TAB	LE OF CONTENTS	Page
Title		i
Declaration		ii
Acknowledgements		iii
List o	f Publications	iv
Table	of contents	v
List o	f figures	x
List o	f tables	xi
Abstra	act	xii
Objec	tives	xiv
Abbreviations		xv
Chap	ter 1	
Introduction		1
1.1.	Osteoporosis	2
1.1.1	Definition of Osteoporosis	2
1.1.2	Osteoporotic fracture	3
	4.1.2.1 Hip fracture	3
	4.1.2.2 Vertebral Fracture	4
	4.1.2.3 Distal Forearm fracture	5
	4.1.2.4 Assessment of fracture risk	5
1.1.3	Methods of bone mass measurement	6
J	1.1.3.1 Dual energy X-ray absorptiometry (DXA)	6
	1.1.3.2 Quantitative ultrasound (QUS)	7
	1.1.3.3 Conventional skeletal radiography	. 7
	1.1.3.4 Quantitative computed tomography (QCT)	8
	1.1.3.5 Peripheral QCT (pQCT)	8

•

1.1.4	Diagnosis of osteoporosis	8
1.2	Physiology of bone tissue	9
1.2.1.	Bone cells	12
	1.2.1.1. Osteoblasts	12
	1.2.1.2. Osteocytes	12
	1.2.1.3. Osteoclasts	13
1.2.2.	Bone Remodelling	14
1.2.3.	Calcium	15
	1.2.3.1. Role of calcium in the body	15
	1.2.3.2. Regulation of calcium metabolism	16
	1.2.3.3. Parathyroid Hormone	16
	1.2.3.4. Calcitonin	17
	1.2.3.5. Vitamin D	17
	1.2.3.6. Estrogen	18
	1.2.3.7. Androgens	19
	1.2.3.8.Calcium Absorption	19
1.3.	Pathogenesis of osteoporosis	19
1.3.1	Risk factors for osteoporosis	20
	1.3.1.1. Age and Gender	20
	1.3.1.2. Estrogen deficiency	20
	1.3.1.3. Genetic and ethnic factors	21
	1.3.1.4. Body weight	21
	1.3.1.5. Physical activity	22
	1.3.1.6. Nutrients	22
	1.3.1.7. Other factors	23

	1.3.1.7. Other factors	23
1.3.2.	Hip geometry	23
1.4.	Prevention and treatment of osteoporosis	27
1.4.1	Non-Pharmacological measures	27
1.4.2	Pharmacological agents	27
	1.4.2.1. Hormone replacement therapy	27
	1.4.2.2. Selective estrogen receptor modulators	28
	1.4.2.3.Bisphosphonates	28
	1.4.2.4. Calcitonin	29
	1.4.2.5. Recombinant human parathyroid hormone	29
1.4.3.	When should osteoporosis be treated?	29
Chapt	rer 2	
Mater	ials and Methods	31
2.1	Study area and geography	32
2.2	Individuals	32
2.3.1	Data Collection	33
2.3.2	Questionnaire	34
2.3.3	Anthropometric measurements	34
2.3.4	Dual Energy X-ray absorptiometry	35
2.3.5	Hip Structure analysis	36
2.3.6	Lung function test	37
2.3.7	Other measurements	37
2.4	Ethical considerations during the study	37
2.5	Statistical analysis	38

## Chapter 3

Resul	Results	
3.1.	The study cohort	40
3.1.1	Geography of the cohort	40
3.1.2	Socio economic status	41
3.1.3	Basic characteristics	41
3.2	DXA	43
3.2.1	Bone Mineral Density measurements	43
3.2.2	Prevalence of osteoporosis	46
3.2.3	Determination of effects of height, weight and BMI on BMD	48
3.3	The effect of reproductive factors on BMD	52
3.3.1	Effect of age of menarche on BMD	52
3.3.2	Effect of age at menopause	54
3.3.3	Effect of length of fertile period on BMD	54
3.3.4	Effect of number of live births on BMD	55
3.3.5	Effect of lifelong breast-feeding on BMD	58
3.4	Effect of calcium nutrition	60
3.4.1	Diary calcium and BMD	60
3.4.2	Dietary calcium intake and BMD	62
3.5	Effect of exposure to sunlight	64
3.6	Changes in hip structure with age	64
3.7	Association of BMD and level of education	68
3.8	Association of BMD with respiratory functions	71
3.9	Association of BMD with systemic blood pressure	73
3.10	Association of BMD with number of teeth lost	73

3.11	Association of Bivid with the length of foot	//
3.12	Validation of a screening tool for detection of high risk subjects	77
Chap	ter 4	
Discu	ssion	80
4.1.	General discussion	81
4.2.	Bone Mineral Density	81
4.3.	Role of calcium nutrition	84
4.4.	Effect of sun exposure	85
4.5.	Hip structure analysis	86
4.6.	Effect of reproductive factors	88
4.6.1.	Effect of age of menarche and menopause	88
4.6.2.	Effect of child bearing and breast-feeding	89
4.7.	Level of education and BMD	91
4.8.	Tooth loss and BMD	92
4.9.	Respiratory function and BMD	92
4.10.	Association of BMD with length of foot and skin fold thickness	93
4.11.	Association of BMD with systemic blood pressure	94
4.12.	Validation of screening tool	95
4.13.	General limitations of the study	95
4.14.	Conclusions	96
4.15.	Recommendations/ Suggestions	97
Biblio	graphy	98
Annex	cure. Questionnaire	12

## List of Figures

No	Title	Page
Figure 1.	Normal and osteoporotic bone	11
Figure 2.	Hip structure analysis measurements	26
Figure 3.	Percentage change in BMD with advancing age	45
Figure 4.	Relationship between the number of live births and BMD	56
Figure 5.	Percentage changes in BMD, neck width and CSA with advancing age	67

## List of tables

Numbe	r Title	Page
Table 1	. Basic Characteristics of the study cohort.	42
Table 2	. The regional BMDs of the cohort and by age groups.	44
Table 3	. The prevalence of osteoporosis and osteopenia, using different reference	
	databases.	47
Table 4.	The association of height, weight and BMI with BMD.	50
Table 5.	Association of weight with BMD at different sites.	51
Table 6.	Effect of age of menarche on BMD.	53
Table: 7	7. Effect of number of childbirths on BMD and prevalence of osteoporosis.	57
Table. 8	. The effect of period of lifelong breast-fed on BMD and prevalence	
	of osteoporosis.	59
Table 9.	Effect of milk consumption on BMD and the prevalence of osteoporosis	61
Table 10	D. Effect non-diary calcium intake on BMD and prevalence of osteoporosis	63
Table 1	1. Descriptive data of women included to hip structure analysis.	65
Table 12	2. Age related changes in femoral neck BMD and indices of hip geometry.	66
Table 13	3. Basic characteristics: mean (sd), of women by different levels of education	69
Table 14	4. Effect of educational level on BMD and Prevalence of osteoporosis.	70
Table: 1	5. The correlations of regional respiratory function parameters to BMD.	72
Table: 1	6. Regression analysis between the total tooth loss and BMDs in all	
	women and subgroups of postmenopausal and premenopausal women.	74
Table 17	: Mean (SD) BMDs and the prevalence of osteoporosis in the thirds of	
	the total tooth loss.	76
Table 18	8. Effectiveness of the screening test in detection of the osteoporotic patients.	. 79