VALUE OF SERUM CALCIUM, PHOSPHATE, PROTEIN AND ALKALINE PHOSPHATAES IN ELDERLY POPULATION

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ABSTRACT:

Objective: The aim of this study was to investigate the value of serum calcium (Ca), phosphate (P), total protein (TP) and alkaline phosphatase (AIP) activities in elderly patients, to know the levels of those biochemical p parameters and to clarify the relationships of these finding with the diseases that having specially over the life

Study design:

A prospective case control study conducted at the biochemistry Department, through a period of 1 year from the first of October 1999 till the end of October 2000.Base line samples were collected to measure S. Ca, P,TP and AIP activities in 110 elderly patients aged 72 ± 6.5 years (62 males and 48 females) and the effects of biological factors (age, sex, and weight) and large set of pathological conditions were examined and for comparison, another 100 subjects aged 68 ± 8 years (63 males and 37 females) whom, were found free of any disease and or alcoholic and smoking habit considered as a control group.

Results:

The results of the study showed a significant decreased ($p<0.05$) in the concentrations of S.Ca and TP and a significant increased ($P<0.05$) in the concentrations of S. P and AIP activity in hypertensive and in patients how have renal failure. A significant increased ($P<0.05$) in the S.Ca, P and AIP activity and a non – significant decrease ($P>0.05$) in the TP level, were observed in the patients having bone and joint diseases. The values of S. P in the patients having heart disease shows a significant increased ($P<0.05$) and non – significant changes ($P>0.05$) in the concentrations of serum Ca, TP and AIP activity is often considered. Non significant alterations ($P>0.05$) was observed in those biochemical parameters in relation to diabetes mellitus or other pathological conditions.

Conclusion:

We conclude that, the measurements of those biochemical's parameters in elderly populations was useful to know some of theories of aging that might take place in the cell, an organ or total organism with a passage of time, and also the sequential or progressive change in an organism that leads to an increased risk of debility, disease and death.

<u>*Key words*</u>*: Calcium, phosphate, protein, alkaline phosphatase, elderly*.

INTRODUCTION:

Aging consists of progressive change that take place in a cell, an organ or total organism with the passage of time. It is a process that goes over the entire adult life span of any living things and is also the sequential or progressive change in an organism that lead to an increased risk of debility, diseases and dealth.[1]
The boundary between middle age and old

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age cannot be defined exactly because it does not have the same meaning in all societies. In many parts of the world, people are considered old of certain change in their activities or social roles. Examples people may be considered old when they become grandparents, or when they begin to do less or different work retirement[2,3].

In north America and Europe, peoples are often considered old if they have lived a certain number of years. In the USA and United kingdom, and many other countries, the aged of 65 years is often considered the beginning of old age, because people become eligible to retine at this age with full social security benefits[4]. Over the life span, the performance of many organs such as heart, kidney, bone and joint, brain and lungs shows the a gradual decline. Port of this decline was due to a loss of cells from these organs, with the reduction in the reserve of capacities or metabolic of individual. Furthermore, the cells remaining in the elderly populations and its metabolic activities may not functions as in the young and thus more time may be required to carry out the chemicalreactions[2,5]. Therefore, the present study was undertaken to estimate the serum levels of calcium, phosphate, total protein and alkaline phosphatase activities among a set of pathological conditions in elderly populations and compared with apparently healthy elderly people to know their levels and to clarify their relationships with diseases that they have.

MATERIALS & METHODS:

A prospective case control study conducted at Basrah province through a period of one year from October 1999 till October 2000. Base line samples' were collected to measure serum Ca, P,TP and AIP activities' in **ll0** elderly patients aged 75±

6.5 year(62 males and 48females) and the effects of the biological factors (age, sex and weight) and large set of pathological conditions including hypertension, renal failure, bone and joint disease, heart, diabetes mellitus or smoking habits were examined, and for comparison, another **100** subjects aged 68±8 years (63 males and 57 females) , whom were found free of any disease after clinical examination by **Professor Dr. Sarkis S. Strak**, (MRCP) in Medicine Department, and or alcoholic and smoking habit consider as a control group. Most of the patients were hospitalized in **Al Sadr** Teaching Hospital for a variety of diseases requiring constant medical assistance and there for could not be regarded as representative of normal, health elderly populations.

Venous blood samples were drawn under standardized conditions (8-9:30 am.) and immediately centrifuged. The serum samples were stored and frozen until assayed. Serum Ca, P,TP and AIP activity are determined by using kits from bio Merieux France.

Results are expressed as mean ± SD. Differences in the mean between various diseases and control groups were assessed using the student "t" test and one way analysis of variance (ANOVA). The statistically significance of relation between the different diseased conditions and the concentrations Ca, P,TP and AIP activities were assessed by using Fisher Exact Test. P values of > 0.05 were considered not significant.

RESULTS:

The basic clinical characteristics of all patients and the control group participated in this prospective study are presented in *Tab1*. Excluding the hypertension patients, the systolic and diastolic blood

pressure in all patients and health control subjects were in a normal ranges according to the WHO classification (WHO,1996)[6]. All the patients were also not obsess and had negative family history of hyperlipidemia.

a. Effect of age, sex, weigh, hypertension and renal failure. *Table 2* shows the above effects on the concentrations of serum calcium, phosphate, protein and alkaline posphatase activity. Hyperphosphataemia and significant increase $p<0.05$ in S.AIP activity and a significant decreased $p<0.05$ in $S.Ca^{+2}$ and total protein levels associates with hypertensive and renal failure patients at the age groups 65-79 and ≥80 years old and non significant alterations $p> 0.05$ in those parameter in age group < 65 years. Sex and weight did not influence significantly $p>0.05$ in those parameters in patients group or related to the control subjects.

b. Effect of age, Sex, weight, bone and joint diseases.

This study demonstrated that, high Ca, P and AIP activity $p<0.05$ and low protein level $p<0.05$ associates respectively with bone and joint disease among age groups 65-79 and ≥ 80 years and in females patients related to the age group < 65 years or in males or control subject. Non-significant influenced of weight $p>0.05$ on these parameters was observed in comparison with healthy population Table[3].

c. Effect of age, Sex, weight and other pathological conditions.

The effect of age, sex, weight and number of pathological conditions on S. Ca, P, protein and AIP activity are presented in *Table4*. Hyperphosataemia

$p<0.05$ and non significant alterations $p>0.05$ in the mean levels of S. Ca, protein and AP activity are demonstrated in patients having heart disease. Non significant changes of those parameters $p>0.05$ was observed among diabetes mellitus or other pathological conditions or among different age or weight or type of sex.

DISCUSSION:

The maintained and improvements of health is a challenge for every individual as well as for all, who work in health services acquiring know ledge and knowing when to use, making decisions about when to take action and of what sort, choosing between competing properties and soon[1].

The health of older people brings some particular challenges for examples, the attempt to maintain adequate function ability in to late age. There for to define the clinical features of normal aging population, we should have an appropriate baseline against which signs and symptoms in elderly people can be assessed[2].

In general this study demonstrated a condition of hyperphoshataemia, high alkaline phosphatase activity, low concentrations of calcium and total protein associates with hypertensive, renal failure, bone and joint disease, heart, diabetes mellitus and other pathological conditions, with special exception in some pathological diseases or in age group 65-79 and ≥ 80 years or related to gender.

Cardiovascular and hypertension events are the most frequent cause of death in patients with renal failure. Heterotrophic calcification of blood vessel walls occurs frequently with advancing age, atherosclerosis and diabetes mellitus. Hyperphosphataemia and increase calcium- phosphate product are important

contributors to vascular calcifications in patients with uremia and hypertention[7,8].

High levels of phosphate, due to phosphorus retention, commonly present in renal failure. On the other hand, high phosphate level enhances parathyroid cell proliferation and parathyroid hormone (PTH) synthesis and secretion directly and indirectly through both a reduction in serum calcium level and a reduction of skeletal resistance to PTH. The resultant high PTH cause osteitis fibrosa and bone loss and there for further increase in calcium- phosphate [9,10]. Furthermore, there is a paradoxical coincidence of vascular mineralization with bone loss in human, which suggests that the same factors that induce high turnover bone disease in renal failuer[11].

On the other hand, many different factors and possibilities cause the significant decreases in the serum calcium level. One of the possibility was due to high phosphate: calcium ratio, which leads to excessive loss of calcium in the urine or might be to the low intake of vitamin D or on the other hand to increase the stress or excretion of calcium[12,13].

Abnormal serum alkaline phosphatase activity was more useful than an abnormal calcium or phosphate concentrations in distinguishing between normal and different type of age production. Numbers of theories or possibilities can cause raised in the activity of alkaline phosphase enzyme in the plasma of the elderly including malignant disease with metastasis to bone or liver, ostemalacia and Paget's disease of bone[14]. The practice in many laboratories is to assume that, in absence of any clinical or other laboratory evidence of disease, an alkaline phosphatase of up to one and half times the upper limit of normal for young adults does not justify further investigation In an elderly subject[15].

The changes in the concentration of total serum protein might be probably due to non- significant alteration in protein break down or to increase the rote of albumin or protein loss, which either due to renal failure or nephritic syndrome, the incidence of this excretion may sometimes correlated significantly with age, sex and type of disease[16].

Fur there more, biological and genetic factors practically account for differences in late life health, however, the specific social environment on the liver is significantly effects late life health, which means that programs and policies can affect the well- being of the elderly and reduce the health gap between men and women in their later years, while this study sheds light on how men and women are affected differently by the same social risk factors, and more research into the cause of gender differences in the late life health and mortality is needed[2].

In conclusion , we have developed that, in the life very few people reached old age completely free of diseases and their organisms function remain unchanged, whereas in other people the function of some organs may affected, so that, the particular feature may appear or undergo moderate decline with age and are severity impaired in others, this phenomena might give us some explanation of alteration in the biochemical parameters that are measured.

ACKNOWLEDGMENTS.

Table 1: Basic clinical characteristics of patients and apparently healthy individuals control group.

Variable		Patients group		Control group	
Age (year)					
<65		36		32	
65-79		52		44	
≥ 80		22		24	
Total		110		100	
Sex					
Males		62		63	
Females		48		37	
Weight (kg)					
40-59		28		25	
60-79		65		60	
≥ 80		17		15	
Height cm		165±6.9		163±7	
Body mass index cm/kg		22.5±2.5		22.6 ±3.1	
Blood pressure					
BP(mmlHg)	Hypertension	CHD	CRF	DM	Control group
Systolic	172.5± 8.8	127±10	132± 7.8	127± 5.3	118±3.5
Diastolic	94±88	85±6.4	85±6	84.6±7.5	82±4.4

CHD   : Chronic heart disease.
CRF   : Chronic renal failure.   DM   : Diabetes mellitus.

Table 2: Effect of age, sex, weight, hypertension and renal failure on the concentration of serum calcium, phosphate total protein and alkaline phosphatase activity in both groups.

	Patient group				Control group			
Variable	**Ca mg/dl**	**P mg/dl**	**Protein g/dl**	**AlP k.A.u/dl**	**Ca mg/dl**	**P mg/dl**	**Protein g/dl**	**AlP k.A.u/dl**
Age/years Hypertension Renal failure								
<65	9.1±0.81	4.2± 0.33	6.9±0.86	9.1± 1.8	9.5± 0.91	3.2± 0.34	6.8±0.76	8.8±1.8
65-79	8.3±0.65^{*a,b}	5.6±0.34^{*a,b}	6.2±0.76^{*a,b}	14±2.0^{*a,b}	9.36± 0.89	3.6± 0.29	6.9±0.82	11.2±2.0
≥ 80	8.2±0.66^{*a,b}	5.4±0.32^{*a,b}	6.1±0.68^{*a,b}	14.8±1.9^{*a,b}	8.9± 0.88	3.8± 0.19	6.6±0.81	10.6±1.9
Sex								
Males	8.3±0.76^{*a,b}	5.4±0.33^{*a,b}	6.0±0.79^{*a,b}	13.6±1.9^{*a,b}	9.2± 0.81	3.4±22	6.8±0.81	10.2±1.0
Females	8.2±0.8*	5.3±0.34*	6.0±0.81*	13.9±2.0*	8.9± 0.76	3.2± 0.24	6.7±0.82	10.5±2.0
Weight (kg)								
40-59	8.1±0.82^{*a,b}	5.2±0.31^{*a,b}	6.6±0.76^{*a,b}	15.6±1.8^{*a,b}	9.4± 0.81	3.2± 0.24	7.1±0.82	10.2±1.8
60-79	8.0±0.76^{*a,b}	5.4±0.34^{*a,b}	6.1±0.81^{*a,b}	12.6±1.65^{*a,b}	9.2± 0.69	3.4± 0.25	6.9±0.69	9.9±2.0
≥ 80	8.0±0.66^{*a,b}	5.2±0.32^{*a,b}	6.3±0.82^{*a,b}	13.2±1.9^{*a,b}	9.3± 0.72	3.5± 0.21	7.12±0.76	10.2±1.9

- The values of mean ± SD of serum calcium, phosphate, protein and alkaline phosphatase activity are approximately the same among hypertension and renal failure patients.
- $P<0.05$.
  a. Significant between the same group.
  b. Significant between patients and control group.

Table 3: Effect of age, sex, weight, bone and joint diseases on the concentration of serum calcium, phosphate total protein and alkaline phosphatase activity in patients and control groups.

Variable	Patient group				Control group			
	Ca mg/dl	P mg/dl	Protein g/dl	AlP k.A.u/dl	Ca mg/dl	P mg/dl	Protein g/dl	AlP k.A.u/dl
Age/years Hypertension Renal failure								
<65	9.2±0.81	3.2± 0.28	6.6±0.76	9.2± 1.9	9.5± 0.91	3.2± 0.34	6.8±0.76	8.8±1.8
65-79	10.5±0.76[*a,b]	4.4±0.31[*]	5.8±0.82[*]	13.8±2.1[*]	9.36± 0.89	3.6± 0.29	6.9±0.82	11.2±2.0
≥ 80	10.4±0.74[*a,b]	4.6±0.29[*b]	5.9±0.84[*]	14.4±1.8[*]	8.9± 0.88	3.8± 0.19	6.6±0.81	10.6±1.9
Sex								
Males	9.4±0.76	3.6± 0.29	6.42±0.72	11.2± 2.1	9.2± 0.81	3.4±22	6.8±0.81	10.2±1.0
Females	10.8±0.82[*a,b]	4.6±0.31[*a,b]	5.8±0.76[*a,b]	13.8±1.9[*a,b]	8.9± 0.76	3.2± 0.24	6.7±0.82	10.5±2.0
Weight (kg)								
40-59	9.2±0.81	4.8± 0.28[*b]	6.4±0.72[*b]	12.4± 2.0[*b]	9.4± 0.81	3.2± 0.24	7.1±0.82	10.2±1.8
60-79	10.2±0.82[*b]	4.6±0.31[*b]	6.2±0.82	12.8±1.9[*b]	9.2± 0.69	3.4± 0.25	6.9±0.69	9.9±2.0
≥ 80	10±0.84	5.1±0.28[*b]	6.0±0.81[*b]	12.9±1.9[*b]	9.3± 0.72	3.5± 0.21	7.12±0.76	10.2±1.9

- $P<0.05$.
  a. Significant between the same group.
  b. Significant between patients and control group.

Table 4: Effect of age, sex, weight, heart, diabetes mellitus and number of pathological conditions on the concentration of serum calcium, phosphate total protein and alkaline phosphatase activity inpatients and control groups.

Variable	Patient group					Control group			
	Ca mg/dl	Heart P mg/dl	D-M P mg/dl	Protein g/dl	AlP k.A.u/dl	Ca mg/dl	P mg/dl	Protein g/dl	AlP k.A.u/dl
Age/years Hypertension Renal failure									
<65	8.8±0.68	5.2*±0.31^{*b}	4.8±0.32^{*b}	6.8±0.76	11.8± 2.1	9.5± 0.91	3.2± 0.34	6.8±0.76	8.8±1.8
65-79	9.2±0.71	5.6±0.29^{*,b}	4.6±0.34^{*b}	6.4±0.74	12.2±1.9	9.36± 0.89	3.6± 0.29	6.9±0.82	11.2±2.0
≥ 80	8.9±0.69	5.4±0.3*	4.7±0.29^{*b}	6.3±0.69	12.3±2	8.9± 0.88	3.8± 0.19	6.6±0.81	10.6±1.9
Sex									
Males	8.9±0.73	5.2±0.29$^{* b}$	4.7±0.31^{*b}	6.4±0.76	12.2±1.9^{*b}	9.2± 0.81	3.4±22	6.8±0.81	10.2±1.0
Females	9.3±0.68	5.3±0.31	4.8±0.3^{*b}	6.5±0.74	12.1±2.0^{*b}	8.9± 0.76	3.2± 0.24	6.7±0.82	10.5±2.0
Weight (kg)									
40-59	8.8±0.71	5.0±0.28$^{* b}$	4.6±0.29^{*b}	6.7±0.76	12.3±1.9^{*b}	9.4± 0.81	3.2± 0.24	7.1±0.82	10.2±1.8
60-79	9.1±0.69	5.3±0.32$^{* b}$	4.5±0.3^{*b}	6.5±0.70	11.9±2.0^{*b}	9.2± 0.69	3.4± 0.25	6.9±0.69	9.9±2.0
≥ 80	9.3±0.68	5.2±0.31^{*b}	4.8±0.31^{*b}	6.4±0.69	12.2±2.1^{*b}	9.3± 0.72	3.5± 0.21	7.12±0.76	10.2±1.9

D.M: Diabetes mellitus.
- $P<0.05$.
  b: Significant between patients and control group.

- The values of means ± SD of serum calcium, Protein and alkaline phosphatase activity are approximately the same among the effects of heart or Diabetes mellitus diseases.

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مستويات قيم الكالسيوم ، الفوسفات ،البروتينات وفعالية خميرة الفوسفات القاعدي عند كبار السن

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الخلاصـــــــة:

الهــــــدف:

أن الهدف لهذه الدراسة هو للتعرف من جهة على مستويات قيم الكالسيوم، الفوسفات ،البروتينات وفعالية خميرة الفوسفات القاعدي لدى كبار السن ولتوضيح العلاقة من جهة أخرى بين هذه القيم والإمراض التي يعاني منها هؤلاء المرضى ولفترات طويلة من العمر .

نمط الدراسة:

صممت هذه الدارسة في فرع الكيمياء الحياتية- كلية الطب- جامعة البصرة. وامتدت على نحو سنة واحدة من أكتوبر ١٩٩٩ إلى أكتوبر ٢٠٠٠ . جمعت عينات الدم من جميع الأشخاص الداخلين في الدراسة (سواء كانوا من المرضى أو المجموعة الضابطة) لتعين مستويات الكالسيوم، الفوسفات ،البروتينات و خميرة الفوسفات القاعدي. ولمعرفة تأثير العوامل البيولوجية (العمر، الجنس والوزن) وكذلك تأثير مجموعة كبيرة من الحالات المرضية، تم اخذ ١١٠ من المرضى من كبار السن والذين يتراوح معدل أعمارهم بين ٧٢ ± ٦,٥ سنه منهم ٦٢ رجل و ٤٨ أمرأة وللمقارنة تم اخذ ١٠٠ شخص ممن يتراوح معدل أعمارهم بين ٦٢ ± ٨ سنه منهم ٦٣ رجل و٣٧ أمرأة والذين لم يعانوا من الإمراض بعد أجراء الفحص الطبي عليهم أو من غير المرضى أو الذين يتعاطون الكحول وعدوا كمجموعة ضابطة.

النتائج :

اضهرت نتائج الدراسة الحالية انخفاضا" معنويا" $p<0.05$ بتركيز كلا" من الكالسيوم والبروتينات وارتفاعا" معنويا" $p<0.05$ بتركيز الفوسفات وفعالية خميرة الفوسفات القاعدية عند المرضى الذين يعانون من ارتفاع ضغط الدم أو عجز الكلى.

تم ملاحظة ارتفاعا" معنويا" $p<0.05$ يقيم الكالسيوم، الفوسفات وخميرة الفوسفات القاعدية وانخفاضا" غير معنويا" $p<0.05$ بمستوى البروتين الكلي عند مرضى العظام والمفاصل.

كما واظهرات الدراسة الحالية ارتفاعا" معنويا" $p<0.05$ يقيمه الفوسفات وتغير غير معنوي $p>0.05$ بتركيز الكالسيوم، البروتين وفعالية خميرة الفوسفات القاعدي عند مرضى القلب وتغير غير معنوي $p>0.05$ يقيم جميع هذه العوامل عند مرضى السكري أو عند المرضى الذين يعانون من حالات مرضية أخرى.

الخلاصة :

واستنادا" لنتائج الدراسة الحالية، يمكننا القول بان قياس هذه العوامل عند كبار السن كان له الأثر الطيب والكثير لمعرفة بعض النظريات أو الفرضيات التي تحصل بشكل عام بتقدم العمر أو التغيرات التي تطرأ على الكائن الحي والتي تؤدي لزيادة النسبة للتعرض للمرض ثم الوفاة.

مفتاح الكلمات: الكالسيوم، الفوسفات ،البروتينات، خميرة الفوسفات القاعدي، كبار السن

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