levels.**

1. INTRODUCTION

Generally, chronological age is used to measure aging, and an older person is often called elderly if he or she is 65 or over (Orimo *et al.*, 2006; WHO,2010) Due to genetic differences, lifestyle, and overall health, the aging process is not the same for everyone (Levine,2013). The chronological age, therefore, does not adequately account for the heterogeneous pharmacotherapy needs of elderly, particularly when pharmacokinetic and pharmacodynamic factors require individualized regimens (Levine,2013). By 2050, the number of people aged 60 years or older is expected to double, and the number of those aged 80 or more is predicted to reach 400 million. The World Health Organization (WHO) predicts that the population will age dramatically globally by 2050, especially as the population ages (WHO,2012).

Clinical medicine commonly encounters electrolyte imbalances among elderly inpatients, since these disorders are quite common (Sherlock & Thompson,2010; Paniker & Joseph, 2014; Upadhyay *et al.*,2006). According to some reports, the prevalence rate is even higher in elderly patients and can reach 50% (Hoyle *et al.*,2006).

Miller *et al.*, study revealed 53% of elderly aged 60 years and above, had electrolyte imbalance (1995). Other studies also observed the prevalence of electrolyte imbalance in almost 50% of geriatric admissions (Mannesse *et al.*, 2013). In one Asian study, Siregar P, described the prevalence ratio of 2.79 for elderly compared to young group in hospitalised patients (Siregar,2011). Cumming *et al.*, as well found 69.7% of hyponatremia due to dehydration and apprehended it could be

'frequently overlooked and underdiagnosed' (Cumming *et al*.,2014). In elderly, dehydration can be due to various factors including decreased body water content, less fluid intake, injudicious use of diuretics, predisposition to infections or a combination.

Lower socioeconomic backgrounds, living alone, pre-existing comorbidities, multiple drugs intake, physical and mental decline make elderly population more susceptible to dehydration and electrolyte disturbances which are associated with high morbidity and mortality (Foroni *et al.,* 2003).Structural and functional changes in the kidneys contribute significantly to electrolyte derangements in elderly.

Therefore, this study will explore various factors that may result in electrolyte imbalance in Geriatrics in Ekpoma, Edo State. The Data gathered from this study, will provide clinicians and researchers with relevant information related to how they address electrolytes imbalance especially among aging men and women in Ekpoma Edo state as despite these various researches on electrolyte imbalance on the aged , there are no published literatures for Ekpoma and its environs. Hence this study will be carried out to evaluate the Serum sodium, bicarbonate and potassium of Geriatrics in Ekpoma Edo State.

In geriatric age group people are more susceptible to dehydration and electrolyte abnormalities. The causes are multifactorial which include physical disability restricting access to adequate fluid intake ,iatrogenic causes like use of diuretics and various drugs (Gaspar , 1999; Allison & Lobo,2004). Serum sodium, bicarbonate and potassium will be evaluated to determine if aging significantly causes these electrolytes imbalance using standard laboratory methods.

Previous studies like Usha, 2016 has shown that 1.5% decline in serum sodium and 4.75% elevation in potassium levels in elderly as compared to controls. Data's produced from this study will be used to establish the serum sodium, bicarbonate and potassium levels of aging men and women and also provide insights into the issues/conditions that may cause electrolytes imbalance among aging individuals. In addition, it is hoped that this project will mark the beginning of an ongoing body of research into the issues of monitoring electrolytes imbalance in the aged.

A prevalence rate of 50% has been reported for elderly patients, but even higher rates have been reported in younger patients.

Researchers have reported hyponatremia in elderly fracture patients in previous research, such as that of Kirsten et al.,(2007).

Miller M reported hyponatremia in 11% of ambulatory geriatric population (Chua et al., 2007).On the contrary hypernatremia was reported in 1% of hospitalized elderly population by Snyder *et al* (2007).

The levels of electrolytes in nursing homes, hospitals, or communities depend on the population studied. Study by Snyder et al also reports higher sodium levels in elderly females compared to elderly male (Snyder *et al* .,2007) which is contradictory to Usha, (2016) result, where didn't find any gender differences in electrolytes.

However, these different results in the aforementioned studies are limited as they focused mainly on hospitalized and elderly in nursing homes. Following this, this present study seeks to evaluate the Serum sodium, bicarbonate and potassium of healthy geriatrics in Ekpoma, Edo State and also with the fact that there is no such data in existence in Ekpoma hence this present study will be carried out. This present study will be limited to the serum sodium, bicarbonate and potassium of Geriatrics in Ekpoma Edo State.

2. MATERIALS AND METHODS

Study Area

This study was carried out in Esan West Local Government Area of Edo. Ekpoma is the administrative headquarter of Esan West Local Government Area of Edo State, which lies between latitude 6º45`N to 6º75`N of the Equator and longitude 6º08`E to 6º13`E of the Greenwich Meridian with altitude of about 332m above sea level. It is made up of quarters including Eguare, Iruekpen, Emaudo, Ujoelen, Ihumudumu, Illeh, Uke, Uhiele, Ujemen, Ukpenu, Idoa, Ukhun, Egoro, Emuhi, Igor and Idumebo (Aziegbe, 2006). Ekpoma has a population of 89,628 in 1991 and 127,718 in 2006, majority of which are civil servants, traders, business men/women, transporters, farmers, teachers/lecturers and students by occupation. A University (Ambrose Alli University) is situated in this town. The main sources of water in the locality are rainfall and wells. It is has 2 distinct seasons, wet and dry seasons. The wet season occurs between April and October with peak in August, average rainfall ranging 150cm to 250cm. The dry season occurs between November and March with cold harmatan between December and January, average temperature of about 25`C (Aziegbe, 2006).

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Study population

A total of one hundred (100) subjects was recruited for this study which will consists of fifty (50) non elderly subjects and fifty (50) apparently healthy elders subjects as control in Ekpoma, Edo State. Subjects data such as name, age and gender was obtained

Ethical Approval

Ethical approval was obtained from the of the Ambrose Alli University, Health Research Ethic Committee of Ambrose Alli University, Ekpoma. Individual consent for collection of samples was requested through verbal and documented data of subject, by educating the subjects on the importance of the research and those that gave their consent were enlisted for the research.

Sample Size

The number of sample required in this research was guided by upper limit to give 95% level of confidence at an expected prevalence of about 5% using the precise formula:

$$N = \frac{z^2pq}{D^2}$$ (Araoye, 2004)

where N= the desired sample size (when population is greater than 10,000)

z = is a constant given as 1.96 (or more simply at 2.0) which corresponds to the 95% confidence level.

P = expected prevalence (7%)

q = 1.0-p

d = acceptable error 5%.

$$N = \frac{(1.96)^2 \text{ X } 0.07 \text{ X } (1 - 0.07)}{(0.05)^2}$$

$$N = \frac{(1.96)^2 \text{ X } 0.07 \text{ X } 0.93}{(0.05)^2}$$

N = 100.034

To make up for the sampling error or drop outs, a minimum of 150 samples was collected and used for the research.

Research Design

This research work was conducted between May and July, 2021. Evaluation of the serum electrolytes, levels was determined using standard laboratory methods and this samples was analyzed in the diagnostic laboratory, Irrua Specialist Teaching Hospital Irrua,

Inclusion and Exclusion Criteria

- **Inclusion Criteria**

Only apparently healthy subjects in Ekpoma, Edo State were recruited for this study.

- **Exclusion Criteria**

Malaria subjects with no either form of illness was excluded from this study.

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Sample Collection

Collection of blood samples

About 6ml of blood sample was collected from each subject on the first day of visiting hospital as baseline. Out of 6ml blood sample collected; 3ml of blood sample was dispensed into plain bottles; serum was extracted to assay Electrolytes, Urea and creatinine Assay method. Malaria parasite was screened for using commercially prepared malaria rapid test kit; also thick and thin blood film was made for microscopic gold standard diagnosis of malaria parasite infection; malaria parasite detection, malaria parasite count and malaria parasite species identification were also determined.

Renal Function Tests

Method for Sodium, potassium and bicarbonate ion Estimation of ion selective electrode (ISE).

Sodium, potassium and bicarbonate was estimated using Ion selective electrode

Principle

ISE is sensitive to the ion activity in the sample. When the ion concentration in the sample is below 10-4M and activity coefficient is close to 1, the difference between ion activity and concentration can be ignored (when concentration goes over 10-4M, the activity coefficient decreases, and the difference increases.)

Procedure

When ISE gets contact with the measured solution, the measured ion in the sample goes to ISE membrane due to the diffusion effects of the concentration difference, which created a potential between measure electrode and reference electrode.

Statistical Analysis

Statistical Package for Social Science (SPSS) version 20.0 software (SPSS Inc., Chicago, IL USA) windows was used, at $P<0.05$ considered as statistically significant

3. RESULT

This study shows the assessment of serum electrolytes levels in Geriatric and Non Geriatric in Ekpoma and Its environment. Table 4.1 shows the socio demographic characteristics of Geriatric and Non Geriatric among different age groups, sex, ethnicity and educational levels. The age group of 50-59 showed the highest frequency of individual Geriatric in Edo state with a frequency of 40% while age group of 60-69, 70-79, 80-90, 90 and above had a frequency of 26%,14%,12%,8% respectively. The frequency among Non Geriatric was quite different as age 51 and above had the highest frequency of 15(30%) while 21-30,31-40,41-50 had 10(20%) each and 16-20 had 5(10%). According to gender(sex) male gender had a higher frequency of 48(96%) among saw millers while female had 2(4%),the reverse was the case among non saw millers as females had a higher frequency of about 40(80%),males had a frequency of 10(20%).According to ethnical diversity my study showed that a 25(50%) of s Geriatric were from Bini while 20(40%) were from Esan while the remaining 5(10%) were non indigenes, among non Geriatric the Bini's were 19(38%),Esan individuals were 21(42%) and the non indigens are 10(20%). According to educational backgrounds(levels) the percentage of literates among the Geriatric were 20(40%) while the remaining 30(60%) are illiterates, among the non Geriatric the literates are higher with 40(80%) and illiterates 10(20%).

TABLE 1: SOCIO DEMOGRAPHIC CHARATERISTICS OF GERIATRIC AND NON GERIATRIC

AGE	**Geriatric**	**Non Geriatric**
50-59	20(40%)	5(10%)
60-69	13(26%)	10(20%)
70-79	7(14%)	10(20%)
80-89	6(12%)	10(20%)
90-above	4(8%)	15(30%)
Total	**50**	**50**
SEX	**Geriatric**	**Non Geriatric**
Male	48(96%)	10(20%)
Female	2(4%)	40(80%)
Total	**50**	**50**

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ETHNICITY	**Geriatric**	**Non Geriatric**
Benin	25(50%)	19(38%)
Esan	20(20%)	21(42%)
Non-indigenes	5(10%)	10(20%)
Total	**50**	**50**
EDUCATIONAL LEVEL	**Geriatric**	**Non Geriatric**
Literate	20(40%)	40(80%)
Illiterate	30(60%)	10(20%)
Total	**50**	**50**

1. Serum electrolytes level of Non geriatric (control) and Geriatric (test) subjects

The mean and standard deviation of control group for sodium (mmol/L) was 124.5417±19.3704 and test was 128.9600±15.85739. For Potassium (mmol/l), the control was 4.1625±0.65129. For Bicarbonate (mmol/l), the control was 19.4583±9.98250 while for the test it was 21.7600±11.80141. However, a non statistical (P>0.05) significant was observed

Table 2. Serum electrolytes level of Non geriatric (control) and Geriatric (test) subjects

Parameters	Control Mean±SD N=50	Test Mean±SD N=50	T-test	P-value
Sodium (mmol/L)	124.54±19.37	128.96±15.85	-0.875	0.388
Potassium (mmol/L)	4.16±0.65	4.35±1.03	-0.780	0.439
Bicarbonate (mmol/l)	19.45± 9.98	21.76±11.80	-0.736	0.466

Key: N- Number of sample examined

SD: Standard deviation

2. Serum electrolytes level of Non geriatric (control) and Geriatric (test) subjects in relation to sex.

The mean and standard deviation of male group for sodium (mmol/L) was 122.54±18.07 and female was 123.16±12.15 For Potassium (mmol/l), the male was 3.05±0.05 while the female was 3.15±0.13 . For Bicarbonate (mmol/l), the control was 17.14± 8.18 while for the test it was 20.16±10.10. However, a non statistical (P>0.05) significant was observed .

Table 3. Serum electrolytes level of Non geriatric (control) and Geriatric (test) subjects in relation to sex

Parameters	Male Mean±SD N=50	Female Mean±SD N=50	T-test	P-value
Sodium (mmol/L)	122.54±18.07	123.16±12.15	-0.621	0.255
Potassium (mmol/L)	3.05±0.05	3.15±0.13	-0.700	0.129
Bicarbonate (mmol/l)	17.14± 8.18	20.16±10.10	-0.306	0.166

4. DISCUSSION

By normal or artificial means, water and electrolytes are consumed along with nutrients. Reports from recent years have criticized the low standards of practice and training in fluid and electrolyte management, contributing to a large amount of avoidable morbidity, especially in the elderly, who are more susceptible to sudden changes in their body composition.

The aging process results in diminished physiological reserves as well as a reduced capacity to respond to environmental fluctuations. Depletion of cardiac and renal reserve leads to increased vulnerability to changes in water and electrolyte balance, which in turn increases morbidity and mortality in the elderly (Radosavljevic, *et al.*, 2001).

The mean and standard deviation of control group for sodium (mmol/L) was 124.5417±19.37 and test was 128.96±15.85. For Potassium (mmol/l), the control was 4.1625±0.65129. For the chloride, the control was 85.7917±14.90544 while the test was 91.12±14.63. For Bicarbonate (mmol/l), the control was 19.45±9.98 while for the test it was 21.760±11.801.

However, a non significant was observed when compared to the control and there was no significant This result was in contrast with some previous study of Adelman *et al.*, (1994).

According to Anderson and Brenne (1986), the baseline function of the kidneys declines with age, as it does with other organ systems.

It is unclear whether these common changes in renal function reflect subclinical disease or normal aging in longitudinal studies of otherwise similar individuals. Individuals aged between 30 and 85 years lose approximately 20% to 25% of their renal mass, which is almost all cortex. The aging kidney also exhibits hyalinization of blood vessel walls and a decrease in the number of glomeruli. Ischemia results in the obliteration of scattered arteriolar walls and a loss of nephrons following hyalinizing arteriosclerosis

A well-known comorbidity is that elevated blood pressure will advance the decline of renal function. Functional changes parallel anatomic changes in the kidney. A decline in renal blood flow is the most studied functional change in the aged kidney, since the kidneys lose the capacity to concentrate over time, and they experience a decline in renal blood flow of 10% per decade after young adulthood.

Rowe *et al* 1976 in 1976 first showed a sequential fall in standardized GFR in an aging population. Subsequent results obtained from the Baltimore Longitudinal Study of Aging demonstrated that a declining GFR is not inevitable. In a healthy cohort, examined regularly for 20 to 30 years, most individuals demonstrated a fall in GFR at an average rate of about 10 mL/min per decade. However, 30% of healthy aging individuals showed no decrease in GFR. It is clinically prudent to assume the older patient has a reduced GFR without additional, more rigorous clinical tests (e.g., 24-hour creatinine clearance) that can more precisely estimate GFR (e.g., a 24-hour creatinine clearance); therefore, it is clinically reasonable to assume that they have a lower GFR with age.

5. CONCLUSION

In conclusion, the result from this study showed that no significant difference was observed in geriatric electrolytes levels and even in relation to sex.

6. RECOMMENDATION

From this study it is recommended that :

i. More studies can be carried out to confirm the result of this study .

ii. Elderly individuals should take more solutions to improve their eletrolytes levels.

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