

## *Dedication*

*To soul of my father..*

*To sweet heart my mother..*

*To my brothers and sisters..*

*To my Dear uncle Prof. Babiker..*

*To my own family*

*I dedicate this effort*

*Zokaa*

## **Acknowledgement**

All my praise and thanks to Allah who helped me and gave me confidence to complete this study.

I would like to express my special gratitude to my supervisor Dr. Amar Mohamed Ismail for his great support and advices.

Thanks are also to the staff of Clinical Chemistry Department for their efforts and patience during the practical part of the study.

I would like to extend my thanks to my family, my mum, my elder brother Abd alNasir, and omer elfaroug, my sisters for their encouragement and support especially my kind mother.

I would like to extend my thanks to my husband and my sweet kids for their patients and understanding all difficulties during my being away from them.

I am very grateful to the volunteers included in this study for their helps and permission to collect samples for this study.

Finally, I wish to extend my sincere thanks to all of my friends, and relatives whose names I could not mention here, for their encouragement and support.

## Abbreviations

<b>ALP</b>	Alkaline Phosphatase Enzymes
<b>ATP</b>	Adenosine Triphosphate
<b>BPG</b>	Biphosphoglycerate
<b>DNA</b>	Deoxyribonucleic Acid
<b>ECF</b>	Extracellular Fluid
<b>ECG</b>	Electrocardiographic
<b>PCT</b>	Proximal Convoluted Tubule
<b>PTH</b>	Parathyroid Hormone
<b>RNA</b>	Ribonucleic Acid

## **Abstract of the study**

**Introduction:** Smoking causes alterations in calcium and electrolytes metabolism. Electrolytes disturbance may lead to life threatening metabolic abnormalities such as coronary heart disease and osteoporosis. A descriptive cross sectional study aims to evaluate serum and saliva calcium, phosphate and magnesium in tobacco consumers and non tobacco consumers in Khartoum state.

**Materials and Methods:** 76 males tobacco consumers and 30 non-consumer males as control group were included. Serum and salivary (calcium, phosphate and magnesium) level were estimated by spectrophotometric method, data analyzed using ANOVA test and Pearson correlation in SPSS computer program.

**Results:** The results showed high percentage of tobacco consumption among the youngest. Serum calcium level is decreased significantly in tobacco consumers versus control group ( $P$ -value 0.000), also saliva calcium significantly increased in tobacco consumers versus control group ( $P$ -value 0.000). The results of serum and salivary (phosphate and magnesium) showed insignificant variation in tobacco consumers when compared with the control group. Person's regression showed no correlation between (calcium, phosphate and magnesium) level with (age and duration of tobacco consumption).

**Conclusion:** In conclusion, salivary calcium increases with decreasing serum calcium in tobacco consumers, which lead to periodontal diseases and osteoporosis.

## مستخلص الدراسة

**مقدمة:** التدخين يسبب تغييرات في الكالسيوم والشوارد الأيضية. قد يؤدي اضطراب الشوارد إلى تهديد الحياة و شذوذ التمثيل الغذائي مثل مرض القلب التاجي ومرض هشاشة العظام. هذه الدراسة مقطعية وصفية تهدف إلى تقييم المصل واللعاب للكالسيوم والفوسفات والمغنيسيوم في مستهلكي التبغ وغير مستهلكي التبغ في ولاية الخرطوم.

**المواد والطرق:** 76 من الذكور من مستهلكي التبغ و 30 من الذكور غير المستهلكين كمجموعة ضابطة، تم شملهم في هذه الدراسة خلال الفترة من شهر فبراير الى يونيو 2014. تم قياس مستويات (الكالسيوم والفوسفات والمغنيسيوم) في مصل الدم واللعاب بواسطة الطريقة المعتمدة على الطيف الضوئي ، تحليل البيانات باستخدام اختبار ANOVA وارتباط بيرسون في برنامج كمبيوتر SPSS .

**النتائج:** أظهرت النتائج نسبة عالية من استهلاك التبغ وسط الشباب. وانخفض مستوى الكالسيوم في الدم بشكل ملحوظ في مستهلكي التبغ مقابل المجموعة الضابطة ( بقيمة  $P=0.000$ )، أيضا الكالسيوم في اللعاب ارتفع بشكل ملحوظ في مستهلكي التبغ مقابل المجموعة الضابطة. لكن نتائج المصل واللعاب (الفوسفات والمغنيسيوم) أظهرت تباين ضئيل في مستهلكي التبغ بالمقارنة مع مجموعة المراقبة. وأظهر ارتباط بيرسون إلى عدم وجود علاقة بين (الكالسيوم والفوسفات والمغنيسيوم) مع مستوى العمر ومدة استهلاك التبغ.

**الختام:** وختاماً، انخفض مستوى الكالسيوم في مصل الدم بزيادته في لعاب مستهلكي التبغ، مما يؤدي إلى أمراض اللثة وهشاشة العظام.

## List of contents

	<b>Title</b>	<b>Page No</b>
	Dedication	i
	Acknowledgments	ii
	Abbreviations	iii
	Abstract of study	iv
	مستخلص الدراسة	v
	List of contents	vi
	List of figures	viii
<b>Chapter One: Introduction and Literature Review</b>		
1.1	Tobacco	1
1.1.1	Tobacco definition	1
1.1.2	Tobacco Classification	1
1.1.2.1	Tobacco smoking	1
1.1.2.2	Smokeless Tobacco	1
1.1.3	Route of administration	1
1.1.4	Complications abuse	2
1.2	Calcium biochemistry and physiology	2
1.2.1	Calcium Distribution	3
1.2.2	Calcium regulation	3
1.2.2.1	Parathyroid hormone (PTH)	3
1.2.2.2	Vitamin D	4
1.2.2.3	Calcitonin	4
1.2.2.4	Thyroid hormone	4
1.2.2.5	Alkaline phosphatase enzymes (ALP)	4
1.2.3	Calcium pathology	4
1.2.3.1	Causes of hypocalcemia	5
1.2.3.2	Hypercalcemia	5
1.2.3.3	Causes of Hypercalcemia	6
1.3	Phosphate biochemistry and physiology	6
1.3.1	Phosphate regulation	7
1.3.2	Phosphate pathology	8
1.3.3	Causes of Hypophosphatemia and Phosphate Depletion	9
1.3.4	Causes of Hyperphosphatemia	10

1.4	Magnesium	10
1.4.1	Biochemistry and Physiology	10
1.4.2	Regulation	10
1.4.3	Magnesium pathology	11
1.4.4	Causes of Magnesium Deficiency	12
1.4.5	Hypermagnesemia	12
1.4.6	Causes of Hypermagnesemia	12
1.5	The Saliva	13
1.5.1	Composition of Saliva	13
1.5.2	Major Function of Saliva	13
1.6	Calcium, Phosphate, Magnesium, and Tobacco Consumption Risk	14
1.7	Rationale	15
1.8	Objectives	16
<b>Chapter Two: Materials and Methods</b>		
2.1	Materials	17
2.2	Methods	18
<b>Chapter Three: Results</b>		
3	Results	21
<b>Chapter Four: Discussions. Conclusion and Recommendations</b>		
4.1	Discussions	29
4.2	Conclusion	31
4.3	Recommendations	32
	References	33
	Appendices	35

---

## List of figures

	<b>Title</b>	<b>Page NO</b>
<b>Fig (3.1)</b>	Fig (3.1) showed frequencies of tobacco consumptions in age group, expressed as percentage (%)	23
<b>Fig (3.2)</b>	Fig (3.2) showed mean of saliva calcium level mg/dl in smoker, snuffer, both and control group, result expressed as (M±STD)	25
<b>Fig (3.3)</b>	Fig (3.3) showed mean of Serum calcium level mg/dl in smoker, snuffer, both and control group, result expressed as (M±STD)	26
<b>Fig (3.4)</b>	Fig (3.4) showed mean of saliva phosphate level mg/dl in smoker, snuffer, both and control group, result expressed as (M±STD)	27
<b>Fig (3.5)</b>	Fig (3.5) showed mean of Serum phosphate level mg/dl in smoker, snuffer, both and control group, result expressed (M±STD)	28
<b>Fig (3.6)</b>	Fig (3.6) showed mean of Saliva magnesium level mg/dl in smoker, snuffer, both and control group, result expressed (M±STD)	29
<b>Fig (3.7)</b>	Fig (3.7) showed mean of Serum magnesium level mg/dl in smoker, snuffer, both and control group, result expressed (M±STD)	30