وَلَقَدْ آتَيْنَا دَاوُودَ وَسُلَيْمَانَ عِلْمًا

وَقَالَا الْحَمْدُ لِلَّهِ الَّذِي

فَضَّلَنَا عَلَىٰ كَثِيرٍ مِّنْ عِبَادِهِ الْمُؤْمِنِينَ

النمل15

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Editorial

"It's been a long,A long time comin',But I know,A change gonna' come!Oh yes it will!"

A song by Sam Cooke.

Dear SMLJ readers;

Many troubled waters passed below the bridge, flushing the good and the bad, altogether, to drain hope and despair. Perhaps that's, the way life goes! And that was our case.

Honestly, we schemed to surprise our audience by introducing this issue, of SMLJ, much earlier, yet the contributions were so scanty and meager to publish. For quite a time, we yearned, besought and entreated for your contributions. Everybody was busy somewhere!

Then, the change comes! We received a flood, call it, a streaming progression of papers, requesting urgent publishing services. Our sudden enthusiasm and exuberance were not good enough to suffice. That is why, we are late.

We would like to inform you that your journal is now available on-line and our URL is http://www.journal.oiu.edu.sd/ojs/index.php/mlj so, just and retrieve your article without the bother to request.

Please now send your next article at the submissions form through the submissions

webpage: http://www.journal.oiu.edu.sd/ojs/index.php/mlj/submissions and till we hear from you, we remain,

Yours

Ali Suleiman Elwakeel

Executive Editor

v

Important Directives

Counsels to contributors

Manuscript submission: We only request the authors to fulfill certain prerequisites on submitting their research work papers. The directives mentioned are meant to ensure security, to facilitate and accelerate the publishing process as well as to eliminate inhospitable conflicts that might probably erupt.

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Article template consists of an **abstract** (less than 300 words). It is of high importance to give, *here*, the name and address (*namely email*) of the *Correspondence Address,* followed by an introduction (*a short concise overview of previous relevant research*), **materials and methods** (*a description of the methodology used*), **patient selection** (*inclusion and exclusion criteria*), **results** (*comprising text, tables and figures, avoiding repetition of data*), **discussion** (*of the results obtained*) and **references** (*in Harvard Style*).

References should be written as follows: name of author(s) + (year) + subject title + journal + pages. For example:

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Two authors: Tamir, M. J. and Sami, R. T. (2000). The role of socioeconomic status in plasma concentration.Sud. Med. J. 15-20.

Three authors: Tamir, M. J. Sami, R. T. and Ahmed, S. F. (2000). The role of socioeconomic status in plasma concentration.Sud. Med. J. 15-20.

Books: name of author(s) + (year) + title + edition + publisher + pages.

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Two authors	(Lamb & Kling 2003)	Lamb, R. & Kling, R., 2003, 'Reconceptualizing users as social actors in information systems research', *MIS Quarterly* 27(2), 197.

Phone: +249 912959304

Mohammed E. H. Ournasseir

Affable Welcome

Assistant Professor

Fayza Rahamtalla

Dean Faculty

Dear Readers and Colleagues,

To the utmost of my pleasure, I feel the zest of flawless, acme perfection to bring

before you the second issue, volume 6 of the SMLJ, assembled under our joint and articulate editorship, enhanced by your colossal and prodigious efforts'

The major target of this journal is to publish open-access, peer-reviewed research articles, reviews or short communications pertaining to the various aspects of medical laboratory sciences.

We are confident that our editorial board constituted by reputable staff members of different specialties and diverse expertise. The ultimate goal behind the dissemination of knowledge is to improve the patients' management and to enhance health care delivery service.

Personally, I would like to take this opportunity to thank prof. Ali S. Elwakeel for taking the arduous task in establishing the journal and special thanks are extended to the authors for their interest and encouragement.

We aspire to see the SMLJ to rank among the major resources for medical laboratory sciences and other related fields, yet this can only be achieved through your contributions and support.

Best of Wishes and Regards,

Dean Faculty of Medical Laboratory Sciences

Original Article

Sudan Medical Laboratory Journal

Effect of Using Different Levels of *Moringa Oleifera* Leaf Meal on Performance and Carcass Characteristics of Broilers

Elsiddig, A.E.A.[1]; Elobeid, E.A.E. [1*] and Amin, A.E.[2]

[1-] Faculty of Agriculture, Omdurman Islamic University ,Omdurman Sudan.
[2-] Faculty of Veterinary Medicine University of Khartoum, Shambat,Sudan.

Abstract:

The Present study was carried out to determine the effect of feeding graded levels of *Moringa oleifera* leaf meal on performance and caracas characteristics of broiler chicks. Two hundred day-old unsexed Ross chicks were allotted randomly to four treatments in a 4x5x10 arrangement. Four experimental broiler rations,(NRC, 1994), semi-isocaloric semi-isonitrogenous were formulated with ascending levels of *Moringa oleifera* leaf meal, (MOLM), replacing performed total protein content of the diet percent-agewise as 0, 2.5, 5 and 7.5% and designated as A, B, C and D respectively with ration A serving as control. Rations were allotted randomly to the four treatments. Experimental feeding was continued for 45 days on *ad libitum* basis, allowing for an initial adaptation feeding period on the control diet for one week. First three days of the adaptation week utilized the pre-starter ration. Experimental diets were then fed each to its respective group till the end of the experiment feeding period.Feed intake, body weight gain and feed conversion ratio (FCR) were recorded on weekly basis. At the end of the experi-ment, 10 birds from each group were selected randomly and slaughtered for carcass characteristics and dressing percentage.

Live weight, weight gain, FCR, weight after cleaning and dressing percentage all showed significant differences (p<0.05) except (p>0.05) for the daily and total voluntary feed intake and protein intake. In all carcass cuts, no significant differences (p>0.05) were found except (p<0.05) in the left side and neck. The present study indicated that supplementation of MOLM to broiler diets had positive effects on body weight gain, dressing percentage and carcass cuts when used up to 7.5% of the ration.

المستخلص:

اعدت هذه الدراسة لتقييم اثر استخدام معدلات متزايدة من وجبة اوراق المورنيقا اوليفيرا علي الاداء الانتاجي وخصائص الذبيحة للدجاج اللاحم. وزعت 200 كتكوت لأحم من سلالة (الروص) عمر يوم غير مجنس عشوائيًا بترتيب أربعة مجموعات لكل منهما خمسة مكررات في الواحدة 10 كتاكيت، أعدت أربعة علائق تجربيه متساوية في الطاقة والبروتين تقريبًا حسب(NRC-1995،) استخدمت فيها أوراق وجبة اوراق المورنيقا اوليفيرا بمستويات(صفر،5 .2 ، 5 ، 7.5%) وسميت (أ)، (ب) ،(ج) و (د) علي التوالي. واستخدمت العليقة (أ) كعليقة ضابطة ووزعت العلائق عشوائيا علي مجموعات التجربة واستمر الاعلاف حراً طول فترة التجربة لمدة 45 يوماً مسبوقا بفترة أقلمة علي عليقة ما قبل البادي لمدة ثلاثة أيام وباقي الاسبوع علي العليقة القياسية (العليقة الضابطة) قبل أن تتغذى الطيور على العلائق التجريبية حتي نهاية فترة التجربة. ووجبة أوراق المورنيقا أوليفيرا أزاحت البروتين الكلي في العلائق الاختبارية (ب) ،(ج) و (د) بنسبة 2.5 ،5 و7.5% علي التوالي. وتم تسجيل المأكول الطوعي والزيادة والوزنية ومعدل التحويل الغذائي علي مدار الاسابيع. وعند نهاية التجربة أخذت 10 طيور في كل معاملة عشوائيا وذبحت لإيجاد نسبة التصافي وفي معدل الأداء الإنتاجي النهائي للوزن الحي والوزن المكتسب معدل التحويل الغذائي والوزن بعد التنظيف ونسبة التصافي أظهرت جميعها تأثيراً معنوياً (ب < 0.05). أما المأكول الطوعي اليومي والكلي وكمية البروتين المستهلك لم تظهر أي تأثير معنوي (ب < 0.05) في أجزاء الذبيح ولم تسجل جميع القراءات أي فروقات معنوية (ب < 0.05) عد الشق الأيسر والرقبة.

نتائج هذه الدراسة برهنت يمكن أنه يمكن اضافة وجبة أوراق المورنيقا في علائق الدجاج اللاحم بتأثير موجب علي الأداء الانتاجي في الزيادة الوزنية ونسبة التصافي والقطع المختارة ويمكن اضافتها حتي نسبة 7.5% بدون أي تأثيرات عكسية,

Keywords: *Moringa olifera,* leaf meal,chicks performance, caracas, broiler chicks

[*]Corresponding Author: Elobeid Abdelraheim Elobeid. Email: Elobeid1954@gmail.com

Introduction

Poultry industry in the Sudan is based mainly on conventional plant protein sources produced from residues of oilseed industries as by-products namely sesame, groundnut, sun flower seed cakes and some other by-products as sorghum gluten feed and wheat bran. Sorghum, wheat bran and oilseed cakes were considered the main sources of protein and energy in Sudan (Babiker *et al.,* 2009), but now supplies are facing the problem of high prices due to continued scarcity and consequent competition between livestock and humans for available grains (Tegbe *et al.,* 1984 and Madubvike, 1988). These problems prompted researchers for finding non-conventional sources of feed and introduce new sources of low prices, high in nutrients and above all not a resource combat.

The research programs to introduce plant protein sources from leaf meals, as with *Cajanus cajan* and *Medicago sativa* , would produce relatively abundant amo-unts of low price, high content amino acids, proteins, vitamins and minerals that can fairly support poultry nutrition (Bhatt and Sharma, 2001; Muriue *et al.,* 2002 and Onyimonyi and Onu,2009). Leguminous, multipurpose trees and shrubs has been suggested to be an available alternative source of protein and the leaf meal stands for not only a source of protein but supplies poultry rations further with vitamins (as β carotenes) and more of macro and micro-minerals (D′ mello *et al.,* 1987; Esonu *et al.,* 2001).

The MOLM was recently focused as a source of non-conventional protein in animal production in the world. The tree can be easily germinated well throughout sum-mer seasons with ability to pro-duced feed. Nutrient components of the MOLM of Ca is estimated at four times that of milk, K as thrice that of bananas, Fe three times as in spin-ach, vitamin A four times as the radish and the protein and amino acids, two times as in milk (Sutherland *et al.,*1990; Makkar and Becker, 1996; Sarwatt, 2002 and Kimoron, 2002). (Ghasi *et al*. (2000) and Matthew *et al*. (2001) reported that MOLM even improved immunity in poultry.

This study was conducted to evaluate the effect of feeding diets containing graded levels of MOLM on performance, carcass and meat quality of boiler chicks.

Materials and methods:

This experiment was carried out in the Poultry Farm, Faculty of Agriculture, Omdurman Islamic University. Omdurman, Khartoum State, Sudan, during the period from January 28th up to February 27th 2012.

Preparation of MOLM: MOLM was produced by picking the leaves in the early flowering stage. Dryness took place under shade in an aerated con-dition for 3-4 days. Leaves were milled electrical-ly. The leaves powder was kept in polythene bags to protect from light and humidity until used. MOLM was proximately analyzed (Table 1) ac-cording to (**NRC, 1995).**

Table1: Proximate chemical analysis (dry matter basis) of MOLM.

Component	%
Dry matter	94.8
Crude protein	22.8
Fat	5.33
Crude fiber	16.79
Ash	8.8
Nitrogen free extract	41.17
Energy Kcal/kg *	1355.64

*(Lodhi *et al*.,1976)

Experimental ration: Other experimental components used in these study preaches from Omdurman marked. Ration formulation of experiment diets according to the (NRC. 1995). Feeding trails was a completely randomized design consisting of four dietary treatments semi –isonitrogen and semi- isocaloric A,B,C and D, treatment A serving as a control ration. Table (2) showed the sum of the % com-ponents of the ration used in the experiment.

Table 2. Percent inclusion rates of components (fresh basis) and proximate chemical composition (dry matter basis) of experimental broiler rations.

Ingredients	A	B	C	D
Sorghum	66.65	66.05	65.42	63.62
Groundnut cake	27	25.1	23.53	22.83
MOLM	0	2.5	5	7.5
Concentrate	5	5	5	5
Di ca	0.5	0.5	0.5	0.5
Shell	0.5	0.5	0.2	0.2
Nacl	0.25	0.25	0.25	0.25
Lysine	0.1	0.1	0.1	0.1
Total	100	100	100	100
Components				
Crude protein	22.85	22.25	22.05	22.07
Ether extract	4.02	3.98	3.98	4
Fiber	4.38	4.59	4.84	5.15
Ash	4.4	4.43	4.49	4.61
Nitrogen free extract	56.13	56.25	56.42	55.94
Ca	1	1	0.96	1
P	0.4	0.4	0.4	0.4
Lysine	1.19	1.2	1.2	1.23
methionine	0.37	0.37	0.38	0.7
Energy cal/kg*	3135	3096	3068	3021

*(Lodhi *et al*.,1976),

Chick of experiment:- A total of 200 Ross day old unsexed chicks were randomly distributed into 4 groups of 50 chicks. Each group was further sub-divided into 5 replicates with 10 chicks per each. The chicks of each replicate were housed in a pen (1 square meter) in an open fine wire mesh sided poultry house on concrete floor, deep litter with the roof of metal sheets. Four (treatments A,B,C and D) with level of MOLM 0.0,2.5,5 and7.5% were fed during the experiments period. Light conti-nued throughout the experiment period, feed and water were off- ered *ad-libitum*. The tempera-ture control by the observation of the chicks be-havior during the day. In the three day the chick feeding on pre –starter and using the control diet the end of the week. All chicks vaccinated against Gym-boree and Newcastle diseases on week and 15 day respectively. Added vitamins to the water throu-ghout the first 5 day and before and after vaccination temperature between 20- 23′.

Experiment data collection:

Performance values of experiment birds weekly calculated, as chicks life weight gain (g) feed in-take (g) and calculated FCR, accepted weight, to-tal protein consumed and mortality rate for exper-iment groups.

At the end of experiment birds overnight fast(except for water) two birds randomly selected from each replicate after weighing and slaughter according to the Islamic procedure to assess the impact (MOLM) inclusion in the diet on perfor-mance and carcass charact-eristics. Slaughter birds washed and then placed on cold snow water to be cold enough. Parts weight separately and recorded were expressed as % of the live weight.

Data analysis:

Data on the performance and carcass characteris-tics analysis (ANOVA) and compare mean ac-cording Duncan (1955) multiple range test and Snedecor and Cochran(1989)**.**

Results:

Observation of yellow colour covering leg, shank, beak, and skin, before and after slaughter and the colour increasing in ascending order by the level of MOLM in the diets increase and no mortality recorded in all treatment groups.

2.1. Effect of adding different level of MOLM on the chicks performance:

Table (3) average (mean±sd) values of performance (Kg) of broiler chicks fed graded level of MOLM for 45days.

Item	Treatment				F –value
	A	B	C	D	
Live weight	2.310±.07a	2.336±.09a	2.296±.09a	2.098±.10b	7.212∞
Weight gain	2.194±.07a	2.219±.09a	2.218±.09a	1.982±.10b	7.212∞
Feed intake	4.270±.10	4.340±.12	4.23±.11	4.220±.09	1.322ns
FCR	1.950±.03b	1.960±.03b	1.940±.06b	2.13±.10a	11.434∞
Protein intake	.97±.02	.96±.02	.94±.04	.93±.02	3.201ns
Feed/day	0.102±.00	0.103±.00	0.101±.00	0.100±.00	1.322ns

Mean in row followed by the same letter or no letter do not differ significantly ($p > 0.05$).

The chicks showed highly significant different (p<0.01) on the final live body weight, weight gain and feed conversion ratio. Treatment D recorded low live body weight, gain in body weight and feed conversion ratio in comparison with the other treatment groups (A, B and D) respectively. While total feed intake, protein intake and daily feed intake showed (p> 0.0 5). **2.2. Effect of adding different level of MOLM on the carcass weight parts:-**

Table (4): Average (mean±sd) values of weight of carcass parts (Kg) of broiler chicks fed graded level of MOLM for 45days.

Items	Treatments				F-value
	A	B	C	D	
Carcass weight after clean	1.464±.05b	1.616±.11a	1.553±.06ab	1.394±.12c	5.945°
Dressing%	68.6±1.42b	70.8±1.21a	69.8±1.03ab	70.7±1.47a	3.065°
Neck	0.085±.01	0.0920±.00a	0.086±.01ab	0.076±.01b	4.885°
Carcass weight after cold	1.481±.06b	1.658±.07a	1.614±.06b	1.414±.12b	9.208∞
Left side hot	0.715±.02b	0.808±.07a	0.779±.o5ab	0.683±.08c	4.412∞
Left side after cold	0.72±.02c	0.883±.05a	0.0813±.05b	0.702±.07c	8.865°

Mean in row followed by the same letter or no letter do not differ significantly (p>0.05).

Highly effected (P<0.01) carcass weight after cold and left side half cut before cold while left side half cut after cold and carcass weight after clean, dressing %, neck, also showed significant different (p<0.05). Treatment B showed high average weight on carcass weight parts and came late treatment C,A and D respectively.

Discussion

No mortality recorded, it may be due to the good environmental factors under control and water clean and feed abundance and balance in nutrients composition components this result agreement with (Yany *et al.*, 2006 and Kakenji *et al.,* 2007) whose indicating that no mortality were observed in the chicken feeding on MOLM which had antimicrobial activities and reducing the bacteria in the animal intestines and no poison substantial in the meal. (Ghasi *et al.,* 2000; Matthew *et al.,* 2001

Yany *et al* .,2006; Du *et al.,* 2007) they reported that MOLM was to enhance immune responses and improved intestinal health of broiler and their efficiency, encourages balanced metabolism healthy digestion of broiler production. (Life in heath,2, 2011) observation of yellow colour on skin ,beak and legs in the experiment birds and these mainly attributed to the presence of xanthophylls and carotenoid pigmentation in MOLM, as in the others tree and shrub leaf meal as out lined by (D Mello *et al.,* 1987Austic and Neishen ,1990; Opara ,1996; Esonu *et al.,*2001 Zanu *et al.,*2012). Chemical composition of MOLM used in table(1) was similar with reported by (Both and Wickens 1988;Kakenji *et al.,* 2003;Folid and Paull, 2008; Onu and Aneibo, 2011) the Crude protein 20-35%; fat 2.3-6.4%; crude fiber 13-22.5%; ash 7.13- 14.17% nitrogen free extract 38.2-47.25%

and dry matter 76.53-92.5%. While contract in dry mater % (94.8%)and energy 1355.64kcal/ kg, the % of energy as recorded by Odura *et al*., 2008 and Onu and Aneibo,(2011),1440; 1296kcal/kg respectively. The differences may be attributed to the of environment factors, different stage of harvesting, storage environment and during the preparing sample in the lablotary for analyses and these agreement with (Yadav and Sehgal, 1997and Yang *et al* ., 2006) in the procedure of leaf meal dryness as recorded.

These increasing effect (P<0.05) of broiler performance in the treatments A,B and C while treatment D with 7.5% MOLM recorded the lower performance due to a high fiber content which effect the digestion, absorption and metabolism of nutrients in the intestinal of the birds and reduce the FCR and these similar with (Aderemi,2003; Onu and Otuma, 2008; Onu,2010). While low live weight of treatment D with high level of protein in the diet return to the effect of anti-nutritional factors as recorded by Kakengi *et al*, (2003). Esonu ,(2001) mention in the study of MOLM contain 1.23(g/kg) tannin and tannin interaction with protein poi logical and less degree with carbohydrate and fat. Low feed intake in group D return to up normality of abetted and testing of MOLM which stop the birds of taking the abundance amount of feed to reached optimizing stat of satisfactory, these agreement with (Kakengi et al,2003) in their studies on the other plants used as leaf meal which mention in the study by (Tangendjaja et al., 1990 ;North.,1990).

High level of protein and energy in the diet with level of MOLM 2.5% ,5% which containing high amount of nutrients content as Fe; Cu; P; Mg; and vitamins as A; C; Thaimin ; Riboflaffen and some amino acids these diets well metabolizable nutrients and increasing the efficiency of body performance of the birds and these inline with (Booth and Wickens .,1988; Makker and Becker.,1996; Fuglie 2000; Kakenji et al., 2003; Oduro et al., 2008; Folid and Paull.,2008; Onu and Aniebo., 2011; Suad, 2012; Zanu et al., 2012).

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Assessment of Serum Chromium and Zinc Levels in Patients with Chronic Renal Failure

Fayza A Rahamtalla[1*], Alaa A Abdeen, Hiba F Omer, Maha A Mohammed, Zehoor I Ali, Maali Ahmed

[1]Omdurman Islamic University, Faculty of Medical Laboratory Sciences, Department of Clinical Chemistry

Abstract

Background: Chromium (Cr) and Zinc (zn) are very important in human nutrition. Many researchers reported that serum chromium and serum zinc are impaired in patients with chronic renal failure,(CRF).

Objectives: This study aimed to assess chromium and Zinc in chronic renal failure patients. **Materials and Methods:** This study was conducted at Khartoum state during November 2017 to May 2018.The study enrolled 35 patients with CRF and 40 healthy controls. Serum Chromium and Zinc levels were estimated using Atomic absorption spectrophotometry, (AAS), technique. **Results:** the current study demonstrated a highly significant a lower level of Cr in patients in contrast to healthy controls, (0.032 versus 0.147 mg/dl; *respectively*, P<0.001), and also of Zn level in patients as compared to healthy controls (0.165 versus 0.564 mg/dl; *respectively*, P<0.001). In contrary, the level of both Cr and Zn were significantly higher after dialysis as compared to their levels, before dialysis (0.137 versus 0.032 mg/dl; *respectively*, P<0.001) and (0.253 versus 0.165 mg/dl; *respectively*, P<0.001) for Cr and Zn, r*espectively*. **Conclusion**: The present study revealed that, Zn and Cr levels decreased in CRF patients and increased after dialysis.

Key words: Trace elements. chronic renal failure. dialysis. Atomic absorption spectrophotometer.

*Corresponding author: fayzarahamtalla2015@gmail.com Tel: 00249913606668

Introduction

Essential trace elements are involved in a number of metabolic activities including neuron conduction, transport and excretory processes [1]. They play a vital role in cellular metabolism and the maintenance of homeostasis, acting as key cofactors for enzymes. Patients with CKD are potentially at risk of both essential trace element deficiencies, but also toxicity due to the failure to excrete other non-essential elements[2]. The kidney is a target site for element toxicity, and the cells of the proximal renal tubule have an important role in the hemostasis of the essential elements[3]. The trace elements are usually associated with enzyme or other protein as an essential component or cofactor[4]. Multiple factors such as malnutrition, alcoholism, increased requirements and many diseases such as sickle cell anemia and renal diseases, which affect the concentration of trace elements in body fluids[5]. The Kidney is an essential organ in hemostatic function. It is a regulatory organ for dietary intake and excretion. Those mechanisms responsible for the trace element disturbances found in renal failure patients are probably multiple and multi-factorial[3]. There are about one million nephrons per kidney, each of which is made up of five main functional segments. When the kidneys are damaged this affects the normal functions such as chronic renal failure (CRF)[6].

Chronic renal failure is characterized by progressive scarring that affects all infra-structures of the kidney. The relentless progression of CKD is postulated to result from a self-perpetuating vicious cycle of fibrosis activated after initial injury[7]. In patients with renal failure, uremic symptoms, uncontrolled hyper-kalemia, and acidosis have traditionally been indications that the kidneys are unable to excrete the body's waste products and a substitute method in the form of dialysis was necessary[8]. Because the dialysis fluids which are used in the different dialytic treatments contain variable amounts of trace elements, so that dialysis contributes to an increase in many trace elements[3]. The objective of this study was to measure serum chromium and Zinc in chronic renal failure patients. Materials and Methods

This is a case controlled study, cond-ucted in patients in Khartoum State within the period from November 2017 to May 2018. Venous blood samples (3ml pre and post dialysis) were collected from 35 patients diagnosed with chronic renal failure. The patients ranged from 19 to 78 years (age 45.34 ± 16.72 years), besides 40 healthy controls, who ranged from 19 to 78 years, were randomly selected from healthy volunteers during the same period. The diagnoses were based on ultra sound, renal function tests, biopsy and history.

Informed consent was obtained from each participant and the study was approved by the Ethical Committee of

Omdurman Islamic University and conducted accordance with the international ethical guidelines.

Data collection

A structured questionnaire was used to obtain de-

mographic data (age, gender and tribe). Blood samples (5 ml) were collected from all patients and controls. Samples were centrifuged for 10 min at 3000× g at 4 °C. Serum was stored at - 20 °C until analysis.

Methods

Estimation of zinc and chromium levels:

Serum Chromium and Zinc levels were estimated using atomic absorption spectrophotometer. The serum waa diluted (1:4), then atomized and vaporized, the atom aborted light and spectrophotometer read the amount of absorption and gave levels of Zn, Cr.

Statistical analysis

Statistical analysis was performed using statistical software package. Student's t test was applied to identify where significant differences lay. Correlations between variables were evaluated by Spearman's correlation coefficient. The results were expressed as means $\pm$ standard deviation. Significance was set at $P < 0.05$.

RESULTS

Compression between level of serum chromium and zinc in patients and controls:

Statistical analysis indicated that mean levels of chromium (0.032 ± 0.010) and zinc (0.165 ± 0.052) were significantly lower in patients compared with Controls (0.147 and 0.564) ($P<0.001$) as shown in (Table 1)

Comparison between the level of chromium and zinc in patients before and after dialysis

The mean levels of chromium (0.137) and zinc (0.253) were significantly higher after dialysis as compared to that before dialysis (0.032 and 0.165), ($P<0.001$) (Table 2).

Correlation between chromium level, zinc level and other studied variables

An insignificant correlation was found between the mean of chromium level and age, gender, duration of disease and medication. The same result was found for zink. While significant correlation ($P<0.05$) was found between the mean of chromium level and the levels of zinc. On the other hand, positive and significant ($P<0.05$) relationships was found between levels of chromium and zinc (Table 3). The result showed that, for each one unit increase in zinc level, chromium level increased by 0.074 (data was not shown).

Table 1: Comparison between level of chromium and zinc in patients   and controls

Variables	Patients	Controls	P. value
Chromium (mg/l)	0.032	0.147	**0.001**[**]
Zinc (mg/l)	**0.165**	**0.564**	**0.001**[**]

** Significant correlation at 0.001

Table 2 :Level of chromium and zinc before and after dialysis

Variables	Before dialysis	After dialysis	P. value
Chromium (mg/l)	0.032	0.137	**0.001**[**]
Zinc (mg/l)	**0.165**	**0.253**	**0.001**[**]

** Significant correlation at 0.001

Table 3: Correlation between chromium level , zinc level and other studied variables (age, gender, duration and medication).

Variable		Chromium	Zinc	Age	Gender	Duration	Medication
Chromium (mg/l)	**r**	1	0.371[*]	-0.085[ns]	-0.029[ns]	-0.043[ns]	**0.004**[ns]
	P		0.028	0.629	0.870	0.805	**0.981**
Zinc (mg/l)	**r**	0.371[*]	1	0.008[ns]	0.105[ns]	-0.145[ns]	**.214**[ns]
	p	**0.028**		**0.963**	**0.549**	**0.406**	**0.232**

* Significant correlation at 0.05, ns: No significant correlation.

DISCUSSION

The changes in body composition in chronic hemodialysis patients before and after hemodialysis have been reported [3]. In the present study, zinc (Zn) level decreases significantly (P.<0.001) in patients with chronic renal failure more than control (0.032 versus 0.147). In renal failure, patients have disturbances in acid base balance leading to acidic blood pH, therefore low zinc levels in these patients are believed to be due to the shift of zinc into red cells under acidic conditions. In addition to that zinc present in serum is combined with plasma proteins, especially with albumin. Proteinuria in renal failure leads to excessive excretion of zinc[3]. On the other hand, the present study found that Zn level was significantly increased after dialysis, this results agrees with Hosokawa *et al*., in 1985[9], who found that serum zinc concentration increases `after dialysis.

In contract most of authors reported low Zn concentration in the serum of patients undergoing hemodialysis (HD), Dvornic *et al*., 2006 [10] and Neto et al., 2016 [11] found that 78% of patients on HD had low plasma Zn concentration. That may be due to three different reasons: changes in elements reser-

voirs in the body, decreased absorption by gastrointestinal tract, dialysate composition which gave the osmolarity difference, allows abundant Zn excretion during the filtration process. Also Toneli *et al.,* 2009 [12] reported that Hemodialysis patients have lower level of Zn than people in the general population and Zn deficiency is a leading cause of diseases in developing countries.

Also the present study found that chromium (Cr) level decrease significantly (P.V<0.001) in patients with chronic renal failure more than control (0.165 versus 0.564), this result disagree with Haese *et al.,* in 1996 [13] who had reported that serum Cr concentration increased in CRF patients compared with those subjects with normal renal function and referred that to Cr, which enters the body via the dialysis fluid. On the other hand, the present study found that Cr level was significantly increased after dialysis. That increased Cr levels in dialysis population are of clinical significance, which is not clear, nor is it elucidated, if the increased serum Cr in the patients is accompanied by an increase in body burden of the element. Furthermore, Minami *et al* in 1986[14] had found that chromium tended to decrease during dialysis, when chromium level in the dialysis fluid was measured, it was significantly higher than before dialysis, This result showed that chromium was transported from serum to the dialysis fluid. After 1 hour when measured chromium level in serum presumed the increase.

once more.

Conclusion

The current study demonstrated that, Zn and Cr levels decreased in CRF patients and increased after dialysis.

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Assessment of Albuminuria, Estimated-Glomerular Filtration Rate and Uric Acid as Markers for Chronic Kidney Disease among Family Members of Sudanese Renal Failure Patients on Hemodialysis

Abozaid M Hamid [1*], Amar M Ismail [2], Maha I Mohammed [3]

1. Department of clinical chemistry, faculty of medical laboratory science, OIU
2. Department of Biochemistry & Molecular biology, faculty of science, Alneelain University
3. Department of Medical Biochemistry, faculty of Medicine & Public health, Alneelain University

ABSTRACT

Background: Chronic kidney disease (CKD) is a global public health problem that increased rapidly throughout the world, and it was recommended that it should be discovered earlier especially among high risk population. **Objective:** To assess albuminuria, estimated glomerular filtration rate (eGFR) and uric acid as markers for CKD among first degree relatives (FDRs) of hemodialysis patients. **Materials and methods:** This is an analytical, case control study conducted at Khartoum state during May 2015 to May 2018, targeting 135 FDRs of end stage renal disease (ESRD) Sudanese patients on hemodialysis and other 161 healthy individuals serving as control group. Their plasma was prepared and analyzed for creatinine, uric acid, calcium, phosphate, and alkaline phosphatase. Also spot random urine sample was collected and analyzed for creatinine and micro albumin, from which albumin to creatinine ratio (ACR) was calculated. The plasma parameters were analyzed by Mendray BS 200 auto analyzer, while urine parameters were analyzed by using Cobas auto analyzer. **Results:** The mean levels of ACR and urine micro albumin were significantly increased while the mean levels of e-GFR and urine creatinine were significantly reduced in FDRs when compared to control group (The means ± SD were: 10 ± 4.4, 123.1 ± 68.2, 93.1 ± 25.6 and153.3 ± 115.3 versus 0.92±0.10, 14.9±2.05, 99.4±22.5 and 190.3±108.8, the p values were: 0.024, 0.001, 0.027 and 0.005 respectively). But there were no significant differences between means levels of calcium, phosphorus, uric acid and alkaline phosphatase when compared in FDRs versus control group. The correlation analysis showed significant positive correlation of serum uric acid with serum creatinine(r= 0.587, P value = 0.000). **Conclusion:** Albuminuria which was detected by ACR was significantly increased among FDRs of hemodialysis patients, while the eGFR was reduced, hence they are prone to develop CKD.

Key words: Chronic kidney disease, Albuminuria, ACR, eGFR, FDRs, Uric acid

Corresponding author: Abozaid Mohammed Hamid, email: elemam69@hotmail.com

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Introduction:

Chronic kidney disease (CKD) is a global public health problem [1], that increasing rapidly worldwide [2]. The estimates are that CKD affect more than 50 million people including over 1.1 million having ESRD, with an addition of 7% annually [2], [3]. Screening surveys performed in the United States, Europe, Australia, Asia, Japan and China, showed that, the prevalence of CKD ranged between 6 -11%. The prevalence of CKD in developing countries is scarce, and there are no reliable statistics of the prevalence of CKD in the majority of African countries [4], [5]. In Sudan, as it reported by Hassan Abu Aisha in his pilot study at 2009 the prevalence range was 7.7 - 11% [4]. It was recommended that; the CKD should be discovered earlier, through renal functions assessment, using newly adopted estimated glomerular filtration rate (eGFR) and measurement of albuminuria especially at high risk individuals to prevent its progression to ESRD [6], [7], [8].

Several studies showed that there was positive screening for CKD among genetic relatives of patients in hemodialysis, also it was demonstrated that; the presence of a family history of ESRD was a risk factor for developing CKD [9], [10]. This study was focused on immediate family members of hemodialysis patients, having family history of ESRD to evaluate their renal status in order to detect the presence of CKD focusing on albuminuria, e-GFR and uric acid which fulfilled many criteria for validated biomarker in CKD, and observational data indicated a relationship between serum uric acid and CKD prevalence and progression [11].

Materials and Methods

Study design and study subjects:

This is an analytical case control study, established at Khartoum State, between May, 2015 and May, 2018. including 135 individuals of first degree relatives of Sudanese patients with chronic end stage renal failure on hemodialysis attending different dialysis centers, and other 161 healthy volunteers that matched for, age and gender served as a control group. All participants with ages ranged between 17- 60 years were included in this study. Participants having diabetes, hypertension, cancer, thyroid dysfunction, some undergoing glucocorticoid or thyroid hormone therapy, HIV infection, pregnancy, and of age more than 60 years were excluded from this study. The individuals were requested to fill a questionnaire, which includes some personal and medical information. The height in cm, weight in kg was measured for them, and then the BMI was calculated. The participant was considered to have CKD, if he showed albuminuria level (ACR>30mg/gm) and/or e-GFR less than 60 ml/min/1.73m^2.

Ethical approval:

The study was approved by the Medical Research Committees of Alneelain University and by the Training and Research Committees at the Ministry of Health in Khartoum State. The aim of the study was explained to all participants then verbal and undersigned consent was taken.

Specimens Collection & Lab measurements:

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A five ml of venous blood was collected from each volunteer by venipuncture technique, using sterile disposable syringe, and then was drained into plain blood vacutainer, the plasma was obtained and used for measurement of creatinine, calcium, phosphate, uric acid and alkaline phosphatase, which were measured by Mind ray BS200 auto analyzer. Also about 20 ml of midstream single random urine sample was collected for creatinine and micro-albumin measurement, which were measured by Cobas auto analyzer, then albumin-creatinine ratio(ACR) was calculated by Medic al [®] Scy med calculator, and expressed in mg/gm, ACR >30mg/gm was considered as positive for albuminuria. e-GFR was calculated by MDRD and CKD-EPI equations (reduced GFR was detected when eGFR<60 ml/min/1.73m^2). Uric acid level more than or equal 7mg/dl was considered increased.

Statistical analysis:

Descriptive statistic was used to show the demographic data for study population, which were presented in form of frequencies, percentages and (Mean ±SD). Student t. test was used to compare between the two means. Correlation analysis was used to detect the association between uric acid on one side and ACR, eGFR and creatinine on the other side. The level of significance was detected when the p value was ≤ 0 .05. The analysis was performed using SPSS software program version 21.

Results:

Two hundred and sixty nine individuals participated in this study. 135 individuals were first degree relatives (FDRs) of Sudanese patients with ESRD on hemodialysis and other 161 individuals resembled the healthy control group. Table 1 shows the demographic data for FDRs and control group, table 2 shows the comparison of biochemical parameters means between family members and control group in which urine micro albumin, urine creatinine, ACR and GFR-EPI showed significant differences between FDRs and the control group, with means ± SD:(123.1 ± 68.2), (153.3 ± 115.3), (10 ± 4.4), and (93.1 ± 25.6) for FDRs versus (14.9 ± 2.05), (190.3 ± 108.8),(0.92 ± 0.1) and (99.4 ± 22.5) for control group, and the p. values were 0.001, 0.005, 0.024 and 0.027 respectively. But there are no significant differences between means levels of calcium, phosphorus, uric acid and alkaline phosphatase when compared in FDRs versus control group. The correlation analysis showed significant positive correlation of serum uric with serum creatinine (r = 0.587, p = 0.000) and insignificant positive correlation with ACR and e-GFR.

Table 1: Characteristic and demographic data for family members of hemodialysis patients and the control group

Variables	FDRs (n = 135)	Control (n = 161)
	Frequency (%) or (Mean ± SD)	**Frequency (%) or** (Mean ± SD)
Gender: N (%)		
Male	49 (36.0%)	85 (52.8%)
Female	86 (64.0%)	76 (47.2%)
Age : (Mean ± SD)	(32.27 ± 14.4)	(32.65 ± 13.5)
Origin: N (%)		
North	42 (31.1%)	17 (10.6%)
West	17 (12.6%)	78 (48.4%)
East	8 (5.9 %)	7 (4.3%)
Central	68 (50.4 %)	59 (36.4 %)
Education level: N (%)		
Primary	20 (14.8 %)	60 (37.2 %)
Secondary	48 (35.6 %)	50 (31.1%)
Graduated	67 (49.6%)	51 (31.7 %)
Smoking: N (%)		
Smokers	8 (5.9 %)	7 (4.3 %)
Non smokers	127 (94.1 %)	154 (95.7 %)
BMI: (Mean ± SD)	(25.9 ± 6.62)	(23.7 ± 5.5)
Albuminuria: N (%)	23 (17 %)	7 (5 %)
Uric acid ≥ 7 mg/dl	14 (10.4 %)	17 (10.6 %)
Uric acid < 7 mg/dl	121 (89.6 %)	144 (89.4 %)
Estimated - GFR: N (%)		
≤ 60 ml/min/1.73m2	6 (4.4 %)	4 (2.5 %)
> 60 ml/min/1.73m2	129 (95.6 %)	157 (97.5 %)

Table 2: Comparison of biochemical parameters between family members of hemodialysis patients and control group

Parameters	Relatives (Mean ± SD)	Control (Mean ± SD)	*P-value*
ACR (mg/mmol)	10.0 ± 4.4	0.92±0.10	0.024
ACR (mg/gm)	88.8 ± 4.4	65.6 ± 7.2	0.036
U. microalbmin	123.1 ± 68.2	14.9 ± 2.05	0.001
U. Creatinine	153.3 ± 115.3	190.3 ± 108.8	0.005
Serum creatinine	0.94 ± 0.58	0.89 ± 0.20	0.269
Serum uric acid	4.68 ± 1.64	4.84 ± 1.51	0.407
Serum calcium	9.48 ± 1.5	9.56 ± 0.98	0.626
S. phosphate	3.55 ± 0.82	3.56 ± 0.83	0.924
ALP (U/L)	115.1 ± 73.8	130.1 ± 104.5	0.150
GFR- MDRD	85.1 ± 24.3	89.6 ± 22.7	0.104
GFR – EPI	93.1 ± 25.6	99.4 ± 22.5	0.027
Cr.C (ml/min)	102.3±35.5	100.1 ± 29.2	0.565

Table 3: Comparison of means of ACR, GFR and serum creatinine based on uric acid levels among patients relatives and control group

| Parameters	Patients relatives		*P-value*
	Uric acid <7 (mg/dl) (Mean ± SD)	Uric acid >7(mg/dl) (Mean ± SD)	
ACR (mg/gm.)	18.15 ± 14.57	18.86 ± 15.58	0.920
ACR (mg/mmol)	9.76 ± 5.2	12.60 ± 4.29	0.845
GFR- MDRD	85.1 ± 24.4	85.29 ± 23.7	0.976
GFR - EPI	93.41 ± 25.8	90.79 ± 24.1	0.718
Serum creatinine	0.86 ± 0.18	1.10 ± 0.23	0.000
Control group			
ACR (mg/gm.)	8.60 ± 6.82	3.45 ± 2.39	0.000
ACR (mg/mmol)	0.97 ± 0.93	0.40 ± 0.26	0.098
GFR- MDRD	89.6 ± 23.11	89.1 ± 19.42	0.938
GFR - EPI	99.8 ± 22.94	94.4 ± 18.46	0.372
Serum creatinine	0.94 ± 0.61	0.99 ± 0.15	0.770

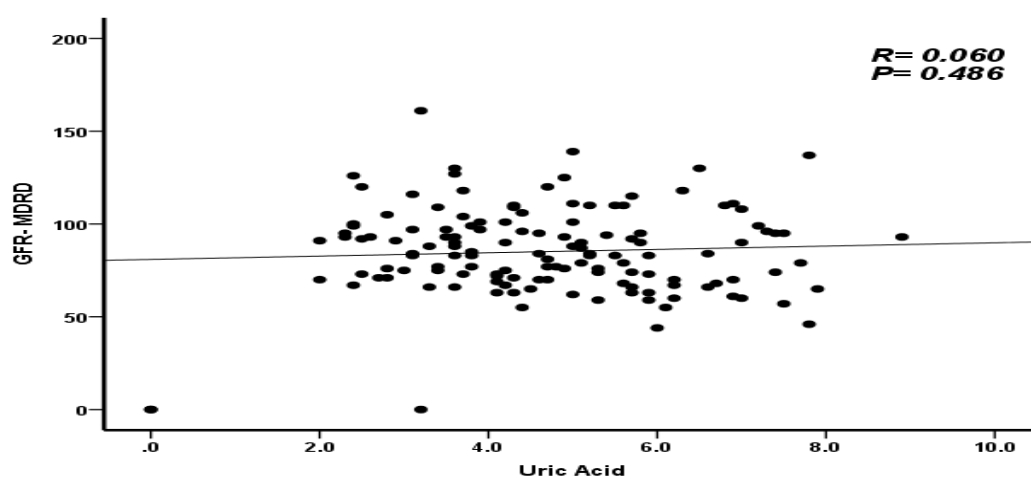20
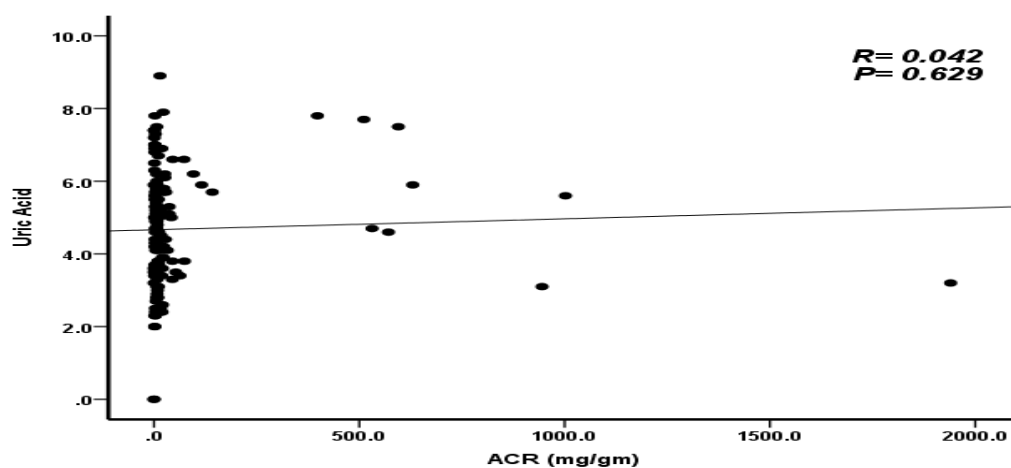
Figure (1): Correlation between serum uric acid and ACR

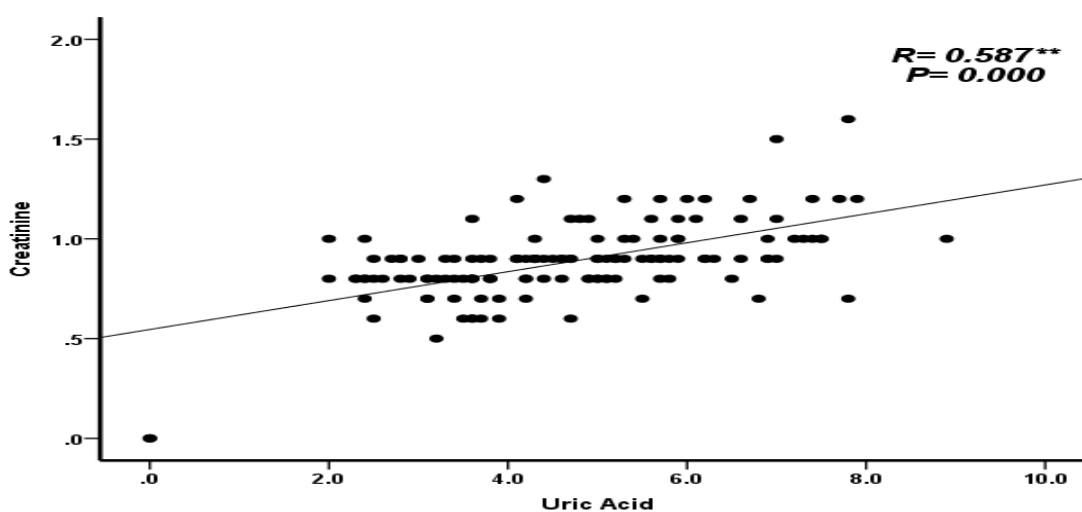**Figure (2): Correlation between serum uric acid and estimated-GFR**

Figure (3): Correlation between serum uric acid and serum creatinine

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DISCUSSION

In this study high prevalence of albuminuria (17%) was detected among FDRs against (5%) in control group. On the other hand the comparison of some biochemical parameters (ACR, urine creatinine and micro albumin, eGFR, serum creatinine, serum calcium, serum phosphate and serum alkaline phosphatase means between FDRs and control group showed significant differences. ACR and urine micro albumin were significantly increased while e-GFR and urine creatinine were significantly reduced among FDRs, these differences are considered to be logical and consistent with the information that is proven to indicate that these markers are affected among high risk groups to indicate presence of CKD, and many studies have shown that these parameters were affected by either increased or decreased as appropriate [12], [13].

The high prevalence of albuminuria and increase level of ACR which indicate the albuminuria was reported by different studies that targeting FDRs of CKD patients, such as study of Jer Chia Tsai, 2010 who reported high prevalence (10.7%) of albuminuria in hemodialysis relatives versus (4.1%) for control group [14], and Y R Raj who reported very high prevalence of albuminuria which is actually detected by increased level of ACR among 230 FDRs individuals [15]. This study goes in this direction and reported 17 % prevalence of albuminuria in FDRs compared to 5% for control group. On the other side the e-GFR showed significant decrease among FDRs, this is also in agreement with Y R Raj [15].

Although the uric acid is considered as important factor in progression of CKD among high risk groups, as it affect the kidneys by different mechanisms including: pre-glomerular arterial disease, renal inflammation and hyper tension and induction of proinflammatory cytokines. But this study showed no significant difference in the mean level of uric acid between FDRs and control group, no similar study assesses uric acid in FDRs, but to somehow this finding was in agreement with Kang D H et al, who found no association between uric acid and CKD. [16] Contrary to some studies that demonstrated this association in diabetics, normal, and hypertensive individuals, most of these studies found that hyper-uricemia to be an independent predictor for incidence CKD [17], [18], [19]. However the mean levels of ACR, GFR and creatinine in both FDRs and control group were compared based on uric acid levels which were divided into increased uric acid level (uric acid $\geq$ 7mg/dl) and not increased level (uric acid < 7mg/dl). Based on this division the serum creatinine mean level was significantly increased in case of increased uric acid (mean $\pm$ SD: 1.1 $\pm$ 0.23 vs. 0.86 $\pm$ 0.18 and the P.value = 0.00), but the mean levels of ACR was insignificantly increased, on the other hand the GFR was insignificantly reduced in case of increased uric acid level. Moreover among FDRs the correlation analysis showed significant positive correlation of serum uric with serum creatinine and insignificant positive correlation with ACR and e-GFR. These findings were in agreement with several studies that targeting other high risk groups

rather than FDRs, which demonstrated increased level of serum creatinine and ACR and reduced GFR, when they compare the means according to uric acid levels, these studies include study of international society of nephrology in Taiwan that showed significant correlation of serum uric acid with urinary ACR and calculated creatinine clearance and detected significant increase uric acid in diabetics with micro and macro albumin-uria(20).

Conclusion:

In conclusion the ACR was significantly increased among FDRs of Sudanese ESRD patients while e-GFR was reduced, and there was a positive significant correlation of uric acid with creatinine, these finding confirm that; the FDRS at risk and should be monitored for CKD.

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Evaluation of Iron Profile in Sudanese Patients with Cardiovascular Disorders under Multiple Transfusions

Salma Yassin Eltayeb [1], Nasr Eldeen Ali Mohammed Gaufri[1]*

1. Department of Hematology, Faculty of Medical Laboratory Sciences Al-Neelain University, Khartoum, Sudan.

Abstract

Background: iron overload is the most common complication in patients who revived multiple red blood transfusions to correct the anemia.

Objective this study aimed to evaluate the iron profile (serum iron, ferritin, total iron binding capacity (TIBC) and transferrin saturation percentage) in Sudanese patients with cardiovascular disorders, who revived multiple red blood transfusions.

Material and methods this was a case control study conducted during August 2015, in Alneelain University, Faculty of Medical Laboratory Science. A total of 100 participants were enrolled in this study, 60 were Sudanese patients diagnosed with cardiovascular disorders and who received multiple blood transfusions at Alshaab Teaching Hospital Khartoum, Sudan; their mean age was (50.6 ± 12.7) years, designated as a patient's group. Other 40 subjects were normal healthy who received no blood transfusions as control group; their mean age was 45.5 ± 11.4 years. Venous blood was collected from all participants, and then the serum was prepared from clotted blood. The iron profile (serum ferritin, serum iron and total iron binding capacity) was carried out using automated chemical analyzer (MINDRAY BS 200-China).Data were analyzed employing statistical package for social sciences (SPSS) version 20. The p value less than 0.05 was considered significant.

Result this study showed that the serum iron and serum ferritin were statistically significantly higher while the TIBC and transferrin saturation percentage were statistically significantly lower in cardiovascular patients who received regular blood cell, compared with those normal ho received regular packed cell with *p value* (0.01,0.04,0.04 and 0.04) respectively.

Conclusion iron overload was present in Sudanese cardiovascular patients who received no multiple blood transfusion compared to those normal who received no blood cell.

Keywords: Serum iron; ferritin; total iron binding capacity; TIBC, iron overload; regular blood transfusion; cardiovascular disorder.

*Author for Correspondence: Nasralimohammed@yahoo.com/

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Introduction

Iron is an essential element that forms an important component of metabolic and biological processes, but when present in excess, it can produce tissue damage due to oxidative stress [1]. Iron concentration is tightly regulated. Iron overload during iron deposition in multiple organs is along with serum ferritin value over 1000 µg/L [2]. That value is, either genetically or acquired, and may occur by several conditions such as frequent transfusions, abuse consumption of iron (often as supplement) and chronic hepatitis has a potential to cause acquired iron overload [3,4].

Hereditary hemochromatosis is the most common genetic cause of iron overload. Small intestine in patient absorbs high level iron which accumulates in liver, pancreas and some parts of brain which impairs vital functions[5].Free radical production due to iron overload causes serious complicated side effects such as mental retardation[6], impotence, infertility [7] and cardiac dysfunction [8]. Anemia is associated with worse outcomes in patients who have both acute and chronic cardiovascular disease, but it is unclear whether this association is causal or whether correction with red blood cell transfusions modifies this relation [9,10,11,12]. Anemia decreases the oxygen content of the blood supplied to the myocardium and may increase myocardial oxygen demand because a higher cardiac output is required to maintain adequate systemic oxygen delivery [13].The heart extracts a high proportion of the oxygen supplied through the coronary arteries, and therefore this circulation is potentially at higher risk from the combination of atheroma related flow limitation and anemia. Hypotension, tachycardia, and the requirement for catecholamine use (for example, during critical illness or major surgery) can further compromise the balance between oxygen supply and demand, resulting in myocardial injury. This has been termed type 2 myocardial infarction [14]. The release of troponin, a biomarker of myocardial injury, is associated with higher mortality in critically ill and perioperative populations [15, 16, 17].

Material and method:

This is a case control study conducted during August 2015 in Alneelain University, Faculty of Medical Laboratory Science. A total of 100 volunteers were selected for this study 60 were Sudanese patients with cardiovascular disorders received multiple blood transfusions at Alshaab teaching hospital Khartoum, Sudan; their mean age were 50.6 ± 12.7 years designated as patients group. Further 40 subjects were normal healthy non received blood transfusions; their mean age was 45.5 ± 11.4 years. This study was approved by Alshaab teaching Hospital for cardiovascular disorders, and Alneelain university ethical committee. The consent was also taken from every participant before the samples were gathering. Patients who received less than three bags of blood cells, or regular blood with iron chelating were excluded from this study. Five ml of venous blood were collected from all participants, and then the serum was prepared from collated blood. The iron profile (serum ferritin, serum iron and total iron binding capacity were done using Automated chemical

analyzer (MINDRAY BS200-China)) then transfusion saturation percentage was calculated. Data were collected by direct questioner and analyzed by using statistical package for social sciences (SPSS) version 20. T. test and ANOVA test were used from comparison of mean between different study groups, while correlation between quantitative variables was assessed with Pearson's correlation. *P.value* considered significance if less than 0.05

Result:

A100 Sudanese subjects were enrolled in this study; 60 were cardiovascular patients attended to Alshaab teaching Hospital, cardiology center for packed red blood transfusion .Further 40 normal volunteer non red blood transfusion were set as control groups.

The current study revealed that the serum iron and serum ferritin were statistical significant higher in cardiovascular patients who received multiple packed cell compared with control group (*P.value* = 0.01 and 0.04 respectively (Table 1).

The present study showed that the total iron binding capacity and transferrin saturation percentage parameter was statistically significantly lower in cardiovascular patients who received multiple packed cell in comparison with those normal non received multiple packed cell with *P. value* 0.04 (Table1).

Table1: Comparison of iron profile in study groups.

parameters	*Transfused patients*	*Normal non transfused*	*P. value*
Serum iron	129.9±66.1	95.9±53.8	0.01
serum ferritin	49.7±48.4	34.3±19.8	0.04
TIBC	167.7±96.4	209.0 ±100.4	0.04
S %	25.44±17.94	45.21 ±25.64	0.04

P.value considered significance if less than 0.05

The present study showed no statistically significant correlation between each of serum iron, serum ferritin, TIBC and transferrin saturation percentage and patients' age (*P.value* = 389, 0.278, 0.792 and 0.067) respectively (Table 2).

Table 2: Correlation between iron profile and patients age

parameter	Correlation coefficient	Age
Serum iron	Correlation coefficient	0.133
	P value	0.389
Serum ferritin	Correlation coefficient	0.142
	P value	0.278
TIBC	Correlation coefficient	0.130
	P value	0.792
S %	Correlation coefficient	0.275
	P value	0.067

In this study the correlation results between the study parameters and the number of bags received by the patients showed that no significantly correlation with serum iron, (*P value* 0.147), serum ferritin, (*P value* 0.132) and with TIBC (P value 0.563) as shown in (Table 3).

Table 3: Correlation between serum iron, ferritin and TIBC and the number of bags blood received.

parameter	Correlation coefficient	Number of bags
Serum iron	Correlation coefficient	0.189
	P value	0.147
Serum ferritin	Correlation coefficient	0.196
	P value	0.132
TIBC	Correlation coefficient	0.076
	P value	0.563
S%	Correlation coefficient	0.278
	P value	0.005

P.value considered significant if< 0.05

Discussion

Anemia is common in patients with hrt disease. It is present in approximately one third of patients with congestive heart failure (CHF) and 10% to 20% of patients with coronary heart disease (CHD) [18-19]. Iron overload is the accumulation of excess body iron in different organs [20]. Besides being a crucial component of hemoglobin with a key role in erythropoiesis, oxygen transportation and storage, iron also has further important functions as part of several enzymatic systems and metabolic processes [21] to prevent of anemia occurs due heart weakness we need frequent red blood cell transfusion and EPO therapy, due to blood transfused and EPO therapy to lead of iron over load [22]. Among serum iron markers, serum ferritin is most commonly used as an indirect estimate of body iron store. However, reliance on ferritin alone can lead to an inaccurate assessment [23]. The literature reported the percentage of patients who received of blood as corrected an anemia were wide in range ,in the United States,

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7.8% to 92.8% of adults undergoing cardiac surgery are transfused[24,25].This study aimed to the evaluation the serum iron, ferritin, TIBC and transferrin saturation percentage in Sudanese patients with cardiovascular disorders received multiple red blood transfusions regardless the causes cardiac disease.The present study revealed that the iron profile (serum iron, serum ferritin) were statistically significant higher and (TIBC and transferrin saturation percentage) significant lower in patient with chronic cardiovascular disorders received multiple blood transfused compared with those normal healthy control group. These findings were in agreement with Gujja P *at el* (2010) and Murphy, Oudit (2010), who concluded that iron overload has been found, resulting from the accumulation of iron in the myocardium mainly because of genetically determined disorders of iron metabolism or multiple transfusions[26,27].Our finding support that the iron overload were occurred in many disorders as result of in transfusion-dependent patients such as, those with thalassaemia major, sickle cell disease ,myelodysplastic syndromes and chronic renal failure [28,29,30].

The current study showed that there is no significant correlation between thenumber of transfusion bags with serum iron and serum ferritin levels. These findings were in contrast of abd alla *et al* (2016) in Sudanese patients and with study by Rerambiah *et al* in (2015) who reported a positive correlations between the number of transfusion bags and serum iron as and serum ferritin, and this different might be attribute to the small number samples size in our study [31, 32].In agreement with study published by abd alla *et al* showed that there is statistical significant correlation between iron profile and patients' age [31].

Conclusion

The present study concluded that multiple blood transfusions for cardiovascular patients increased the levels of serum iron and serum ferritin and decreased total binding capacity, and we recommended that the iron chelation therapy should be used to prevent the accumulation of iron in the patient who received multiple blood transfusions.

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O*riginal* A*rticle*

Sudan Medical Laboratory Journal

Determination of HCV genotypes and viral loads in chronic hepatic Sudanese infected patients

Mohammed E. H. Ournasseir[1*],Alfadel Al Obaid Omer [2],Haitham E Elawad[1,] ,NajemAldin M. Osman[1], Khalid Mohammed Khalid Al Hussain[1], Abdulazeem abdulsalam I Alkhidir[1].

[1]Department of Microbiology, Medical Laboratories Sciences, Omdurman Islamic University, Omdurman, Sudan
[2]Department of Microbiology, faculty of medical laboratory sciences, University of Science and technology.

Abstract

Background. Knowledge of Hepatitis C virus (HCV) genotypes is significant for arranging treatment regimes. Quantitative HCV RNA testing provides prognostic data useful in monitoring the efficacy of antiviral therapy.

Methods. A total of 1203 serum samples were collected from individuals attending out-patients units at Khartoum State and Gezera State. The study population comprises two groups. Blood donors study groups (n= 600) and chronic hepatic patients during the course of HCV infection (n= 603). Serum samples were screened using enzyme linked immune-sorbent assay (ELISA) (Biokit, A.S. Spain[®)].HCV positive samples (n=100) were quantified by HCV Real-TM Quant SC (Sacace Biotechnologies Italy®).

Results: Hundred HCV seropositive samples were subjected to genotyping and quantitative analysis of these samples using RT- PCR, HCV genotype 4 was the predominant genotype (92%) followed by genotype 2 (4%), Genotype 1 (2%) and 3 (2%) in different groups. The average viral load of the patients infected with genotype 4 was higher than an average viral load of the patients infected with genotypes 1,2 and 3.

Conclusions: The present study highlighted that genotype 4 is the predominant genotype in Sudanese hepatic patients followed by genotype 2. The severity of liver disease was more among genotype 4 patients as assessed by a higher viral load.

Key words: Hepatitis C virus, genotypes, viral loads, chronic hepatic

Correspond to: Mohammed E. H. Ournasseir, Department of Microbiology, Medical Laboratories Sciences, Omdurman Islamic University Email: ornaser@hotmail.com/

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Introduction

Hepatitis C infection (HCV) was recognized in 1989 and was observed to be in charge of 70-90% of post-transfusion hepatitis in all countries wherever blood was tested for Hepatitis B infection (HBV) [1]. At least six major HCV genotypes involving various, more closely related subtypes have been identified [2]. HCV genotypes show significant variations in their worldwide distribution and predominance, making genotyping a helpful technique for determining the source of HCV transmission in an infected localized population [3]. Infection by HCV is the main cause of chronic liver disease worldwide [4], the patients uninformed of their disease and at risk for developing cirrhosis and hepatocellular carcinoma[5]. HCV is an enveloped virus that has a place with the family Flaviviridae. Its linear positive-stranded RNA genome of approximately 9.6 kb in length encodes both structural (E1, E2 and core) and nonstructural (N2, NS3, NS4a/b, p7 and NS5a/b) proteins in a single open reading frame, flanked by short conserved untranslated regions (UTRs) located at the 5\ and 3\ ends of the genome that are required for viral replication and protein translation [6,7]. Humans appear to be the only source of infection and inoculation with blood and blood products are the most recognized mode of transmission [8]. The majority of the acute infections are symptomless with around 10% of patients having a mild flu-like illness with jaundice and an increase in blood serum aminotransferase. Hepatitis C virus (HCV) is the dominant part of parenteral and sporadic non-A-non-B hepatitis cases. At least 70% of infected patients develop chronic infection and approximately 20% progress to cirrhosis of the liver [9,11]. In spite of the fact that hepatitis C virus (HCV) infection is a major cause of chronic liver disease around the world, the virus has not yet been cultured *in vitro* and little is understood regarding its biological and physicochemical properties. Till sensitive and accurate test become available, diagnosing of HCV is usually done by exclusion of a high-risk individual with negative markers for HAV and HBV and also on clinical and epidemiologic features of the individual patients [12, 13]

HCV RNA can be detected fourteen days after disease and anti-HCV antibodies are typically positive six weeks from infection [14]. Sensitive methods or tests also are currently available for the detection of viral nucleic acid Antigens from nucleocapsid regions have been used to develop ELISA, the present assay ELISA-3 (3rd generation ELISA) incorporate nonstructural recombinant antigens three, four and five (NS3, NS4, and NS5) regions. The patient infected with HCV develops antibodies to numerous structural and nonstructural viral proteins. Sensitive methods or tests also are currently obtainable for the detection of viral nucleic acid. For example RT.PCR can detect HCV-RNA in the blood however it is possibly used when serological tests gave obscure results as were as and in selecting for, and estimating response to therapy [15,16]. The absence of convenient culture system for HCV implies the utilization of molecular biology to evaluate viremia. Direct hybridization of serum samples is possible however is hampered by the low virus concentration in

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many patients. Amplification of viral nucleic acid by the polymerase chain reaction (PCR) gives an exceedingly sensitive and antigen-antibody-independent technique to identify continuous viral infection. Although a positive PCR assay is not absolute verification of HCV viremia, it strongly suggests active virus production inside the body [17]. The treatment plan (a combination of compounds, dosages, and duration) and therefore the virological follow-up for management of antiviral treatment in chronic HCV hepatic patients is very important, but to guarantee good monitoring of the treated patients, doctors require fast, reproducible, and sensitive molecular tools with a large scope of detection and quantification of HCV RNA in blood tests.

Objectives

In the current study, we aimed to quantify and genotype HCV in patients suffering from chronic hepatitis during the course of infection.

Materials and Methods

Enrollment of patients

Serum samples were obtained from subjects attending out-patients units in Khartoum State and Gezira State medical centers.

Sample Collection:

Blood samples were taken from 1203 individuals, including chronic hepatic patients and normal healthy blood donors upon their consent. All serum was separated from whole blood within 6 h of collection, and stored at −20°C until testing.

Extraction of HCV RNA:

Viral RNA was extracted from serum samples with QIAamp viral RNA mini kit (Qiagen, Hilden,

Germany®)following the manufacturer's directions; wherever the input volume of blood serum was 170 µL and therefore the output was 60 µL.

Reverse Transcription of HCV RNA

Reverse transcription was carried out using RT-G-mix-1 and RT-mix., were thawed, vortex and centrifuged briefly. Reaction Mix were prepared: by added 5.0µl RT-G-mix-1 into the tube containing RT-mix and vortex for at least 5-10 seconds, centrifuged briefly. 6 µl M-MLV were added into the tube with Reagent. Then it were mixed by pipetting, vortexes for 3 sec, centrifuged for 5-7 sec (must be used immediately after the preparation).10 µ of Reaction Mix were added into each sample tube.10µl RNA samples were pipetted to the appropriate tube. A, re-centrifuge all the tubes with extracted RNA for 2 minutes were done at maximum speed (12000-16000 g) and carefully supernatant were taken. Tubes were placed into thermal cycler and incubated at 37ºC for 30 minutes. Each obtained cDNA sample was diluted 1:2 with TE-buffer and centrifuged briefly the tubes. cDNA specimens could be stored at -20ºC for a week or at -70ºC up to one year.

Result

Analytical specificity and Linearity: The standard calibration curve was generated, using the Smart Cycler II software and serial dilution. The analytical specificity of the primers and the probes was validated with 80 negative samples. They did not generate any signal with the specific HCV primers and probes. The specificity of the kit HCV Real-TM Quant was 100%.The linearity of the HCV Real-TM Quant assay was tested with the HCV RNA Standard and its dilution using

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HCV-negative human plasma. Each dilution was ter of each sample was determined analyzed three times and the mean HCV RNA ti-
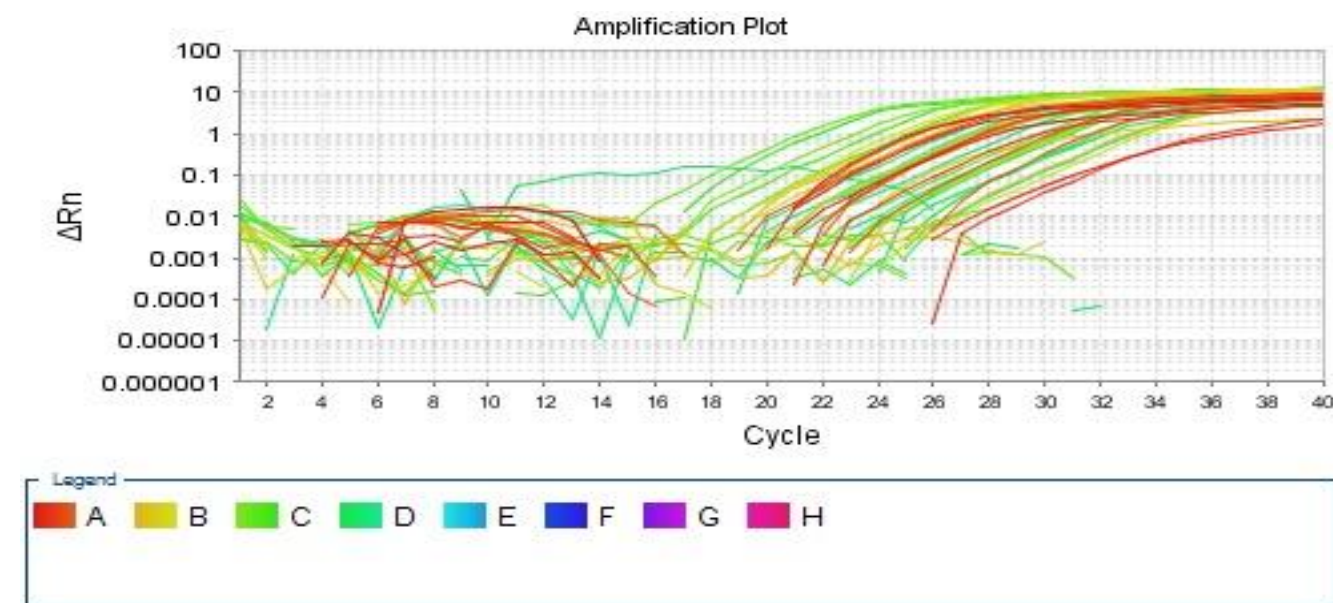

Figure 1. The R-PCR amplification plot of standard control of HCV, the point that the fluorescence signal increased above baseline is the threshold cycle (CT).Each plot corresponds to a particular input target quantity marked by a corresponding symbol. The X axis denotes the cycle number of a quantitative PCR reaction. The Y axis denotes the fluorescence intensity
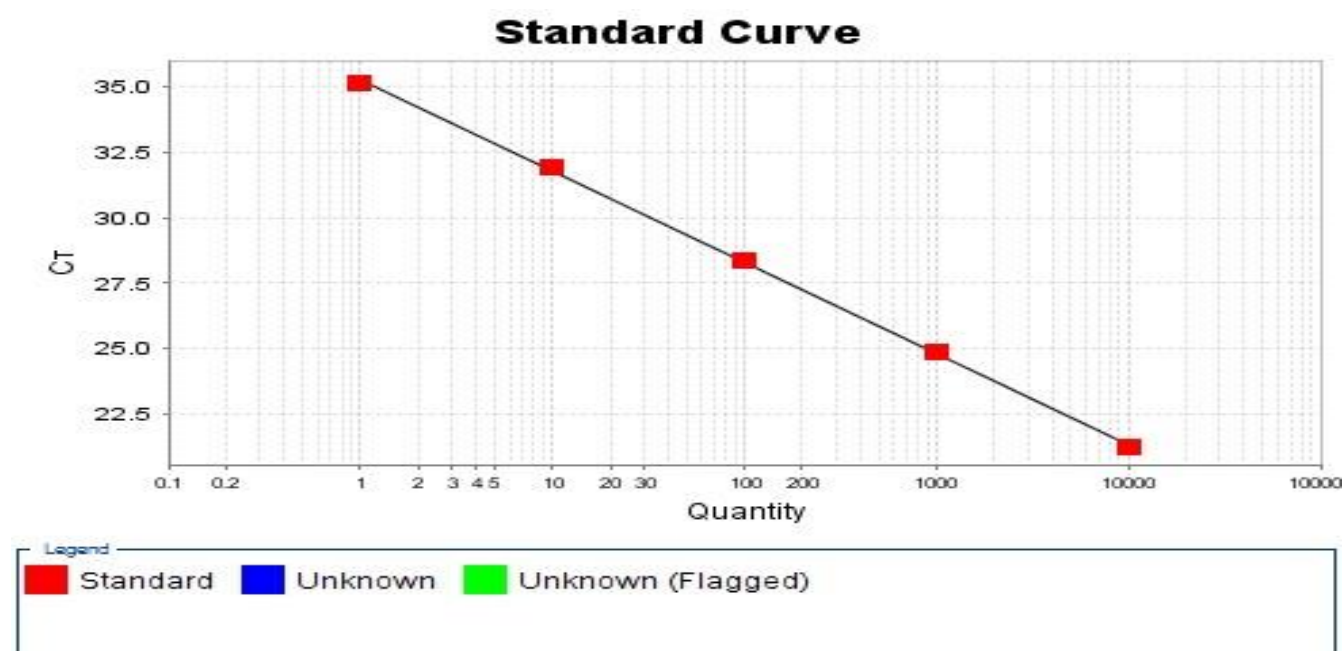

Figure 2.plot of the threshold cycle (CT) against the input target quantity (common log scale). The input target quantity was expressed as copies of HCV cDNA. The correlation coefficient is 0.994.

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A total of 1203 samples were obtained from chronic hepatic patients during the course of infection as study groups (n= 600) and normal healthy blood donors represent a control (n= 603). The collected samples were screened for the HCV and HBV antibodies using ELISA. Of the 600 normal healthy blood donors which were screened for the presence of anti HCV/HBV antibodies, 8 out 600 (1.3%) showed HCV positive while 17out of 600 (2.8%) were HBV positive. Serological screening was carried out for chronic hepatic patients during the course of infection, we found that 92 out 603 (15.2%) were positive for HCV antibodies, while 107 out 603 of (17.7%) showed positive HBV antibodies. (Table I).

Table (1): Seroprevalence of HCV and HBV infection in all groups

Types of hepatitis	Blood donors	Chronic hepatic patients	Total
	positive	positive	
HCV	8/600 (1.3%)	92/603 (15.2%)	100 (16.6)
HBV	17/600 (2.8%)	107/603 (17.7%)	124 (20.6%)
Total of hepatic patients	25/600 (4.1%)	199/603 (32.9%)	224

Detection of Plasma Cell-free HCVRNA in chronic hepatic patients

The HCV antibody positive samples were tested for the presence of HCV RNA. A molecular study was conducted to investigate the prevalence of Hepatitis C virus genotypes in HCV infected population of Khartoum state. 100 HCV seropositive samples were subjected to genotyping and quantitative analysis of these samples using RT- PCR , HCV genotype 4 was the predominant genotype (92%) followed by genotype 2 (4%), Genotype 1 (2%) and 3 (2%)(Table 2).

Table 2: Distribution of HCV genotypes in all study population

HCV Genotype	Blood donors	Chronic hepatic	Total samples
Genotype 1	0.0	2.0	2 (2%)
Genotype 2	0.0	4.0	4 (4%)
Genotype 3	1.0	1.0	1 (1%)
Genotype 4	7.0	85	92 (92%)
Genotype 5	0.0	0.0	0%
Genotype 6	0.0	0.0	0%
Total	8	92	100

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Quantitative HCVRNA –specific PCR

Viral load quantification was carried out by Taqman real time PCR system in all 100 HCV RNA positive patients and was compared between the four groups of genotypes. The average viral load of the patients infected with genotype 4 was higher than average viral load of the patients infected with genotypes 1.2 and 3 $(2.76 \times 10^3 - 9.3 \times 10^6)$ copies/ml.

Discussion

In the present study the seroprevalence, genotyping and estimation of viral load (viremia) of viral hepatitis C was evaluated in sera of different groups include blood donors and hemodialysis patients, randomly selected in Khartoum area and screened by ELISA (third generation) using recombinant HCV – antigens, as well as real-time polymerase chain reaction (RT-PCR) for genotyping and quantitative viral load assay were estimated in positive individuals for HCV. In blood donors study population (8/17/600) of about (1.3/2.8 %), samples showed positive results of HCV/HBV – antibodies respectively, when tested by ELISA using recombinant HCV – antigens. A similar study was previously done in Juba town, in Southern Sudan, and 3% of the studied populations were found positive for HCV–antibodies[18]. Similarly, El-Hazmi, M (2000), also reported or highlighted the prevalence rates of HBV and HCV (1.5% and 0.4%), respectively among completely different groups. The prevalence differs from one group to another, being the most reduced among Saudi and young donors. Accordingly, extensive recruitment of Saudi and

young donors should help ensure a long-term increase in the blood supply without risk. Another investigation concluded that the prevalence of HCV infection in the population recruited from different health centers in Jordan was comparatively low and estimates a prevalence of 0.42% among all age groups and 0.56% among those aged above 15 years old [19, 20]. Low values of both this study and others suggest that HCV infection is not an endemic disease in healthy blood donors. In this study HCV infection has been found high among hemodialysis patients ,(15.2%), of the whole hemodialysis samples (92/603), have been found positive to HCV–antibodies, when tested by ELISA using recombinant HCV– antigens, whereas 107 (17.7%) of HBV positive antibodies were found when tested using same technique. This is in agreement with [21]. Similarly [22,23] reported that the prevalence of HCV infection among dialysis patients was generally higher than that among healthy blood donors. Dialysis patients have an increased risk of exposure to parenterally transmit hepatitis virus. Hemodialysis machine may represent a hazard of HCV transmission of HCV antibodies positive patients. The present study is in support of the positive and have a history of presentation to a dialysis machine. Once, more results are in agreement with those obtained by [24]. However, the dialysis process itself and also the level of a hygienic standard may influence the risk level of HCV infection. Another study, in Saudi Arabia, reported that the overall of anti-HCV antibodies were detected in 7.3% (1124/15323) of

the studied individuals [25]. Abdel-Aziz, F *et al*, 2000 reported that the high rate of anti-HCV prevalence has been assessed in Egypt of the total samples 24.3% (973/3,999). That showed the highest value, reported in a community-based study through all age groups as well as reflected, that HCV was endemic in Egypt [26]. In conclusion, the rate of risk factors that might contribute to HCV infection, we found patients, who suffered chronic disease in about 92%. This might represent the probability of hemodialysis machine in the transmission of the disease. While patients who received a blood transfusion and who suffered a history of surgery represented 24% and 6% respectively. Tattooing represented 3% and alcohol uptake individuals 0% had no role in predisposition to the disease.

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O*riginal* A*rticle*

Human T-lymphotropic Virus Type 1/2 In Renal Transplant Recipients and Hemodialysis Patients in Khartoum state

Amira A. Majzoub[1], Sara M. Gamar Eldin [1], Abrar O. Farah [1], Mohammed I. Garbi [1], Mahmmoud S. Salih [1], Rihab Akasha [2].

[1] Department of microbiology, faculty of medical laboratory sciences, Intern Univ. of Africa

[2] Dept. of clinical chemistry, faculty of medical laboratory sciences, Inter Univ. of Africa

Abstract:

Background: The human T-lymphotropic virus or human T-cell leukemia-lymphoma virus (HTLV) is one of human retroviruses family. There are numerous sorts of HTLV; The human T lymphocyte virus 1 (HTLV-1) is a kind of HTLV that can be a reason for some maladies, for example, HTLV-1 related myelopathy (HAM) and adult T-cell leukemia, (ATL). HTLV-2 is another kin-d of HTLV however it isn't care for HTLV-1 it is less pathogenesis. Patients with hemodialysis powerless to viral contamination since some infections like HTLV can be transmitted by blood; additionally patients with renal transplantation are defenseless to viral diseases because of their immune compromised background. **Objective:** This study aims to provide data about prevalence of (HTLV1/2) among renal transplant recipients and hemodialysis in Khartoum State. **M**aterials and methods: A total of 100 patients, 50 patients had renal transplantation and the other 50 patients on hemodialysis. Blood samples were obtained to measure HTLV type 1/2 antibodies using Enzyme-linked Immuno Sorbent Assay (ELISA). The study was done in the period from June to November 2017 in Khartoum state. And SPSS 20 software and Microsoft Excel were used for the statistical analysis. **Results**: The study showed among hemodialysis patients, 2 out of 50 (4%) were seropositive for HTLV1\2, IgG antibodies and 48 (96%) of the cases were sero-negative. Also showed among renal transplant recipients all of them were sero-negative for HTLV1\2 IgG antibodies. The percentage of male and female in the hemodialysis patients was 62.0 % and 38.0 % respectively and in renal transplantation patients was 76.0 % and 24.0 % respectively. **Conclusion**: The human T-lymphotropic virus 1/2 seropositive was found among hemodialysis patients, and the HTLV1/2 sero-negative was found in renal transplant recipients in Khartoum, Sudan. Thus the prevalence of HTLV 1/2 in a large sample size in Sudan should be conducted.

Keywords: Renal failure, Human T-lymphotropic Virus, Khartoum state

Correspond to:

Introduction:

Human T-lymphotropic infections (HTLV) one of the Retroviridae family, qualities Delta retrovirus, now they are arranged into four kinds: 1, 2, 3 and 4. The HTLV-1 was portrayed in 1980 [1] also, from that point forward has been recognized on each of the five main lands, with an expected of 15 to 20 million contaminated individuals [2].

Regions of incredible predominance for HTLV-1 incorporate Japan, Sub-Saharan Africa, Caribbean bowl, South America, Melanesia and the Middle East. The HTLV-2 was portrayed in 1982 [3] and it is endemic in African and Amerindian populaces, yet its overall conveyance has been attributed to transmission among intravenous medication clients. HTLV-3 and 4 were found in a country zone of southern Cameroon and, at show, they are limited to that area [4].

HTLV-1 and 2 are transmitted sexually and vertically, right off the bat by breastfeeding, and also parenterally, by tainted blood transfusion, sharing of polluted needles and syringes, or transplantation of contaminated organs and tissues. The levels of HTLV-1 proviral load and hostile to HTLV-1/2 antibodies are critical to sexual or vertical infection transmission, other than the time of presentation to hazard factors (sex or breastfeeding). In endemic territories for HTLV-1, around 25% of newborn children's breastfed by HTLV-1 seropositive moms secure the contamination. In view of HTLV-1/2 transmission by blood transfusion, distinctive nations have presented at various circumstances screening for the infections in blood donation centers, som

e of them the nation over and others just in endemic zones [5].

The effectiveness of HTLV-1 transmission by blood transfusion may rely upon sort and time supply of the blood segment, other than the proviral heap of the blood contributor, since the transmission is needy of the nearness of tainted cells. Think back investigations have indicated diverse rates of sero conversion in patients who have gotten HTLV-1 contaminated blood, which is higher in zones with high commonness than those with low predominance [6]. Hence, HTLV-1/2 screening of blood units is critical to keep the most instances of transfusion transmitted disease, yet the generally long HTLV immunological window period (51 days) may prompt its transmission, been vital build up haemovigilance activities in blood donation centers [7].

HTLV-2 isn't known to have an exact pathologic part. It isn't related with any malignancies, yet just with uncommon instances of subacute myelopathy like HAM/TSP, that have an all the more gradually movement [8]. In any case, HTLV-2 seems, by all accounts, to be related with an expanded rate of pneumonia, asthma and bronchitis, bladder and kidney disease, incendiary conditions, for example, joint pain, and with expanded mortality, being recommended that HTLV-2 may repress immunologic reactions to respiratory contaminations and incite fiery or immune system responses [9].

Human T-lymphotropic infection 2 (HTLV-2) is endemic in some African populaces and in Ameri-indians clans from North, Central and South America, particularly in Brazil, where a few clans indicate predominance of 30% [10]. HTLV-2 is like

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wise present among intravenous medication clients (IDU), for the most part in the United States and in Europe [11].

Material and Methods:

This study is a cross sectional study, which was conducted in Khartoum state from June 2017 to November 2017. It included 100 patients, 50 hemodialysis patients at Military hospital, the other 50 were renal transplant recipients at Ahmed Gasim hospital.

Blood sample was collected and allowing stand at room temperature for one hour to obtain serum, centrifuged at 3000 rpm for 5 min, then serum was kept at −20ºC until analysis of HTLV antibodies. HTLV type 1/ 2 antibody analysis was done by standard ELISA technique (Dia Pro diagnostic bio probe kits made in Italy) in the microbiology lab of International University of Africa (IUA).

Permission to carry out this research was obtained from the health authorities. Patients were fully informed about this work.

Statistical analysis

For data analysis the Statistical Package for Social Science (SPSS-20) and Microsoft Office Excel was used.

Result:

The frequency of hemodialysis patients and renal transplant recipient were equal to 50 patients, (ie.50 % each), (Table 1). The percentage of male and female in the hemodialysis patients was 62.0 % and 38.0 % respectively and in renal transplantation patients was 76.0 % and 24.0 %, respectively (Figure 1).

This study also represent that among hemodialysis patients, 2 out of 50, (4%) were seropositive for HTLV1\2, IgG antibodies and 48, (96%) of the cases were seronegative, (Table 2). The 2 HTLV positive cases were on hemodialysis 2 – 3 time per week. As among renal transplantation recipients all of them were seronegative for HTLV1\2 IgG antibodies (Table 3). All the cases under this study were transplanted just once and no history of graft rejection.

Table (1): Represent the frequency of patients in both cases:

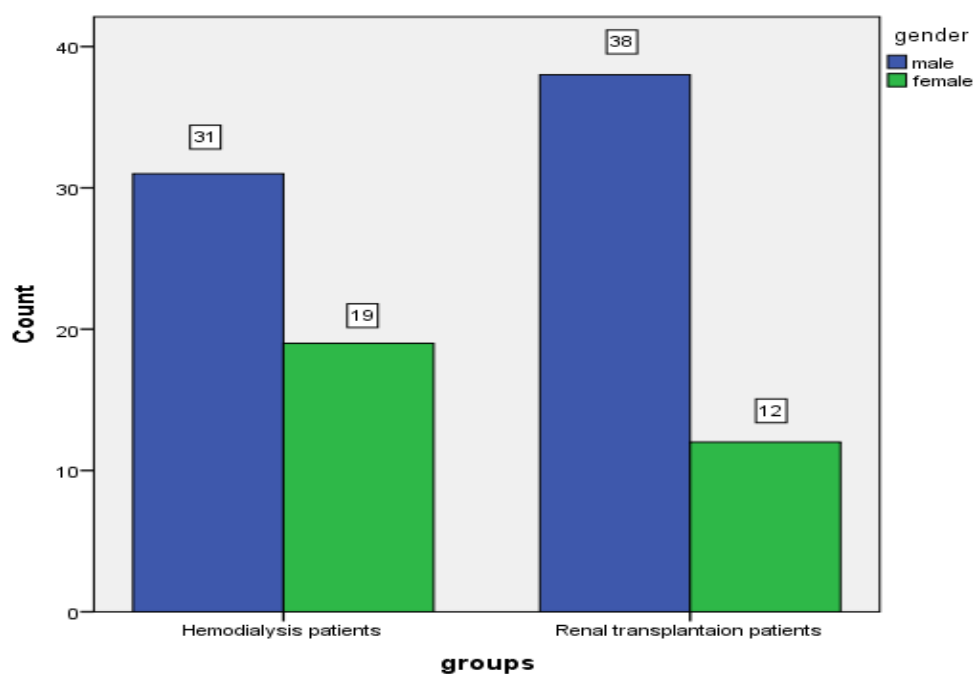|	FREQUENCY	PERCENTAGE
HEMODIALYSIS PATIENTS	50	50 %
RENAL TRANSPLANT RECIPIENTS	50	50 %
TOTAL	100	100 %

Figure (1): Shows the distribution of patients according to gender

Table (2): The percentage of HTLV1/2 positive cases in hemodialysis

	FREQUENCY	PERCENTAGE
HTLV1/2 IGG POSITIVE	2.0	4.0 %
HTV1/2 IGG NEGATIVE	48	96 %
TOTAL	50	100 %

Table (3): The percentage of HTLV1/2 positive cases in renal transplantation recipients

	FREQUENCY	PERCENTAGE
HTV1/2 IGG POSITIVE	0	0.0 %
HTV1/2 IGG NEGATIVE	50	100 %
TOTAL	50	100 %

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Discussion:

This illustrative investigation was directed to give some epidemiological information with respect to the commonness of HTLV1/2 in chance gathering patients, the hemodialysis and renal transplant beneficiaries in Khartoum state –Sudan. Using ELISA, the overall seroprevalence of HTLV1/2 was 4 % from hemodialysis patients.

As stated in the Introduction, there are few articles in this regard, worldwide. Nakamura and colleagues from Japan, in an endemic region for HTLV-1, reported the seroprevalence of HTLV-1 as 8.3% to 9.9 % in renal transplant recipients [12]: another study by Linhares and colleagues found the HTLV seropositivity of renal transplant recipients to be 11.1%; in Brazil [13]. Both mentioned frequencies much higher values than those achieved in our study, which can be justified by the higher HTLV seroprevalence among their population compared to ours.. However, another study by Perez reported only 2 HTLV-1seropositive cases, (0.89%), in a population of 224 American renal transplant recipients [14].

The current study revealed no significant difference between the seroprevalence of HTLV among hemodialysis patients and renal transplant recipients. The frequency is higher in hemodialysis patients.

Constrained accessible information from Japan uncovered that in HTLV-1 endemic territories of Japan, (for example, Okinawa), the seroprevalence of HTLV-1 in transplant beneficiaries is much lower than that of hemodialysis patients (just about 9% versus 20 %) [15].

Conclusions

The study concludes that the frequency of HTLV-1/2 seropositive was found among hemodialysis patients, in Khartoum State, and all the renal transplant recipients in the study were seronegative for HTLV-1/2.

Limited sample size in the study probably interfered and had an influence on the final results, so implementing further studies with large amounts of participants to study the prevalence of HTLV-1/2 infection is strongly recommended.

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.

Original Article

Sudan Medical Laboratory Journal

Evaluation of Liver Function Tests among Sudanese Malaria Patients

AbdElkarim A. Abdrabo[1], Adham AA, Ammar OM[1], Mohammed HT,[1]

[1]clinical Chemistry- Faculty of Medical Laboratory Sciences, Al-Neelain University-Khartoum-Sudan

[2]Clinical Chemistry Department, Faculty of Medical Laboratory Sciences, Sudan International University.

Abstract

Background: Malaria is a major public health problem in tropical areas. It is responsible for infecting 300-500 million people and 1-3 million deaths annually. The liver takes part in malaria parasite live cycle, this leads to the destruction of liver cells and leads to liver function tests abnormalities.**Objective:** To assess liver function tests in Sudanese adult patients infected with malaria parasite compared with a healthy control group. **Methods:** In a case-control study, 150 malaria patients were recruited to assess liver function tests compared to another 50 healthy people as control group. **Results:** The study showed that malaria-infected patients have significant elevation in total bilirubin, direct bilirubin, indirect bilirubin, alanine amino transferase (ALT), aspartate amino transferase (AST) and lactate dehydrogenase (LDH). Tests also show a significant decrease in albumin level, whereas there is no significant difference in total protein levels between malaria patients and control group. **Conclusion:** malaria infection affects liver parameters, for it increases levels of direct bilirubin, indirect bilirubin, total bilirubin, AST, ALT, and LDH also decrease the level of albumin but the level of total protein is not affected.

Keywords: ALT, AST, LDH, Malaria, bilirubin, albumin

Corresponding author: Associate Professor of Clinical Chemistry /AbdElkarim A. Abdrabo

Introduction

Malaria, a major public health problem in tropical areas is responsible for infecting 300-500 million people and 1-3 million deaths annually. Majority of deaths occur due to severe malaria, having one or more complications in a patient of Falciparum infection [1].

Malarial transmission to the human host is established by sporozoites infection to the liver [2]. Malaria causes symptoms that typically include fever, fatigue, vomiting, and headaches. In severe cases, it can cause yellow skin, seizures, coma or death [3].

The liver is a bilobed largest organ in the body situated in the upper part of the abdominal cavity. The cell constituents of the liver are arranged as hepatic lobules. The lobules are central in the organized functions of the liver being ushered with important vessels as portal vein, hepatic artery and a bile duct [4]. Important functions of the liver include: metabolism of fat, carbohydrate, protein, iron, hormones and drugs. It is also char-

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acterized with vascular function e.g. storage and filtration of blood and the synthesis of blood coagulation factors.

The excretory and secretory functions of the liver are emphasized in drugs and hormones and the notable drugs are sulphonamides, penicillin, and erythromycin, while the hormones include; thyroxin, estrogen, and aldosterone [5].

The liver also forms and secrets bile, excrete bilirubin particularly the conjugation of it to arrest a disease situation; jaundice in excess circulation. It is also involved in protection function against foreign particle invasion e.g. bacteria through hepatic macrophages activities.

The liver is therefore very strategic in the overall body physiology and any harmful effect will impair the aforementioned activities. Several types of infections may affect the liver functions, among those is malaria infection. It has been emphasized through many reports that malaria infection is the cause of increased levels of total bilirubin, direct bilirubin and indirect bilirubin due to the consequent hemolytic anemia. [6] On other hand the increase in ALT, AST and LDH levels as a result of the destruction of liver cells by malaria parasite is evident. Through the desttructin of hepatic cells Malaria parasite is responsible for low albumin level due to decreased synthesis of albumin.

Liver involvement in malaria is common in patients of severe malaria and may manifest as jaundice (Hyperbilirubinemia), hepatomegaly and elevated liver enzymes like aspartate aminotransferase, alanine aminotransferase and lactate dehydrogenase[7]. Hyperbilirubinemia, mainly unconjugated , is a common feature of falciparum malaria and is attributed to hemolysis of both parasitized and non-parasitized erythrocytes and partly due to liver damage.[8] Although hyperbilirubinemia has been linked with increased malaria-related mortality , it is often seen in association with other complications such as acute renal failure or cerebral malaria. [9,10]

Materials and methods:

Study design: this is an analytical case control–based study to assess liver function tests in 150 malaria patients compared to 150 healthy as control group.

Study population: adults Sudanese infected with malaria.

Ethical consideration: this study was approved from the scientific community and department of clinical chemistry and any individual in this was informed by the importance of this study.

Exclusion criteria: patients with preexisting liver diseases.

Methodology: malaria was diagnosed using thin and thick blood film reference method. The degree of parasitaemia is classified into mild (+), moderate (++) and severe (+++) according to the numbers of parasites per blood film. Estimation of liver function tests was performed by Cobas c-311 automated chemistry analyzer.

Data analysis: The results were analyzed using the Statistical Package of Social Science (SPSS) version 16.0

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Results

Table (1) shows that, total bilirubin, direct bilirubin, indirect bilirubin, ALT, AST and LDH levels were significantly increased in malaria patients as compared control group. There was no significance difference in total plasma protein between malaria patient and control group .

Albumin levels were significantly decreased by about 17.6 % in malaria patient as compared to control group. There was no significant difference in total plasma protein between malaria patient and control group.

Table (2) shows, there were no significant differences in the mean levels of plasma total protein, albumin, total bilirubin, direct bilirubin, indirect bilirubin, ALT, AST and LDH between different age groups of malaria patients

Table (3) shows, a significant difference in the mean levels of albumin, total protein, direct bilirubin, indirect bilirubin, total bilirubin, AST, ALT, and LDH between the degree of parasitaemia of malaria groups (mild, modrate and severe).

Table (1): Liver function test in malaria patients and control group.

Parameters	Malaria Patient	Control group	P.value
Total protein (g/dl)	7.6	7.5	0.515
Albumin (g/dl)	3.4	4.0	0.000
Total bilirubin (mg/dl)	3.46	1.12	0.000
Direct bilirubin (mg/dl)	1.34	0.18	0.000
Indirect bilirubin (mg/dl)	2.12	0.94	0.000
ALT (IU/L)	74.70	26.26	0.000
AST (IU/L)	59.66	25.98	0.000
LDH (IU/L)	338.1	135.9	0.000

Table (2): LFTs in malaria patients according to age groups

Age group in years	Total protein (g/dl)	Albumin (g/dl)	Direct bilirubin (mg/dl)	Total bilirubin (mg/dl)	Indirect bilirubin (mg/dl)	ALT (IU/L)	AST (IU/L)	LDH (IU/L)
15-20	7.6	3.3	1.46	3.54	2.09	72.6	60.1	268
21-25	7.6	3.5	1.28	3.45	2.17	76.7	59.8	364.5
>25	7.6	3.9	0.80	2.00	1.20	59.0	47.0	341
P-value	0.649	0.101	0.615	0.830	0.844	0.752	0.855	0.45

Table (3) Comparison of LFTs parameters according to the severity of malaria

Test	Severity of malaria (No of patients)	Mean ±SD	P.Value
Albumin (g/dl)	mild (63)	3.61±0.21	0.000
	modrate (39)	3.33±0.09	
	Severe (48)	3.00±0.05	
	Total (150)	3.34±0.29	
Total protein (g/dl)	mild	7.85±0.09	0.000
	modrate	7.63±0.04	
	severe	7.35±0.37	
	Total	7.63±0.30	
Total Bilirubin (mg/dl)	mild	1.90±0.31	0.000
	modrate	3.22±0.40	
	severe	6.81±2.72	
	Total	3.82±2.63	
Direct Bilirubin (mg/dl)	mild	0.80±0.14	0.000
	modrate	1.22±0.09	
	severe	2.26±0.85	
	Total	1.38±0.79	
ALT (U/L)	mild	57.09±6.33	0.000
	modrate	69.76±4.00	
	severe	116.38±28.22	
	Total	79.36±30.79	
AST (U/L)	mild	53.33±5.92	0.000
	modrate	58.69±0.48	
	severe	70.79±27.00	
	Total	60.31±17.17	
LDH (U/L)	mild	226.86±15.35	0.000
	modrate	308.23±18.91	
	severe	508.38±35.12	
	Total	338.10±124.77	

Discussion

This analytical case-control study was primarily designed to evaluate LFT's parameter in Sudanese patients infected with malaria compared to healthy individuals in an attempt to determine the effect of malaria infection on these parameters.

There was high elevation in the levels of total bilirubin, direct bilirubin, indirect bilirubin, ALT and AST in patients samples when compared to the control group and the differences were significant (p-values < 0.000), whereas highly reduction

in albumin level was found in malaria patient when compared to the control group by about 17.6% and the difference was significant also (p-value = 0.000) .

Total protein was not different in malaria patient compared to control group (p-value = 0.515).

The increase in levels of total bilirubin, direct bilirubin, indirect bilirubin, and LDH may be due to haemolytic anemia which caused by the malaria parasite. While the Increase in ALT and AST levels may be due to destruction of liver cells by ma-

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laria parasite also. Low albumin level may be due to decreased synthesis of albumin by hepatic cells which are destructed by malaria parasite, too.

The normal level of protein may be due to an increase in globulins fractions due to the production of antibodies (IgG, IgM, IgA) against sporozoites, sexual and asexual forms of malaria. Several studies showed that the levels of total bilirubin, direct bilirubin, ALT, AST, and LDH were elevated in malaria patients these results were obtained by Godse RR. 2013(11), and Kochar DK (2003) (12), and it agrees with these results. Whereas several studies show that the level of total proteins in plasma decreased after the infection with *P. Falciparum* malaria, Abdelgadir NE (13), Adebisi SA, (1998)(14), Adeosun OG (2007) (15), and these results were not in agreement with this study results. On the other hand, Mu AK et al, (16) found that the level of albumin was decreased in patients infected with malaria and this agrees with this study results also.

Acknowledgment:

Conflict of interest statement

We declare that we have no conflict of interest.

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O*riginal* A*rticle*

Sudan Medical Laboratory Journal

Assessment of Serum Magnesium, Calcium and Phosphate in Sudanese Cigarette Smokers

GadAllah Modawe[1] [*], Mohammed Esam[2], Malik Etayeb[2], AbdElkarim A. Abdrabo[2, 3]

1. Omdurman Islamic University, Faculty of Medicine and Health Sciences, Biochemistry Department, Omdurman, Sudan.
2. Sudan international University, Faculty of Medical Laboratory Sciences, Clinical chemistry Department, Khartoum, Sudan.
3. Alneelain University, Faculty of Medical Laboratory Sciences, Clinical chemistry Department, Khartoum, Sudan.

Abstract

Background: Smoking is one of the major community environmental pollution in the world, Cigarette smoking is a worldwide major cause of preventable morbidity and mortality. The minerals are very essential for human skeleton and many physiological mechanisms and cofactors of metabolic pathway in the human body.

Aim: The purpose of this study was to assess the level of serum magnesium (Mg), calcium (Ca) and phosphate (P) in Sudanese cigarette smokers.

Methodology: This case-control study included 50 adult male of a current smoking status; the ages were matched, and the age ranged between 15 and 80 years and their mean 35 years. Fifty non-smokers were considered as control group. We evaluated the effect of cigarette smoking on serum Mg, Ca and P. Three ml of fasting venous blood were collected from each volunteer; serum obtained and analyzed using spectrophotometers (URIT-810), and measured using end point method (enzymatic method).

Results: Our study revealed a significant (*p value*=0.001) increase in the levels of serum phosphate, while the serum calcium significantly (*p value*=0.040) decreased, among smokers compared to controls, whereas the mean level of serum magnesium and calcium/ phosphate ratio did not differ. Their ages positively correlated to serum phosphate (r=0.345, p=0.023). Moreover, the duration of smoking/ years negatively correlated to serum Ca (r=-0.367, p=0.034) and positively correlated to serum phosphate (r=0.305, p=0.044), and did not effect serum magnesium. There was no correlation between the numbers of cigarette/day and serum parameters in our study.

Conclusion: It was found that there was an increase in serum phosphate and a decrease in serum calcium, while the serum phosphate correlated with the age. The duration of smoking correlated with serum calcium and phosphate respectively.

Key words: serum calcium, serum magnesium, serum phosphate, Sudanese.

Corresponding author: Dr..GadAllah Modawe, Email: gadobio77@hotmail.com/

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Introduction

Worldwide more than 3 million people currently die each year from smoking, half of them before the age of 70, an enormous human cost, and more than one third have cardiovascular events that often determine permanent disability of the affected Subjects (Aurelio, 2005). Smoking is a practice in which a substance, most commonly tobacco or cannabis is burned and the smoke tasted or inhaled. The most common method of smoking today is through cigarettes (Shiffman and Robert, 2007). Minerals are very essential substances involved as catalysts in most cellular enzymatic reactions and assume a major role in metabolism (John, 2007).The cigarette smoke contains many harmful carcinogenic constituents, including metals, PAHs, dioxins, and some non-volatile nitrosamines. Smokers are at greater risk for of bone and skeleton and nerve system, bone matrix loss, and hepatotoxicity (Aurelio, 2005). Smoking has effect on skeleton and concentration of mineral, calcium is important mainly for bone structure and teeth; the normal level of serum calcium is 8.9-10.1 mg/dl. Like calcium, phosphate is also an important mineral. Phosphate is a constituent of bone and teeth. The normal value of serum phosphate is 2.4-4.1 mg/dl (Hopper *et al.*, 1994). Serum calcium and phosphate regulation are achieved by hormonal action on the bone, kidney and intestine. The parathyroid hormone causes mobilization of calcium and phosphate from bone to plasma, while its action on the renal tubules is to enhance reabsorption of calcium and loss of phosphate, the overall action of PTH is to increase serum calcium and to reduce serum phosphate (Dawson *et al.,* 1984). Magnesium is a critical cation and cofactor in numerous intracellular processes. It is involved in more than 300 essential metabolic reactions, some of which are: energy production, synthesis of essential molecules, structural roles, ion transport across cell membranes, cell signaling, and cell migration (Rude *and* shills, 2006). The role of magnesium is an essential cofactor of metabolic pathway enzymes including those important in glycolysis, transcellular ion transport, neuromuscular transmission, synthesis of carbohydrates, proteins, lipid and nucleic acids in the liver, adipose tissue, renal, intestinal and other tissues in the human body (Seed and Samia, 2013). It is also beside the calcium and phosphate involved in several processes including: hormone receptor binding, gating of calcium channels, trans-membrane ion flux and regulation of adenylate, cyclase, muscle contraction, neuronal activity, and control of vasomotor tone, cardiac excitability and neurotransmitter release in the most vital tissues in human body (Seed and Samia, 2013). The objective of present study was to assess the level of serum magnesium (Mg), calcium (Ca) and phosphate (P) ions in Sudanese tobacco smokers.

Materials and Methods

The present study has been approved by the Faculty of Medical Laboratory Sciences, Sudan International University scientific Committee. Furthermore, all smokers undersigned the formal consent before data and samples were collected. This case-control recruited 50 male cigarettes smokers

and 50 age Sex-matched non-smokers. All of them were from the Khartoum State, Khartoum and Bahry towns, Sudan. A questionnaire was designed to collect personal information, clinical data, and smoking history from each participant. The study participants were clinically evaluated for their health. None of the participant reported to have diseases/disorders or medications that affect magnesium, calcium and phosphate level. Blood samples were collected from participants to measure serum minerals. All the blood samples were centrifuged at 600 x g for 5 min at the room temperature and the serum minerals were measured immediately. The serum minerals were analyzed by enzymatic spectrophotometric method.

Statistical analysis

Statistical analysis was carried out using Statistical Package for Sciences (SPSS, version 20). Data were expressed as (mean ± SD) and compared firstly with controls and secondly with the provided reference values of the reagents and the data published in the literature. Means of continuous variables were compared between the two groups. The p value of was computed for mineral levels in the obtained study results. Besides, Pearson's correlation test was applied to predict the correlate of serum mineral to age, duration of smoking/years and number of cigarette/day in smokers.

Results

The general characteristics of the study group and the comparison of the measured parameters

Smokers' ages ranged between 15 and 80 years with the mean age of 35.0±13.59 years. The mean smoking duration was 13.1±9.25 years and the average number of cigarettes per smoker per day was 11.9±7.66, was presented in table (1).

Table (2) shows the measured serum mineral level in the two groups, significantly (*p value*=0.001) an increase in the levels of serum phosphate, the serum calcium showed a significant (*p value*=0.040) decrease, among smokers than controls, whereas the mean level of and serum magnesium and calcium/ phosphate ratio did not differ..

Table (1): Descriptive Statistics for study variables

Variables	Minimum	Maximum	Mean±SD
Age (Years)	15.0	80.0	35.0±13.59
Duration of smoking	2.0	45.0	13.1±9.25
Number of cigarette/ day	2.0	30.0	11.9±7.66

Table (2): Mean comparison of study parameters in smokers versus non-smokers

Parameters	Smoker (Mean ± SD)	Non-Smoker (Mean ± SD)	*P-value*
Mg (mg/dI)	2.15±0.21	2.11±0.22	0.314
Ca (mg/dl)	9.44±0.50	9.61±0.31	0.040*
Ph (mg/dl)	4.13±0.98	3.58±0.64	0.001**
Ca/Ph (mg/dl)	2.44±0.70	2.77±0.47	0.008

The correlation of between age and of the measured serum parameters

The ages were positive correlate only to serum phosphate (r=0.345, p=0.023) and no correlation between the ages and serum calcium and magnesium, were shown in figures (1, 2, and 3) respectively.
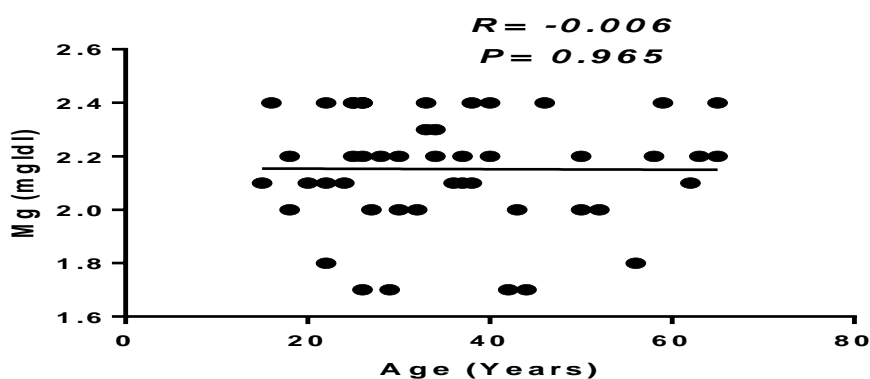
Figure (1): The correlation of age and serum magnesium
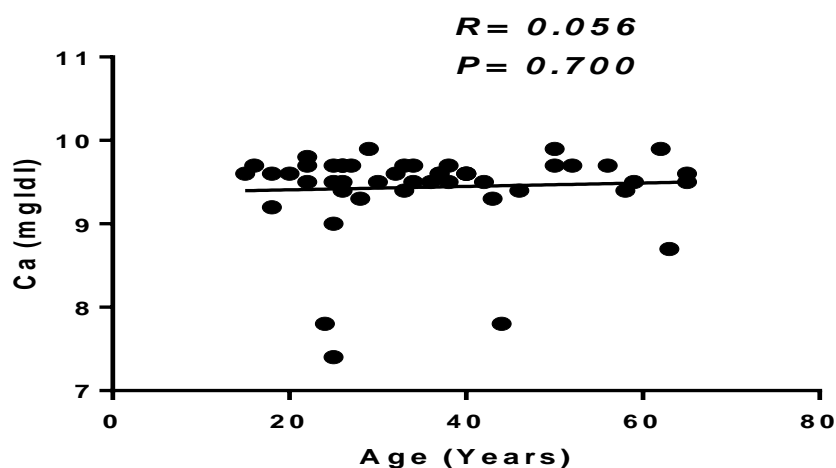
Figure (2): The correlation of age and serum calcium

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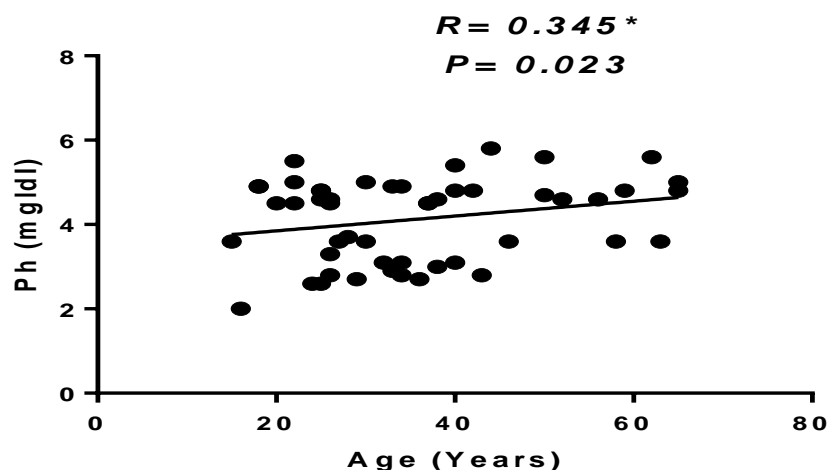
Figure (3): The correlation of age and serum phosphate

The correlation between duration smoking / years and the measured serum parameters

The duration of smoking/ years were negatively correlated to serum Ca (r=-0.367, p=0.034) and positively correlated to serum phosphate (r=0.305, p=0.044) and did not affect serum magnesium, as shown in the figures, below, (4, 5, and 6) respectively.
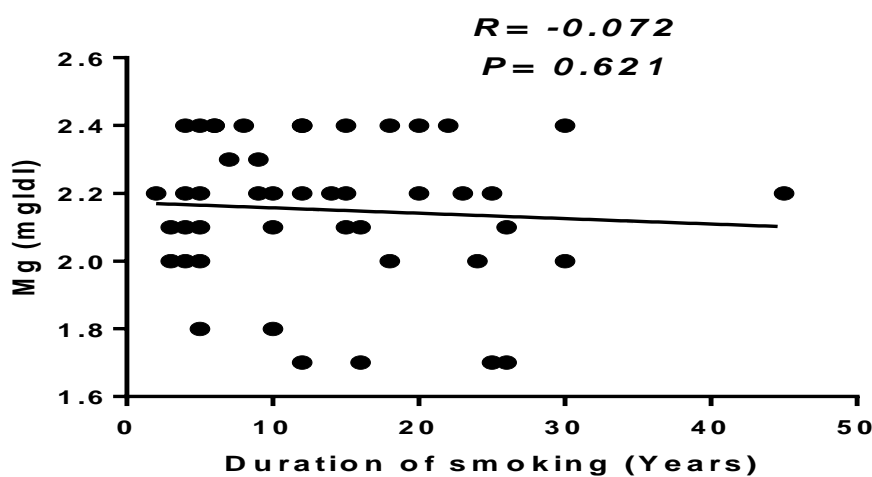

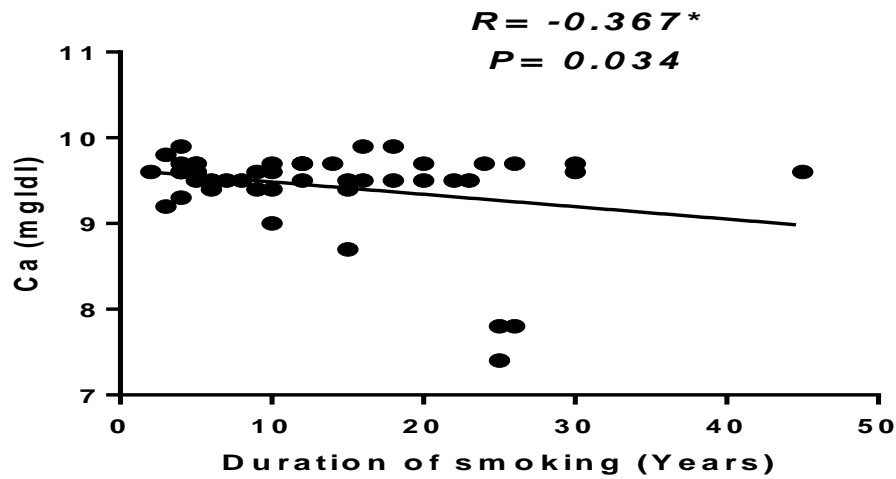**Figure (4):** The correlation of duration of smoking/years and serum magnesium

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Figure (5): The correlation of duration of smoking/years and serum calcium
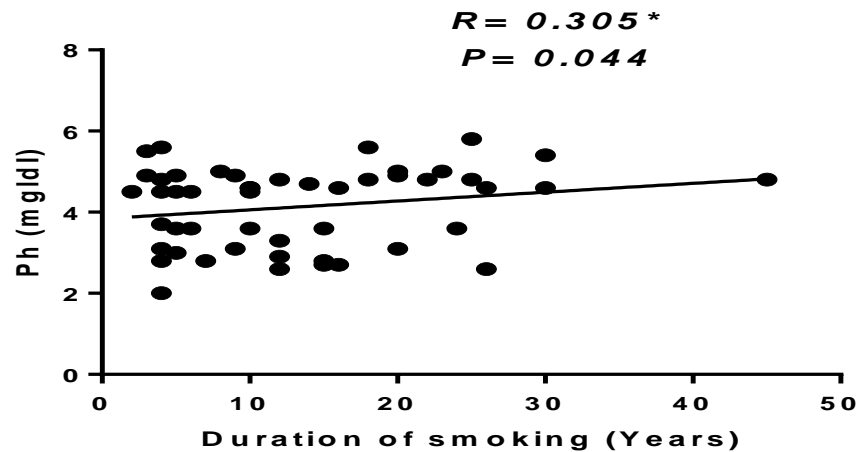
Figure (6): The correlation of duration of smoking/years and serum phosphate

The correlation of numbers of cigarette/day and the comparison of the measured serum parameters

There was no correlation between the numbers of cigarette/day and serum parameters in the study, were showed in the figures (7, 8 and 9)
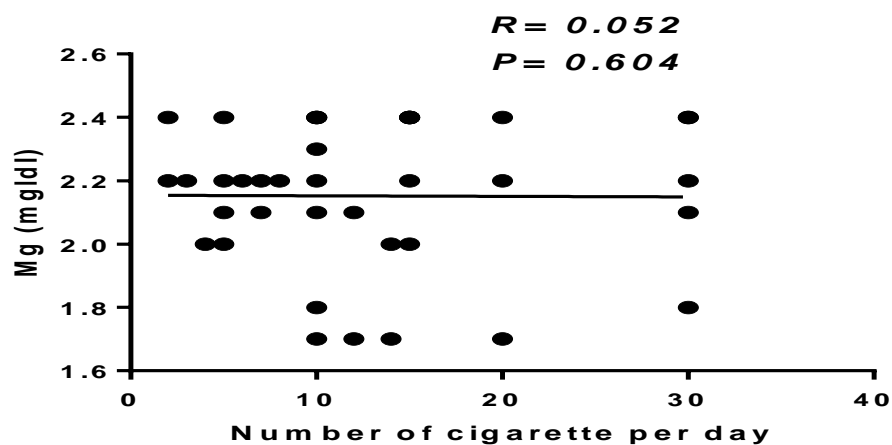
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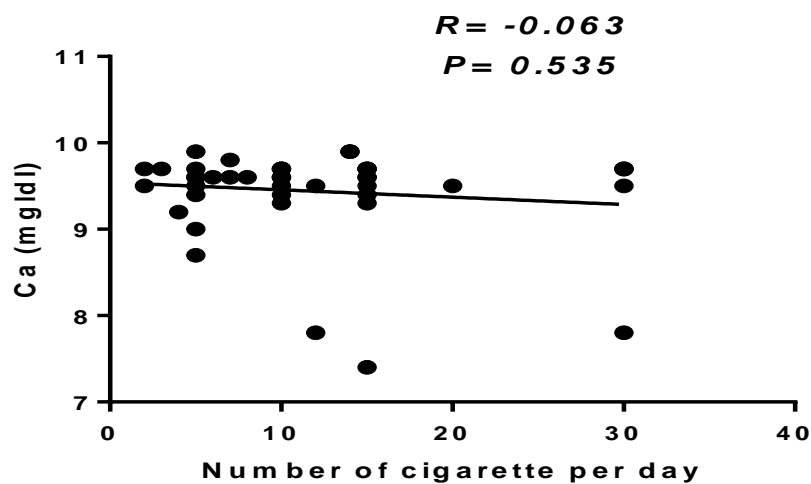**Figure (7):** the correlation of number of cigarette/day and serum magnesium

Figure (8): the correlation of number of cigarette/day and serum calcium
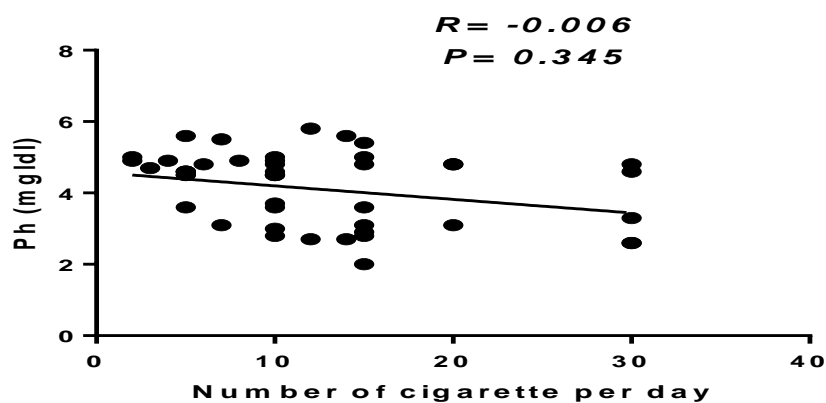

Figure (9): the correlation of number of cigarette/day and serum phosphate

Discussion

Smoking is a major health hazard, with detrimental effects on many organs, including skeleton (Salah Elden, 2015). There are limited international and local data about the effect of cigarette smoking on the serum levels of calcium, phosphate and magnesium and hence its effect on the skeleton (Salah Elden, 2015). The study was conducted in Khartoum state, yet this study shows the effect of cigarette smoking on serum level of calcium, phosphate and magnesium. There was a decrease in serum calcium and magnesium and an increase in serum phosphate in smokers group compared to control group. The results on calcium and phosphate are similar to Sudanese the study conducted, also, in Khartoum State by (Eiman and Adel, 2017). Moreover our results of serum calcium agree with (Salah Elden, 2015), who reported that serum calcium decreased in smoker than in non-smokers. Another study reported that increase in calcium among smoker groups was observed, compared with non-smoker groups (Hopper *etal.*, 1994). This may be due to interference of smoking with the action of parathyroid hormone in renal tubule, thus lowering the serum calcium level and increasing that of serum phosphate. These results agree with study of (Salah Eldin (2015). Magnesium is a very essential mineral that serves as a cofactor of many enzymes involved in energy metabolism, protein synthesis, RNA and DNA synthesis, and maintenance of the electrical potential of nervous tissues and cell membranes. Of particular importance with respect to the

pathological effects of magnesium depletion is the role of this element in regulating potassium fluxes and its involvement in the metabolism of calcium, (Al-Ghamdi *etal*., 1994). Our result agree with (Sulafa *etal*., 2013). The study revealed that serum magnesium decreased in smokers when compared to non-smokers. This result is in agreement with a previous study (Peacock, 2010); as cigarette smoking causes a decreased supply of magnesium leading to a weaker appetite and reduced absorption of the digestive system due to disturbances (Winiarczyk *et al*.,2008). Depleted magnesium leads to hypertension (Peacock,1999) and cardiovascular diseases (Liao *etal*.,1998). Our study the age showed positive correlation with serum phosphate (r=0.345, p= 0.023) and no correlation with serum calcium and magnesium respectively. There are no previous studies reported, Except for only one contrary study that reported that serum magnesium level did not change due to age difference (Sulafa *et al*., 2013). On the other hand our study revealed that the duration of smoking/years with has a positive correlation with serum phosphate (r=0.305, p=0.044), negative correlation with serum calcium (r=-0.367, p=-0.034), yet did not correlation with serum magnesium. The study disagrees with (Sulafa *et al*., 2013), who reported that a weak negative correlation was found between serum magnesium and the duration of smoking. Our study agrees with (Eiman and Adel, 2017), who reported that serum calcium negatively correlated with the smoking period. Another study, conducted by (Salah Elden, 2015), yieded

similar results to ours, and reported that scatter plot shows negative correlation between the levels of serum calcium and the duration of smoking and also a strange positive correlation between the levels of serum phosphate and the duration of the smoking. Our study found no correlation between the number of cigarette/day and serum parameters. The study differs with (Sulafa *etal.,* 2013), who reported that a weak negative correlation between serum magnesium level and number of cigarette/day. Other studies conducted by (Eiman and Adel, 2017) disagree with our results and also reported that, calcium negatively correlated with number of cigarette/day while the serum phosphate positively correlateed with the number of cigarette/day, (Salah Elden, 2015) reported negative correlation between the levels of serum calcium and the number of cigarette smoked/day and positive correlation between the levels of serum phosphate and duration smoked/day, which contradicts with our study results

Conclusion: it was found that smoking increased serum phosphate level, yet decreased the serum calcium. As for the serum phosphate level, it correlated positively with the age of the smoker. The duration of smoking correlated together with the serum calcium and phosphate.

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Frequency of Euthyroidism among Patients with Goiter in Algeneina Town, West Darfur State

Alsafat Mohammed Ibrahim, Samia Mahdi Ahmed[1*],

[1]Department of Medical Laboratory Technology, Faculty of Applied Medical Sciences, Taibah University, AL Madinah, Saudi Arabia.

Abstract

This is a cross sectional hospital-based study carried out to measure the levels of thyroid hormones (T3, T4 and TSH) in Sudanese patients with goiter in west Darfur state (Algeniena City) during the period from April to July 2011.

Eighty Sudanese patients with goiter; including 20 males (aged 10-65years), and 70 females (aged 10-65years), were enrolled in this study; also 40 healthy individuals to serve as control group; including 20 males (aged 10-65 years), and 20 females (aged 10-65 years).

Five ml of venous blood were collected from each participant to obtain serum. T3, T4 and TSH levels were measured by Enzyme linked immuno assay (ELISA) technique.

Statistical analysis revealed that 64 samples (82.5%) were found to have normal thyroid hormones levels (euthyroid), while 6 samples (7.5%) were found to have hyperthyroidism, 4 samples (5.0%) were found to have hypothyroidism, and four samples (5.0%) had high TSH and normal T3 and T4 .

Results showed that T4 and TSH were significantly decreased in patients with goiter compared with control group, (p value 0.00) and (p value 0.01) respectively. Unlike T3 since no difference was found between patients and the healthy control group (p value 0.76).

This study concluded that the frequency of goiter was high among people in west Darfur state (Algeneina city) with higher percentage in females than males. Also, the frequency of goitrous euothyroidism was higher compared to both, goitrous hyperthyroidism and goitrous hypothyroidism.

Keywords: Euthyriosism. Euthyroid, goitrous, goiter, TSH, hyperthyroidism

*Correspond to: Samia Mahdi Ahmed. Department of Medical Laboratory Technology, Faculty of Applied Medical Sciences, Taibah University, ALMadinah, Saudi Arabia

smmohammed@taibahu.edu.sa

Introduction:

Thyroid gland is a small gland located in the front of neck (Fox, 2006). It secretes thyroid horm-ones that play an essential role regarding increase of oxygen con-sumption, normal growth and me-ntal development, increase the se-nsitivity to the cardiovascular and central nervous systems to cate-cholamine and so influence card-iac output and heart rate. Also co-ntrol energy expenditure and pro-tein synthesis; and play a role in lipid me-tabolism (Burtis *et al,* 2008).

To synthesize thyroid hormones, two raw materi-als are required: thyroglobulin (a glycoprotein sy-nthesized intracellular) and iodine (a natural com-pound of many fo-ods (mainly sea food) (Baynes, 2005).

Goitre (thyroid enlargement) can occur in cases of hyperthy-roidism, hypothyroidism, or euth-yroidism (nontoxic goiter).

Non-toxic goitre is divided into two groups: en-demic goiter (wh-ole community or population may have a high incidence of goiter); and sporadic goiter (only some individuals are affected).

Deficiency of iodine may have a mental and a physical effect, and after many months a goiter may develop. Women with iodine def-iciency may give birth to babies with severe neurological and me-ntal impairment (Myers, 2001).

In Sudan, especially Western reg-ion (Darfur), iodine deficiency is a serious public health prob-lem results in mental retardation and lower re-sistance against infect-ions.

Goiter is one of the major pro-blems in Sudan es-pecially in Western area where the iodine defi-ciency is quite prevalent. The aim of this study This study was carried out in 2011, the aim was to measure thyroid hormones in patients with goiter in Algeneina area; this may help to control the disease, raise people awareness about iodine defi-ciency and imp-rove the behaviors of good nut-rition.

Methods:

All the study population that agreed to partici-pate in the study were Sudanese volunteers from Algeneina area in west Darfur state. Goiter pa-tients were investigated for thyroid and goiter dis-ease. Pregnant women were excluded. All partici-pants were informed about the aim of the study. All information obtained from patients was kept as a high security data.

Samples were selected through a simple random sampling method. The study sample size was set as (120) samples as shown in (table 1).

Venous blood samples were ob-tained from each subject (5ml). Each sample was collected in a plain container, then allowed to clot and immedi-ately centrifuged at 13000 x g for 5 minutes. Se-rum was stored at -20c and transported from Dar-fur to Khartoum in ice bag by the mean of air-plane. The collected data were statistically ana-lyzed using statistical package for social sciences (SPSS) comp-uter program.

T3 and T4 were measured using ELISA microtiter reader (HU-MAREADER) with the wave-length set at 450nm. Specimen's concentration was in-terpolated from a dose response curve generated by utilizing serum calibrators of known antigen

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concentrations (Micallef, 1994). Also TSH was measured acc-ording to (Micallef, 1994).

Results:

As shown in figure (1), results revealed that the mean of TSH was significantly decreased in fe-males group compared to males group (p value 0.04) unlike T3 and T4 since no difference was found between females group and the male group among patients with goiter (p value 0.9), (p value 0.07) respectively.

Table (1) Frequency of Sex among study groups.

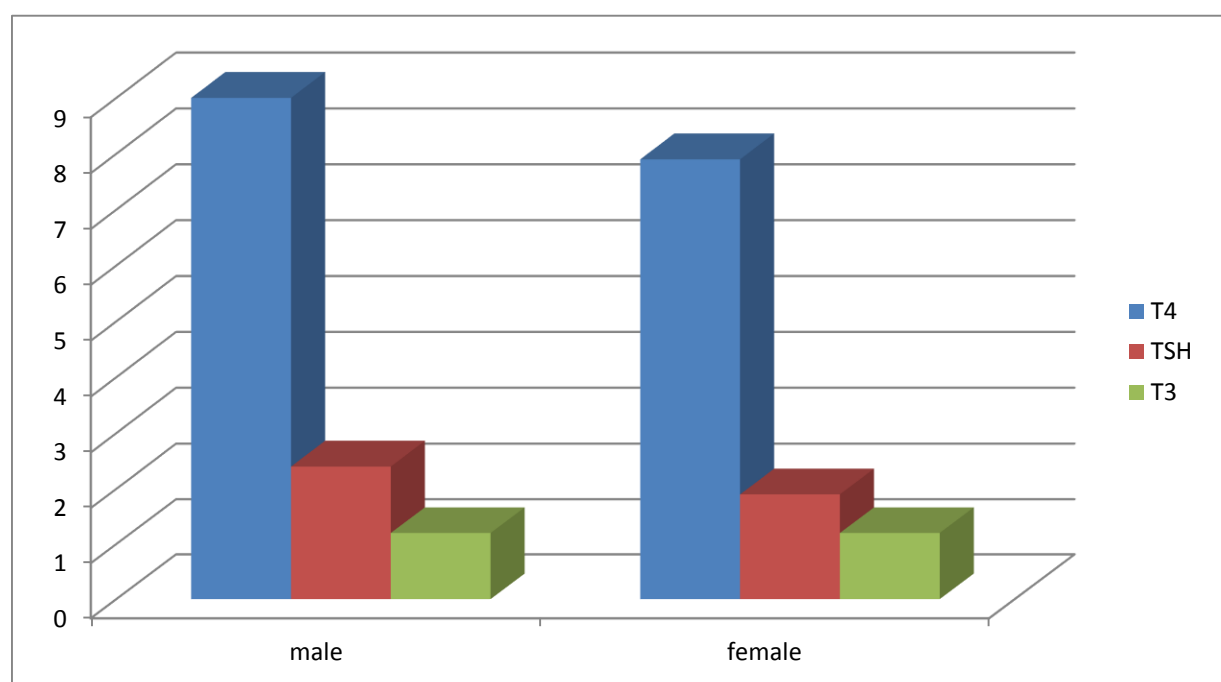| Sex	Study groups	Frequency
Males	Patients	10 (10-65years)
	Healthy control	20 (10-65years)
Females	Patients	70 (10-65years)
	Healthy control	20 (10-65years)

Figure (1) Comparison of Thyroid hormones between males and females among goiter patients

T4 and TSH (as shown in figure 2) were found to be significantly decreased in patients with goiter compared to control group (p value 0.00) and (p value 0.01) respectively. Unlike T3 since no difference was found between patients and the healthy control group (p value 0.76)
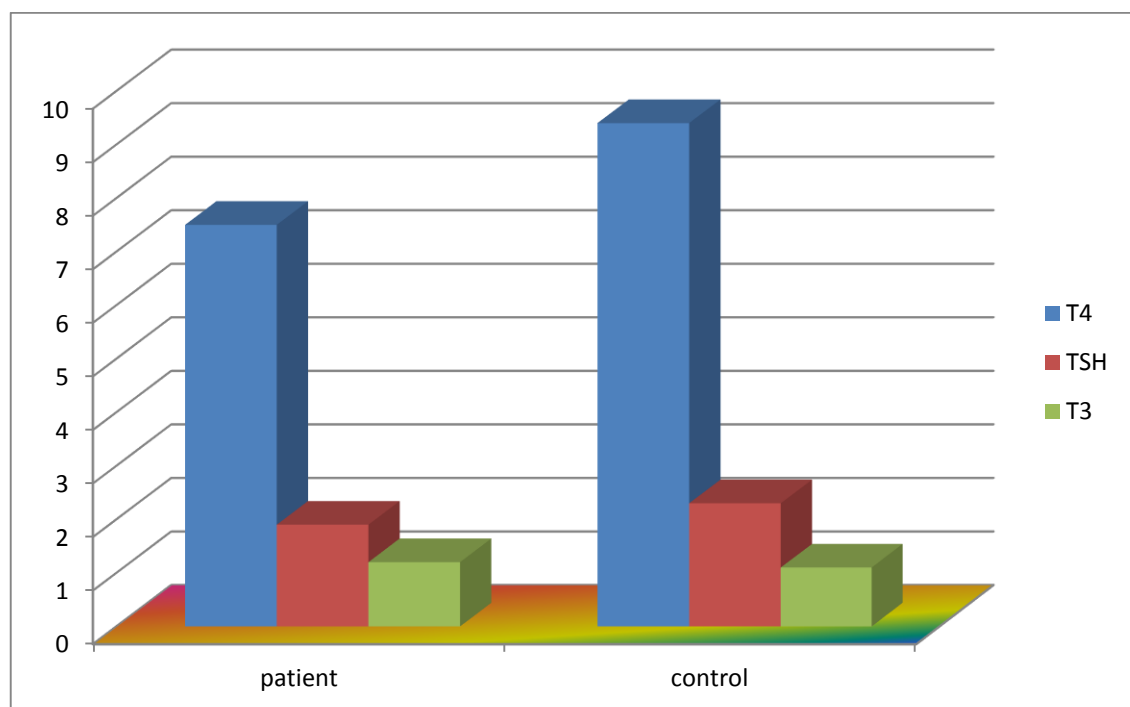

Figure (2) Comparison of Thyroid hormones between patients and control group among study groups.

Results Showed that 66 of patients were suffering Euthy-roidism (accounting for 82.5%), whereas six patients were found hyperthyroidism (representing 7.5%), only four patients were hypothyroidism (representing 5%) and only four patients have high TSH and normal T3,T4 (representing 5%) (figure 3).
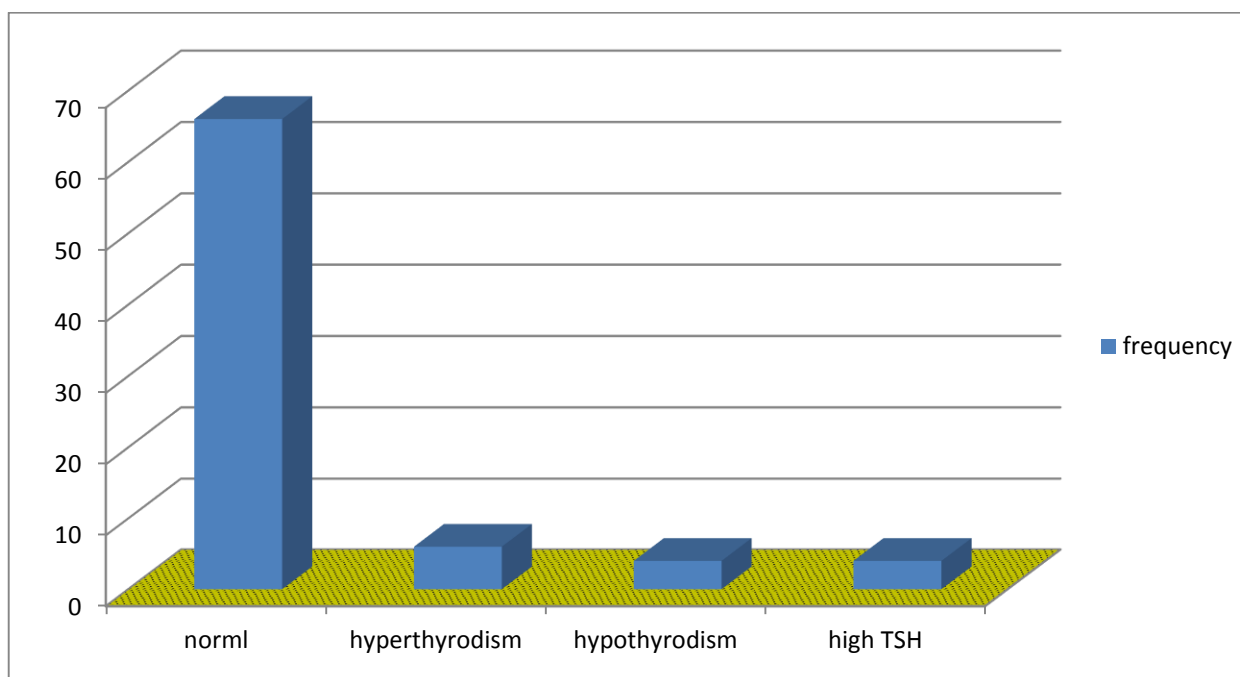
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Figure (3): Frequency and Percentage of patient's results.

Discussion

Thyroid diseases and goiter pose a major health problem that has great impact on both individuals and society. Goiter is one of the major problems in Sudan especially in western area where the iodine deficiency is quite prevalent. The aim of this study was to measure thyroid hormones in patients with goiter in Alg-eneina area. This might help to control the disease,, raise people awareness about iodine def-iciency, and improve the beh-aviors of nutrition.

This study was carried out to investigate and esti-mate the thy-roid hormones levels (T3, T4, TSH) among patients with goiter in west Darfur state (Algeneina town).

One hundred and twenty individuals (aged 10-65years) were investigated for thyroid hormones levels. Results of this study showed that, goiter and thyroid disorder are distributed in all age groups from childhood to older ages. Goiter dis-eases are more common in the middle and old ag-es. These results agree with a previous study which confirms that patients with thyroid dis-orders are usually common in old ages.

A goiter disease was found to be more common in females than in males. These results are in line with observation of Rallison *et al* (1991) who claimed that thyroid disease is more common in women than men, and that was later confirmed through many studies.

In this study there were no significant differences between thyroid hormones levels (T3, T4, and TSH) among age groups and gender groups.

The study showed no significant differences be-tween patients T3 hormone when compared with control groups (p value 0.76). That may be due to the effect of some drugs taken by the patients, like beta blocker drugs.

There was a significant decrease in patients TSH hormone when compared with control groups (p

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value 0.01) and significant decease in patients T4 hormone when compared with control groups (p .value 0.00). So the laboratory investigations and monitoring of thyroid diseases, both, depend on (T4, TSH) levels for international diagnosis of thyroid disease. These findings were supported by a study con-ducted in New Guinea which showed that the mean of serum T4 was significantly lower in goitrous patients than that in non goitrous individuals. However, serum T3 and TSH reveals no difference in presence or absence of goiter (Chopra *et al*, 1975).

The results of patients with goiter showed that the frequencies of euothyroidism re-presented (82.5%) due to iodine deficiency. Hyperthyroidism ac-counted for (7.5%), hypo-thyroidism represented (5%), whereas high TSH with normal T_3 and T_4 represented (5%).

Thyroid diseases are mostly caused by iodine deficiency as previously reported by (ELtom, 2000) particularly in Kurdfan, around the Nuba mountains and Darfur state due to heavy rain fall that washes the iodine content off the soil.

Iodine deficiency remains a major public health problem in Sudan. More than 20% of school – age children are goitrous, and the prevalence richest 40% in Darfur region of western Sudan; only 1% of the population has access to adequately ionized salt. (Peter L, Susanne B. 2002).

Further studies including more sample size should be conducted to evaluate the incidence and prevalence of euthyroid among goitrous patients in Sudan. Also, screening programs including patients with goiters should be established by Sudanese Federal Ministry of Health. Estimation of iodine level in the urine is essential to clarify its effect in development of goiter. Finally, development of a network of goiter centers would be invaluable to provide high qua-lity care and support across Sudan.

Conclusion

From this study the following could be concluded:-

1-The frequency of goiter was high among peoples in west Darfur state.

2- The frequency of euoth-yroidism was high among goi-trous patients in west Darfur State (Algeneina town).

3- The percentage of goiter diseases in females was higher than males.

4- Most of patients with goiter had normal life and normal thy-roid hormones function.

Acknowledgement

[Attached pictures are pictures for some patients enrolled in the study of euthyroid goiter].

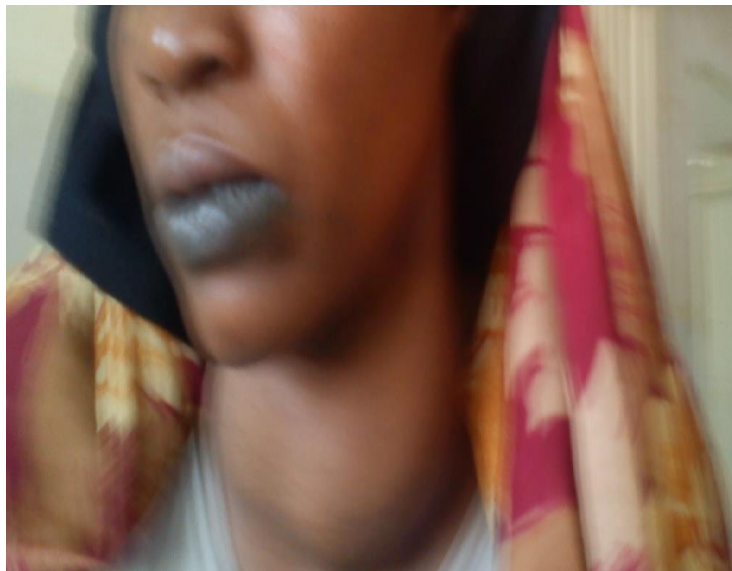Result of this patient was normal thyroid hormones (T3, T4, and TSH)

Result of this patient was normal thyroid hormones (T3, T4, and TSH)

Result of this patient was normal T4, TSH and T3)

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Result of this patient was normal thyroid hormones (T3, T4, and TSH)

The Result of this patient was normal thyroid hormones (T3, T4, and TSH)

Result of this patient was normal thyroid hormones (T3, T4, and TSH)

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