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Abstract:

In this paper cold and hot drinks turmeric was carried out including turmeric tea, Latte coffee and some supplemented juice with turmeric including Carrot, Orange, and Lemon as functional foods for diabetic and its effect on osteoporosis. The drinks were prepared by adding 5 gm of turmeric powder without sugar and were evaluated sensory taste, color, flavor and texture by using 30 diabetes patients of female suffering from osteoporosis. The results showed that the drinks were acceptable and not significant differences $P>0.05$ compared to control drinks. Blood glucose and bone minerals improved after two month 124 ± 1 mg/dL compared to blood glucose level before the test 170 mg/dL with improvement in the weight 90 ± 0.5 compared to before the test 106 ± 1.0 , also bone minerals level as calcium, phosphorus and Potassium improved to 1.13 ± 0.6 mmol/l, 4.2 ± 0.2 mg/dl and 4.3 ± 0.5 mmol/l compared to before the test 1.29 mmol/l, 3.05 mg/dl and 3.64 mmol/l. A combination turmeric in right proportions in fruit drinks and hot drinks is recommended as an alternative treat, flavouring and preservative.

Key words: Curcumin, turmeric, blood glucose, diabetic, osteoporosis, bone minerals and bone pain.

Introduction:

Recent trends were appeared in the benefit from medicinal plants as a treatment for many chronic diseases, among these plants is turmeric. Turmeric powder is used as a spice and additive for foods that need yellow color, and its importance is shown in its curcuminoids content. Due to pharmacological and biological effects, including liver and kidney diseases, blood pressure, osteoporosis, anti-inflammatory, antioxidant, anticancer, cardio-protective, anti-microbial, anti-rheumatic effects, immunomodulatory and diabetes. So turmeric increased its using in food industry. Diabetes is considered epidemic disease, it affected on over 400 million people worldwide (**International Diabetes Federation, 2017**), type 2 diabetes mellitus represents the most prevalent form (**World Health Organization, 2016**). But type 2 diabetes was controlled and prevented by using anti-diabetic drugs, lifestyle such as healthy diet

and Physical activity (**Johnson et al, 2019**). Also people, who are suffering from prediabetes or type 2 diabetes mellitus (T2DM), modify lifestyle and pharmacologic (**American Diabetes Association, 2017**). Currently, medical plants was used to prevent and control type 2 diabetes (**Demmers et al, 2017 & Poolsup et al, 2019 & Suksomboon et al, 2011**), Among these medical plants, Curcumin, is an active substance present in Curcuma, also known as turmeric, it has biological and pharmacological effects, and include antioxidant, anti-inflammatory, anti-microbial, cardio protective, nephro protective, anti-neoplastic, hepato protective, immunomodulatory, hypoglycaemic, anti-diabetic, anti-viral and anti-cancer activities and anti-rheumatic effects (**Mirzaei et al, 2017 & Derosa et al, 2016 & Nabavi et al, 2014 & Perrone et al, 2015**). Also curcumin has effect against diabetes, such as the study of (**Nishiyama, et al, 2005 & Stani, 2017**) investigated the effect of curcumin on animals suffering from diabetes, the experiment explained that curcumin have a mechanism of action similar to thiazolidinedione, an anti-diabetic drug, this effect is due to the peculiar chemical structure of turmeric such as curcumin 75%, demethoxycurcumin 20%, and bisdemethoxycurcumin 5%. (**Francesca et al, 2019**) talk about curcumin and Type 2 diabetes mellitus as prevention and treatment, it has medicinal properties such as anti-inflammatory, antioxidant, anti-carcinogenic, anti-mutagenic, anti-coagulant, antifertility, antidiabetic, antibacterial, antifungal, antiprotozoal, antiviral, antifibrotic, antivenom, antiulcer, hypotensive and hypocholesteremic activities (**Rahul Kumar Verma et al, 2018**). Also (**Rohith N.Thota et al, 2018**) investigated curcumin alleviates postprandial glycaemic response in healthy subjects, the results were obtained were decreasing in postprandial glucose concentrations by the curcumin 60.6%, $P=0.0007$ and curcumin+fshoil group 51%, $P=0.002$ groups at 60min from baseline compared with placebo. Turmeric can treat osteoporosis and improving bone minerals level as the study of (**Yang MW, Wang TH et al, 2011**) carried out the natural substances such as curcumin can prevent and treat osteoporosis. The combination of curcumin and alendronate has beneficial effects on BMD and bone turnover markers among postmenopausal women with osteoporosis, the results are showed increasing BMD in four areas compared to the control and alendronate groups, so it was recommended the combination between curcumin and alendronate because it has effects on BMD and bone turnover markers among postmenopausal women with osteoporosis. Also curcumin is considered a natural antimicrobial agent, a strong antioxidant, anti-inflammatory, antibacterial, antifungal, and antiviral agent (**Fatemeh Khanizadeh et al, 2018**). Curcumin is a natural antimicrobial and bacteria agent that it was tested efficacy against over

100 strains of pathogens belonging to 19 species (Artur Adamczak et al, 2020). Also it investigated the effect of curcumin supplementation on anthropometric indices, insulin resistance and oxidative stress in patients with type 2 diabetes, the results are showed a significant changes in mean weight compare to placebo (-0.64 ± 0.22 vs. 0.19 ± 0.37 $p < 0.05$), body mass index (BMI) (0.3 ± 0.03 vs. 0.1 ± 0 $p < 0.05$), and daily intake of curcumin (1500 mg) has positive effects in reducing fasting blood glucose level from 11.7 mg/dL to 1.3 mg/dL and weight in patients with type 2 diabetes with improvement lipid profile (Homa Hodaei et al, 2019 & Naline Poolsup et al, 2019). The Golden spice curcumin describe with has Anti-infective properties a biological and pharmacological properties, for example, as anti-inflammatory, anti-angiogenic, anti-neoplastic, antiviral and antibacterial activity like the influenza virus, hepatitis C virus, HIV and strains of staphylococcus, streptococcus, and pseudomonas (Dimas Praditya et al, 2019). (Jia He et al, 2020) investigated the impact of curcumin on bone osteogenic promotion under high glucose conditions and enhanced bone formation in diabetic mice, the results showed the possibility of using curcumin for bone regeneration under high glucose concentrations. Also curcumin involved in bone remodeling, and it can be affect the skeletal system, alleviates osteoporosis and may be a potential therapeutic for the treatment of osteoporosis (Ramin Rohanizadeh1, 2016 & Zhiguang Chen et al, 2016). This paper aimed to production of suggested healthy drinks using turmeric as a functional food for diabetic and its effect on the bone health.

Material and methods

Patient selection and source of materials

- Dried turmeric not powder, black pepper, fruits and milk used in the work were collected from market from Cairo, Egypt.

-The study's participants, 20 diabetic of women suffering from osteoporosis, 45 - 50 years of age were recruited for this study, height 165 Cm, Actual weight was 95 kg, perfect weight was 65 kg and body mass index was 34 kg/m^2 , patients known to be diabetic for 1 year, suffer from high blood glucose level and osteoporosis. The Scientific Research Ethics Letter No. EC 2302 was obtained from the Scientific Research Ethics Committee at Fayoum University.

Preparation of the turmeric and drinks

-Turmeric and black pepper were prepared by grinding in the blender to get powder, 5gm of turmeric and little of black pepper were added to tea, latte coffee, juice of carrot, orange and lemon.

Sensory evaluation: Twenty diabetic women, suffering from osteoporosis, were used for the sensory evaluation of the turmeric drinks

using a 5-point hedonic scale, blood glucose level and osteoporosis analysis is performed for them.

Study design of diabetic and suffered from osteoporosis

-The study design was lasted 2 months. The patients were drinking the turmeric drinks as turmeric tea, turmeric coffee, Carrot Juice, orange Juice and Lemon juice.

-Diabetes was diagnosed according to WHO, blood glucose level more than (120/80 mg/dL) was classified as Diabetic or hyperglycemia.

- Osteoporosis was diagnosed by bone mineral densitometry according to WHO, Bone density (<-2.5) was classified as osteoporosis.

Sample Collection

Blood samples were collected from patients at the beginning of the study and after 8 weeks with and without drinks supplementation with turmeric. Blood samples were collected in EDTA vials. Plasma or serum was separated by centrifugation at 3,000 rpm for 10 min, and then blood glucose, bone mineral, HDL, LDL, VLDL level were measured in plasma. Also some biochemical parameters were determined in Tumeric.

BMD measurement and calcium, phosphorus, potassium analysis

BMDs of femoral neck and total hip were determined by dualenergy X-ray absorptiometry (DXA) at the beginning of the study and after 2 months using Hologic and Waltham. The study defined osteoporosis according to World Health Organization (WHO). The analysis of Ca, P, and K were (1.29 mmol/L, 3.05 mg/dl, 3.64 mmol/L), these data were showed decreasing in the bone minerals and osteoporosis.

Determination of proximate composition

Moisture, protein and crude fiber contents were determined by the method (James, 1995). Total ash was determined by (AOAC, 2000). Fat content of the sample was determined by (Pearson, 1976).

Phytochemical Screening

Alkaloids and sterol were determined by the method (Haborne, 1998). Saponins were determined by the method (AOAC, 2000). Flavonoid was determined by the method (Haborne, 1998). Phenol and Tannins were determined by the method (Person, 1976).

Test for alkaloid

The extract (1.0 ml) was shaken with 5.0 ml of 2 % HCl on a steam bath and filtered. To 1ml of the filtrate, Wagner's reagent (iodine in potassium iodide solution) was added. A reddish brown precipitate confirms that its presence.

Test for Saponins

One millilitre of the filtrate was diluted in 1ml of water and shaken vigorously.

A strong Frothing confirms presence of Saponins.

Test for tannins

Five millilitres of the extract was added to 2.0ml of 1% HCL. Deposition of a red precipitate shows the presence of tannin.

Test for sterol

The extract (1 ml) was dissolved in 2.0 ml of chloroform in a test – tube, and then 1 ml of conc. H₂SO₄ was added. Formation of reddish brown colour at the inter - phase confirms the presence of steroid.

Test for phenol

The extract (1.0 ml) was added with 1.0 ml of 10 % ferric chloride. The formation of a greenish brown or black precipitate or colour is taken as positive for a phenolic nucleus.

Test for flavonoid

The extract (1.0 ml) was diluted in 1.0 ml of diluted NaOH. Formation of precipitate shows the presence of flavonoid.

Determination of vitamins

Riboflavin, thiamine and niacin were determined by the method (Onwuka, 2005).

Determination of minerals

Calcium, phosphorous, potassium and iron were determined by the method (James, 1995).

Table 1: Composition of ingredients in turmeric drinks

Drinks	ingredients in drinks/gm - ml					
	Fruit	Sugar/ gm	Water ml	low fat milk ml	Turmeric gm	Black pepper gm
Turmeric tea	_	No	200 ml	_	5	2 gm
Turmeric coffee	_	No	_	50	5	2 gm
Carrot Juice	3	No	25	_	5	2 gm
orange Juice	2	No	25	_	5	2 gm
Lemon juice	1	No	200	_	5	2 gm

Statistical analysis of data Results and discussion

The data presented as the mean \pm standard deviation (SD) and frequency. ANOVA were applied for comparison of the results appropriately statistical analysis of data was performed by SPSS 19 SPSS, Chicago, USA software. P value < 0.05 was considered significant.

Results and Discussion**Sensory evaluation mean of turmeric drinks**

Data in **table 2** explains the sensory evaluation mean of turmeric drinks as, Turmeric tea, Turmeric coffee, carrot juice, orange juice, lemon juice. The results shows that there was no significant difference ($P > 0.05$) in sensory evaluation properties, also these drinks were achieved good results in taste, color, Aroma, texture and general acceptability (4.64, 5, 4.98, 5 and 4.9) , so it was acceptable compared to control and commercial drink used as standard (Ehirim et al, 2006). High

Performance Liquid Chromatography (HPLC) is used to determination Phytochemicals of turmeric. These results agreed with (Ankitha et al, 2018) whose investigated salubrious curcumin fortified whey beverage formulation and study its antioxidant property, the results obtained showed that development product was rich in antioxidant activity and level of curcumin; sweetener and flavor were acceptable for consumer. Also, developed product can be considered as beneficial and highly nutritional in functional properties. Due to the high content of protein and carbohydrates, besides some essential minerals, turmeric could be an excellent candidate nutritional food supplement, additional to it is excellent antioxidant activity, so it makes as functional foods and prevention for chronic diseases such as diabetics, blood pressure and osteoporosis (Jaime Restrepo-Osorio et al, 2020). Extracts of pineapple, turmeric and ginger were also made and blended with different rates to prepare turmeric ginger-flavoured pineapple drinks and determined sensory evaluation of the drinks, the drinks were acceptable and were found to be as good as the commercial pineapple drink used as standard, so A combination of turmeric and ginger in the right proportions is recommended as flavouring and preservative for pineapple fruit drinks and other cereal foods (Ekeledo, et al, 2014).

Table 2: Sensory evaluation mean of turmeric drinks

Sensory evaluation Juice samples	Taste " 5 "		Coloure " 5 "		Aroma " 5 "		Textures " 5 "		general acceptability " 5 "		Mean
	C	T	C	T	C	T	C	T	C	T	
Turmeric tea	5	4	5	5	5	4.5	5	5	5	4.7	4.64
Turmeric coffee	5	5	5	5	5	5	5	5	5	5	5
Carrot Juice	5	5	5	5	5	4.9	5	5	5	5	4.98
orange Juice	5	5	5	5	5	5	5	5	5	5	5
Lemon juice	5	4.8	5	5	5	4.8	5	4.9	5	5	4.9

C: means control sample T: means test sample "with Turmeric".

Proximate composition of Turmeric

The results in Table 3 shows that the turmeric contains 9.63% protein, 66.81 % carbohydrates, 6.82% oil, 2.86% ash, 8.87% moisture and 7.48% fiber, so it could be a good source of protein, fiber and carbohydrate (Jaime Restrepo-Osorio et al, 2020). The high content in ash is responsible for increasing mineral level in Turmeric. The role of fiber in Turmeric will help to prevent the absorption of excess cholesterol, hypocholesteremic and diabetes mellitus (Ikpeama, Ahamefula, et al, 2014 & Bamishaiye et. al., 2011).

Table 3: Proximate composition of Turmeric

Parameters	Contents %
Protein	9.63
Carbohydrates	66.81
Oil	6.82
Ash	2.86
Moisture	8.87
Fiber	7.48

Values are means \pm standard deviation of three determinations
Vitamins and mineral composition of Turmeric mg/gm

The results in **Table 4** shows that turmeric plant has 3.46 A, 1.25 B2, 0.38 B3, 0.89 C, 0.68 D, 1.63 Ca, 1.31 K, 1.08 P, 0.755 S and 0.0665 mg/g Fe, with constant feeding on turmeric plant could improve strong bone, muscle contraction and relaxation, reduce blood pressure and help in hemoglobin formation, and patients with soft bone problems are usually placed on high calcium and potassium meals (**Kubmarawa et al., 2007**). Vitamins, minerals and phytochemical compositions were determined in Turmeric; the results indicated that it contains high quantities of protein and carbohydrates, also vitamins and minerals (**Imoru et al, 2018**).

Table 4: Vitamins and mineral composition of Turmeric mg/ gm

Vitamins	Contents	Minerals	Contents
Vit. A	3.46	Ca	1.63
Vit. B2	1.25	K	1.31
Vit. B3	0.38	P	1.08
Vit. C	0.89	S	0.755
Vit. D	0.68	Fe	0.0665
Vit. E	0.43	Cu	0.0455

Values are means + standard deviation of three determinations
Phytochemicals composition of Turmeric mg/ gm
 The results in **Table 5** shows that turmeric plant is excellent content in phytochemicals, it had 1.33 Tannins, 0.078 Phenols, 0.48 Sterol, 0.56 Flavonoids and 0.743 mg/g Saponins, this compounds confirmed the medicinal properties of the turmeric plant, so it had antioxidants and antimicrobial properties, Saponins and Tannins prevents the development of microorganisms and have antifungal properties (**Ikpeama et al, 2014; Iniaghe et al., 2009; Prasad et al., 2008; Okwu and Josiah, 2006**). Due to the nutritional value and phenolic compounds contents, turmeric makes as functional foods (**Jaime Restrepo-Osorio et al, 2020**). Study of the health benefits of turmeric in the management of oxidative and inflammatory conditions, metabolic syndrome, arthritis, anxiety, and

hyperlipidemia, these benefits can be attributed to its antioxidant effects. (Susan J. Hewlings et al, 2017)

Table 5: Phytochemicals composition of Turmeric mg/ gm

Phytochemicals	Contents mg/gm
Tannins	1.33
Phenols	0.078
Sterol	0.48
Flavonoid	0.56
Saponins	0.743

Values are means + standard deviation of three determinations

Table 6: Baseline characteristics of diabetic and bone minerals measure

Data in **table 6** shows baseline characteristics of diabetic and bone minerals measurements as (Ca, P, and K). Twenty participants females aged 45-50 years with height 165 ± 3 Cm, Actual weight 106 ± 1 Kg, perfect weight 75 ± 2 Kg and body mass index 34 ± 5 Kg/m². The results indicate an improvement in total cholesterol, triglycerides, HDL, AST, ALT, Urea level, blood glucose level improved to (124 mg/dL) compared to the results before the experience (170 mg/dL), bone minerals level (Ca, P, K) shows improvement (1.13, 4.2 and 4.3) compared to the results before the experience (1.29 mmol/L, 3.05 mg/dl, 3.64 mmol/L). These results agreed with (Ikpeama et al, 2014) which mentioned that Turmeric is nutritionally rich in essential vitamins and minerals needed for body growth. The results of the study support the development of new drugs from the plant. The nutritional value of phytochemicals , phenolic compounds contents and health benefits of curcumin makes as functional foods against the chronic diseases as diabetes and osteoporosis, due to pharmacological and biological effects as anti-inflammatory, antioxidant (Daria Jovičić et al, 2017; Jaime Restrepo-Osorio et al, 2020). Also Turmeric boosts glucose control and augments the effects of the medications which are used in the treatment of diabetes. It decreases the body's resistance to insulin which can prevent Type-2 diabetes from developing (Rahul Kumar Verma et al, 2018). (Maithili Karpaga Selvi et al, 2015) investigated the effect of Turmeric as an adjuvant to anti-diabetic therapy, there was significant decrease in fasting plasma glucose in both groups but the decrease was comparatively more in turmeric supplemented group. Turmeric supplementation treated type 2 diabetic patient significantly, it decreased fasting glucose (95 ± 11.4 mg/dl), also Turmeric exhibited beneficial effects on LDL cholesterol, it decreased LDL (113.2 ± 15.3 mg/dl, P\0.01) and increased HDL cholesterol (138.3 ± 12.1 mg/dl, P\0.05), so Turmeric supplementation is recommended, because of its beneficial effect on blood glucose, oxidative stress and inflammation.

Table 6: Baseline characteristics of diabetic patients and bone minerals measure

Variables	All participants N = 20		
	Measurements before the experiment	Measurements after the experiment	Normal
female	20	_____	_____
Age/ years	45-50	_____	_____
High cm	165±3	_____	_____
Actual weight kg	106±1	90±0.5	_____
perfect weight kg	75±2	85±1.5	_____
Body mass index kg/m ²	34±5	27±1	24 kg/m ²
Total cholesterol mg/dl	207.4±2	176±1.1	200
Triglycerides mg/dl	219.9±1.5	197±1.0	200
HDL mg/dl	37.6±3	49±2.3	55
LDL mg/dl	49.1±3.5	35.7±0.5	_____
VLDL mg/dl	53±3.5	25.5±1.7	_____
AST (IU/l)	16.5±4.1	33.5±0.3	40
ALT (IU/l)	23.6±2.3	38.1±4.1	41
Urea (mg/dl)	25.5±2.1	37.4±1.6	16.6-48.5
Blood glucose level mg/dL	170±2	124±1	120/80
Duration of diabetes years	≤1	_____	_____
Calcium mmol/L	1.29±0.5	1.13±0.6	1.05-1.13
Phosphorus mg/dl	3.05±0.2	4.2±0.2	2.5-4.5
Potassium mmol/L	3.64±0.1	4.3±0.5	3.4-5.1

Conclusion:

Turmeric is a spicy condiment is a flavorful and a colorful. Curcumin is added to foods such as butter and margarine to prevent oxidation and to improve the color and appetite, act as a carminative, and treat gallstones and other biliary problems. Turmeric has received worldwide attention because of its multiple health benefits, due to antioxidant and anti-

inflammatory properties. According to the results of preclinical and clinical studies, curcumin may be helpful in the prevention and treatment of many diseases, including cardiovascular diseases, diabetes mellitus, obesity, allergy, asthma, inflammatory diseases, and neurodegenerative disorders, e.g., Alzheimer's and Parkinson's.; it should be combine curcumin with agents such as piperine to achieve the best health benefits. . In this paper, supplemented health drinks with turmeric was made and its effects on diabetes and osteoporosis disease were studied, the results showed an improving in the blood glucose level and bone minerals because of its rich in some essential vitamins such as (C, E, B1, B2, B3 and B6) and minerals such as (Copper, Magnesium, Calcium, Iron, Zinc and potassium) needed for body growth, so combination of turmeric in the right proportions is recommended as flavoring and preservative for fruit drinks and The results of the study support the development of new drugs from the plant.

The sample of hot and cold drinks



Curcumin coffee



Curcumin tea



Carrot juice with Curcumin



Carrot juice control



Lemon juice with curcumin



Lemon juice control



Orange juice with curcumin



Orange juice control

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الملخص العربي:

أظهرت الاتجاهات الحديثة الاستفادة من النباتات الطبية كعلاج للعديد من الأمراض المزمنة، ومن بين هذه النباتات الكركم؛ فهو من عائلة الزنجبيل، وتعتبر الهند أول منتج ومستهلك ومصدر للكركم، حيث يستخدم مسحوق الكركم كتوابل ومضافات للأطعمة التي تحتاج إلى اللون الأصفر، وتظهر أهمية الكركم في محتواه من عنصر الكركومين المتوافر في جذور الكركم. وبسبب التأثيرات الدوائية والبيولوجية للكركمين مثل أمراض الكبد والكلية والسكري وضغط الدم وهشاشة العظام ومضادات الالتهابات ومضادات الأكسدة والوقاية الكيميائية ومضادات السرطان والقلب ومضاد الميكروبات والوقاية من أمراض الكلى ومضاد الأورام والوقاية من الكبد، مناعة، نقص سكر الدم، تأثيرات مضادة للروماتيزم، تحسين وظائف الخلايا، يمنع موت خلايا بيتا وحماية الجهاز الهضمي، زيادة استخدامه في صناعة الأغذية. أصبح مرض الداء السكري مصدر قلق في جميع أنحاء العالم؛ ففي هذا البحث تم عمل مشروبات باردة وساخنة من الكركم تتضمن شاي الكركم، قهوة لاتييه، وبعض العصائر المكملة بالكركم المتضمنة الجزر والبرتقال والليمون كأطعمة وظيفية لمرضى الداء السكري وتأثيرها على هشاشة العظام، حيث تم تحضير المشروبات بإضافة ٥ جرام من مسحوق الكركم بدون سكر وتم تقييمها حسيًا من حيث (الطعم، اللون، الرائحة، القوام) باستخدام ٣٠ مريضة بالسكري من الإناث المصابات بهشاشة العظام. أظهرت النتائج أن المشروبات كلها كانت مقبولة وليس بها فروق معنوية ($P > 0.05$) مقارنة بالمشروبات الضابطة، كذلك تحسن مستوى الجلوكوز في الدم ومعادن العظام بعد شهرين (124 ± 1 مجم / ديسيلتر) مقارنة بمستوى السكر في الدم قبل الاختبار (170 مجم / ديسيلتر) مع تحسن في الوزن (90 ± 0.5) مقارنة قبل الاختبار (106 ± 1.0) ، أيضاً تحسن مستوى معادن العظام مثل الكالسيوم والفوسفور والبوتاسيوم إلى (1.13 ± 0.6 ملي مول / لتر ، 4.2 ± 0.2 مجم / ديسيلتر و 4.3 ± 0.5 ملي مول / لتر) مقارنة بالنتائج قبل الاختبار (1.29 ملي مول / لتر ، 3.05 مجم / لتر) ديسيلتر و 3.64 مليمول / لتر). الخلاصة: يوصى بمزج وخط الكركم بالنسب الصحيحة كمادة حافظة لمشروبات الفاكهة والمشروبات الساخنة وتوابل مناسبة للأرز المقلي وأطعمة الحبوب الأخرى.

الكلمات المفتاحية: الكركمين، الكركم، جلوكوز الدم، السكري، هشاشة العظام، معادن العظام وآلام العظام.