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Effect of a mixture of shrimp peel extract and shellfish of some types of oysters on male experimental rats with osteoporosis induced with dexamethasone

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Abstract: Aim of the study: This research aims to study the effect of a mixture of shrimp peel extract and shellfish of some types of oysters on male experimental rats with osteoporosis induced with dexamethasone as a nutritional supplement to maximize the role of the Blue Economy in promoting sustainable development. **Methods Used:** Shrimp peels extract (it is extracted by water and alcohol). Oyster extract (extracted by water and alcohol). **Measures, Biological assessment:** A biological experiment is being carried out on experimental rats (albino rats) to evaluate the effect of feeding a mixture of shrimp shell extract and shellfish of some types of oysters on patients with osteoporosis by experimental rats induced with dexamethasone. A number (25) of (albino rats) are used, distributed into five groups under test. Each group consists of five (5) rats; all rats were fed with the standard food for a week before the start of the experiment to get adapted. Both the positive control and experimental groups of rats have to be injected intramuscularly with DEX (7 mg / kg of body weight) once a week for 4 weeks. (Hassan, 2019). 1- The first group, the healthy (negative) control group, feed on the basic food; 2- The second group, the infected (positive) control group feed on the basic food; 3- The third experimental group (1) feed on the basic food + extract of 500 mg of oyster shells + extract of 500 mg of shrimp shells; 4- The fourth group; the experimental group (2),are fed on the basic food + extract of 1600 mg of oyster shells + extract of 1600 mg of shrimp shells; 5- The fifth group; the experimental group (3), are fed on the basic food + extract of 3000 mg of oyster shells + extract of 3000 mg of shrimp shells. **Chemical analysis:** Complete calcium analysis, Ionized calcium analysis, Vit D, Dexa rays. **Statistical Analysis**: The data are treated according to the SPSS program and the necessary statistical treatments, P=0.05. **Conclusion:** The results of this study about the effects of a mixture of shrimp peels extract and shellfish of some types of oysters on experimental rats with osteoporosis induced with dexamethasone revealed the following conclusions: 1- Dexamethasone administration induced significant decreased levels of T. Cal, I Cal and VIT D_3 in the serum of rats. 2- Shrimp peels and oyster shell injections led to increased T. Cal I Cal and VIT D_3 levels in different concentrations, Dex (4) reported the higher results might be due to Individual causes of rats or environmental causes. **Recommendation:** It is recommended that Bio-economic importance of shrimp and oyster shell due to the benefit of chitosan and chitin from the waste in agriculture and biotechnology industry, wastewater treatment, Energy conversion and biomedical material development.

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Key words: Shrimp peel extract and oysters; rats; osteoporosis dexamethasone.

1. Introduction

Osteoporosis represents a major health burden affecting millions of people all over the world, and is one of the most common metabolic disorders associated with disabilities and deaths as it is a chronic and progressive bone disease associated with a decrease in bone mass and a subtle weakening of the bone tissue, which leads to osteoporosis and increased risk of fractures.

Osteoporosis is classified as one of the common diseases of aging after diabetes, high blood pressure and heart disease according to the World Health Organization.

There other researchers reported some side effects of shellfish consumption (Yuan et al., 2001; Zheng et al., 2012; Zheng et al., 2013) .

Albert et al. (1998) reported fish consumption and risk of sudden cardiac death.

Albert et al. (2002) blood levels of long-chain n-3 fatty acids and the risk of sudden death.

Ascherio et al (1995) added dietary intake of marine n-3 fatty acids, fish intake, and the risk of coronary disease among men.

In the framework of implementing one of the research projects in cooperation with a research team from the Nile University and another team from the University of Nottingham in Britain, Amal Al-Husseini, a researcher from the Nile University team, says, the shrimp peel is not used in Egypt, but rather it is thrown as waste. We can use these crusts in the manufacture of safe and healthy bags for carrying food, and even after use, it is thrown away and becomes good for soil because it is biodegradable and safe for animals, and even if your child bites a piece of it, it will not affect him. Thus, plastic can be used in large-scale industrial production, and the next development will be in the pharmaceutical industry from a polymer material that is extracted from shrimp peels. The third member of the team, Hani Shabib, stated that Egypt imports from 20 to 25 tons of shrimp of which about 10 tons complete with the crust and about 2 tons of the crusts and waste are removed from them (Mahdy, 2017)

At the same time, we find that vitamin D deficiency is a common nutritional problem all over the world, as it is considered an international public health problem, as vitamin D plays an important role in maintaining the rate of calcium and phosphorus by increasing the effectiveness of the intestine for their absorption. Vitamin D deficiency also causes many health problems for children and adults such as rickets (softening of the bones) and osteoporosis (thinning of the bones) and there is a clear relationship between vitamin D deficiency and other diseases such as many types of cancer, coronary heart disease, diabetes, high blood pressure, Alzheimer and multiple sclerosis (Shedeed, 2018)

Osteoporosis is second only to cardiovascular diseases as a global health problem. In it, the bones are characterized by low mass density and deterioration of the bone tissue, which results in an increase in exposure to fractures. It is better to obtain calcium and vitamin D from nutrition as they are necessary in order to increase bone density and ensure the renewal and mineralization of bone tissue. Eating appropriate amounts of protein improves bone health and bone mass by increasing insulin-like growth factor 1 (Ryeaan, 2014).

Bones are living tissues that can suffer from osteoporosis when the forming new bone tissues do not keep pace with the loss of old ones. In adults bone resorption and bone formation usually occur at the same rate and this keeps bone mass stable. With age, loss of bone mineral density and osteoporosis are due to excess bone resorption without an equal amount of bone formation.

Osteoporosis causes bones to become weak and easy to break, making them so fragile that any fall or even simple effort such as bending or coughing can cause fractures. Osteoporosis-related fractures most commonly occur in the hip, wrist and spine.

Tong et al. (2024) reported immune responses in mice implications on clinical diagnosis of shellfish allergy.

The importance of the Blue Economy stood out at the Ministerial Meeting for the Mediterranean held in Brussels on 17 November 2015, where ministers from the 43 countries recognized the potential of the Blue Economy to boost growth, jobs, investments and reduce of poverty while emphasizing that healthy seas are drivers and enablers of national and regional economies.

A sustainable Blue Economy allows society to derive value from its seas, oceans, and coastal areas, while respecting the long-term ability of the seas and oceans to regenerate and sustain such activities through the implementation of sustainable practices., which implies that human activities must be managed in a way that ensures the health of the seas and oceans and protects economic productivity, so that the potentials it provides can be realized and sustained over time

Aim of the Study

This research aims to study the Effect of a mixture of shrimp peel extract and shellfish of some types of oysters on male experimental rats with osteoporosis induced with dexamethasone as a nutritional supplement to maximize the role of the Blue Economy in promoting sustainable development.

2. Material and Methods

Materials:

- Shrimp peels

-Shells of some types of oysters available in the study environment, such as clams and mussels.

That is by using food waste from each of (special food industry factories, civil society consumption, including (restaurants, markets, household consumption).

- Experimental rats from (Helwan Farm, Ministry of Health, Cairo, Egypt)
- Chemicals: They will be obtained from the General Company for Trade and Chemicals

Methods Used:

Shrimp peels extract (it is extracted by water and alcohol)

Oyster extract (extracted by water and alcohol)

Measures:

Biological assessment:

A biological experiment is being carried out on experimental rats (albino rats) to evaluate the effect of feeding a mixture of shrimp shell extract and shellfish of some types of oysters on patients with osteoporosis by experimental rats induced with dexamethasone. A number (25) of male (albino rats) are used, distributed into five groups under test. Each group consists of five (5) rats, All rats were fed with the standard food for a week before the start of

the experiment to get adapted. Both the positive control and experimental groups of rats have to be injected intramuscularly with DEX (7 mg / kg of body weight) once a week for 4 weeks. (Hassan, 2019)

- The first group, the healthy (negative) control group, feed on the basic food
- The second group, the infected (positive) control group feed on the basic food
- The third experimental group (1) feed on the basic food + extract of 500 mg of oyster shells + extract of 500 mg of shrimp shells.
- The fourth group; the experimental group (2),are fed on the basic food + extract of 1600 mg of oyster shells + extract of 1600 mg of shrimp shells
- The fifth group; the experimental group (3),are fed on the basic food + extract of 3000 mg of oyster shells + extract of 3000 mg of shrimp shells.

Chemical analysis

Measuring of T.Cal, I.Cal vitamin D3.

Histopathology of liver and kidney.

Histopathology of the knee joint of male and female rats.

X-ray of the left hand of rats.

Extraction of Shrimp Shells:

Shrimp shells and heads weighing 3 kg were dried using hot air in an oven at a temperature of 40 degrees Celsius for 5 hours. After drying, the shells and heads were finely ground using a mill with a power of 3000 watts. The dried powder was then extracted using a mixture of water and methanol, with 50% water and 50% methanol at room temperature, and the extraction continued until completion to ensure maximum extraction of the extractable components. The methanolic extracts were then concentrated under reduced pressure using a rotary evaporator to remove the solvent. This concentration resulted in a viscous brownish-white crude extract weighing a total of 213 grams. The process was performed on 21 kg of shrimp shells and heads, yielding a total extraction weight of 1690 grams.

Extraction of Oyster Shells:

Oyster shells weighing 2 kg were dried using hot air in an oven at a temperature of 60 degrees Celsius for 4 to 5 hours. After drying, the oyster shells were finely ground using a mill with a power of 3000 watts. The dried powder was then extracted using a mixture of water and methanol, with 50% water and 50% methanol at room temperature, and the extraction continued until completion to ensure maximum extraction of the extractable components. The methanolic extracts were then concentrated under reduced pressure using a rotary evaporator to remove the solvent. This concentration resulted in a viscous brownish-white crude extract weighing a total of 90 grams. The process was performed on 40 kg of oyster shells, yielding a total extraction weight of 1750 grams.

Link to source (https://www.mdpi.com/1420-3049/27/19/6304)

The Experiment

A total of 25 male rats were brought in and divided into 5 groups, with each group consisting of 5 rats.

Male Groups:

- Group One (Control Group): Consists of 5 male rats fed only basic food and water.
- Group Two (Negative Control Group): Consists of 5 male rats suffering from osteoporosis, fed only basic food and water.
- Group Three: Consists of 5 male rats suffering from osteoporosis, fed basic food with the addition of a mixture containing 500 mg of shrimp shell extract and 500 mg of oyster extract.
- Group Four: Consists of 5 male rats suffering from osteoporosis, fed basic food with the addition of a mixture containing 1600 mg of shrimp shell extract and 1600 mg of oyster extract.
- Group Five: Consists of 5 male rats suffering from osteoporosis, fed basic food with the addition of a mixture containing 3000 mg of shrimp shell extract and 3000 mg of oyster extract.

Basic diet for rats:

Rodent diet number 3

Composition percentages:

Casein: 4.12%, Corn: 70.24%, Soy: 8.80%, Bran: 14.34%, Vitamins: 1.00%, Minerals: 1.00%, Salt: 0.50%

Link to source (https://www.ncbi.nlm.nih.gov/books/NBK231925)

Inducing Osteoporosis in Rats: The process involves inducing osteoporosis in rats by injecting them with 7 mg of dexamethasone solution weekly for two months to induce the condition.

Statistical Analysis

The data are treated according to the SPSS program and the necessary statistical treatments, P=0.05.

3. Results

Table (1): Serum levels of total calcium (T.Ca), ionized calcium (iCa), and vitamin D3 (Vit. D3) in male.

Sex	Sample	T Ca (mg/dL)	I Ca (mg/dL)	VTD3 (pg/mL)
♂/male	C(-)	10.5±0.1	4.7±0.1	105±1.9
	Dex 1	9.3±0.4	4.5±0.2	85±1.6
	Dex 2	9.0±0.66	4.4±0.1	83±1.7
	Dex 3	8.2±0.98 *	3.9±0.3 *	76±1.3 *
	C(+)Dex 4	8.0±0.87 *	3.8±0.2 *	73±1.2 *

Table (2): Rat (Serum) Detection

Sample No.			T.Ca (mg/dL)	iCa (mg/dL)	Vitamin D3 (pg/mL)
Male	C(-)	1	12.21	4.55	113.55
		2	10.86	4.87	100.99
	DEX1	1	9.11	4.26	84.72
		3	9.25	4.12	86.03
	DEX2	1	8.93	3.79	83.05
		4	9.04	4.08	84.07
	DEX3	1	8.27	3.81	76.91
		5	8.18	3.6	76.07

C-Control group: (T.ca-ica-vit.D3) levels were normal.
DEX 1 group: (T.ca-ica-vit.D3) was slightly lower than the control group.
The DEX 2 (T.ca-ica-vit.D3) group was somewhat lower compared to the DEX 1 group.
The DEX 3 (T.ca.-ica-vit.D3) group was less than or approximately equal to the DX 2 group.
The DEX 4 (T.ca.-ica-vit.D3) group had the lowest levels compared to the DEX3 group.

Table (3): T.Ca, I Ca, $VITD_3$ in control and experimental rats (males)

Sample	**T.Cal (mg/dl)**	**ICa (mg/dl)**	**VITD3 (pg/ml)**
C (c=1)	10.5 ± 0.1	4.7 ± 0.09	105 ± 1.9
Dex1	9.3 ± 0.07 *	4.5 ± 0.08 *	85 ± 1.6 *
Dex2	9.02 ± 0.06 *	4.4 ± 0.05 *	83 ± 1.5 *
Dex3	8.2 ± 0.07 *	3.9 ± 0.03 *	76 ± 1.3 *
Dex4 (c+1)	8.01 ± 0.08 *	3.8 ± 0.02 *	73 ± 1.4 *

Means were significant at $P \leq 0.05$
C = control group T.Ca, I.Ca, $VITD_3$ normal.
Dex_1 group significantly lower than controls.
Dex_2 group significantly lower than control
Dex_3 group significantly lower than control
Dex_4 +C = have the lowest level

Table (4): Table represent BMD, BMC, area of male rats representing M±SE. *P=0.05 significant, **highly significant P=0.01, NS = non-significant,

	Male		
	BMD (g/cm²)	BMC (g)	Area (cm²)
Control	0.19 ± 0.03	0.041 ± 0.003	0.19 ± 0.03
D4	0.16 ± 0.02*	0.03 ± 0.003*	NS
D3	0.17 ± 0.03*	0.03 ± 0.002*	NS
D2	0.15 ± 0.02*	0.03 ± 0.002*	NS
D1	0.12 ± 0.01**	0.02 ± 0.001*	NS

Table (5): Indicating total protein of the mixture

Sample	**Total Protein g/100 g**		
	Reference Method	**Units**	**Results**
Shrimp peel	*Kjeldahl* Method	g/100 g	25.81
Oysters Shell			5.17

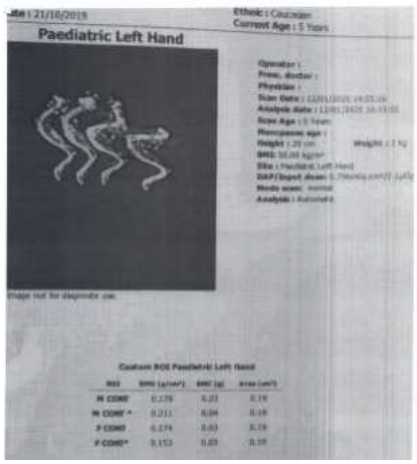
Determination of total protein:
Crude protein ($N \times 6.25$) using the Kjeldahl method and total ash of samples were determined (AOAC, 2007).

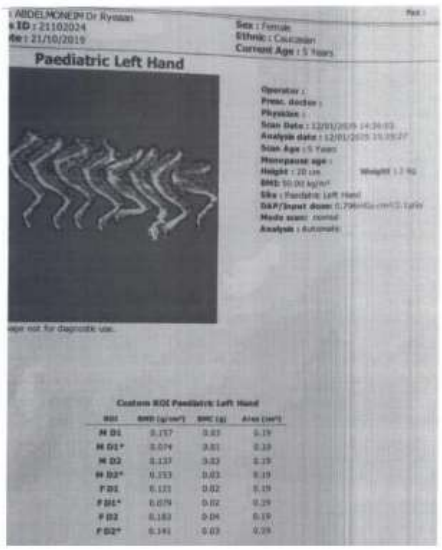
Table (6): Indicating the content of minerals per 100 g

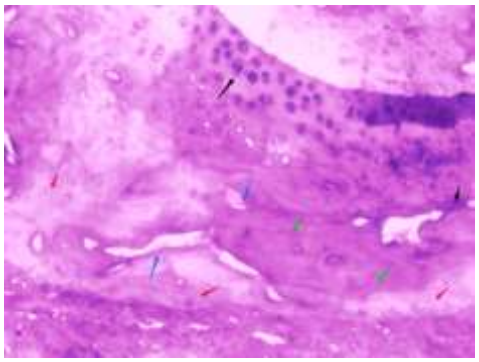
Macro-elements	Reference Method	Units	Shrimp peel	Oysters Shell
Calcium (Ca)	Atomic Absorption	mg/100 g	89.21	46.830
Phosphorus (P)	Atomic Absorption	mg/100 g	34.90	1.961
Sodium (Na)	Atomic Absorption	mg/100 g	935.18	178.952

Determine minerals
The contents of minerals such as: sodium was determined by the flame photometry method (Jahan *et al*., 2011). Calcium and phosphorous were determined by flame atomic absorption spectrometry (Kirk and Sawyer, 1991).

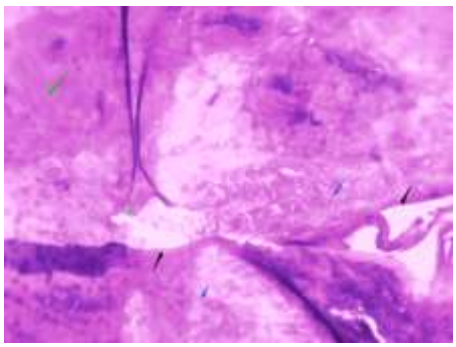
Shrimp shell and 500 mg oyster shell in male, the results reveal that BMD (g/cm²) was elevated in case of male rats i, and D1 group in male showed lower BMD than the (+) control groups in male rats.



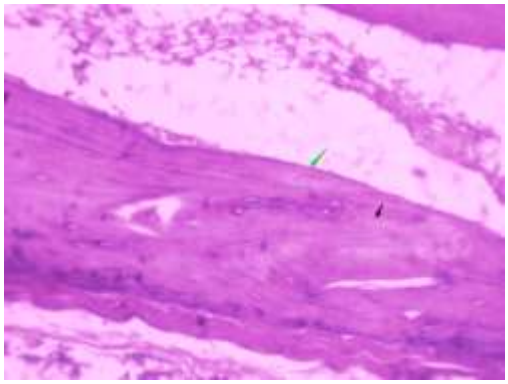




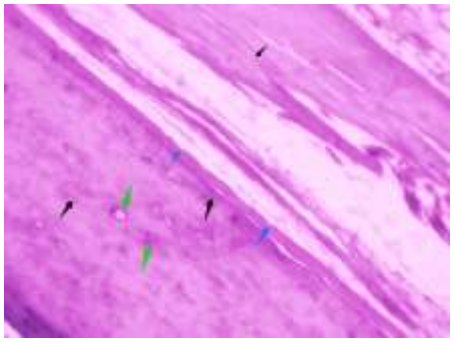
DEX2: By examining the histopathology of the knee joint of male rats in the treated group, mononuclear infiltration was noted, accompanied by bone erosion (black arrows). There were moderate structural changes in the cartilage (blue arrows), a decrease in the thickness of the cartilage in the flat area (green arrows), and a moderate appearance of fibroblasts and collagen production, which is a sign of tissue repair (red arrows).



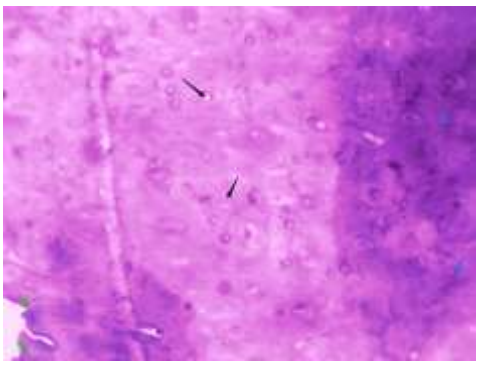
DEX3: Histopathological examination of the knee joint of male rats in the treated group showed a clear histological improvement and a decrease in the degree of cell infiltration in and around the joint (black arrows). Hyperactivity of fibroblasts and production of reticular fibers and collagen were found (blue arrows). Synovial inflammation and cartilage hyperplasia were found (green arrow).



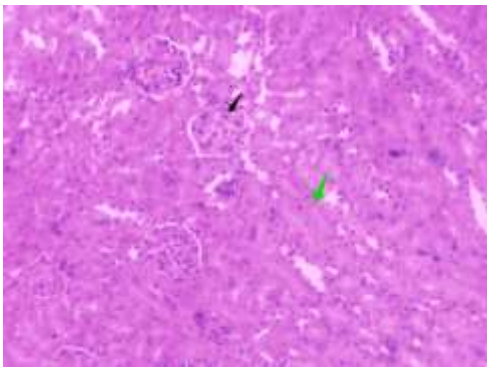
C: By histopathological examination of the knee joint of male rats, a normal articular cartilage surface was observed (black arrow) and the absence of erosion or tearing of the synovial membrane (green arrow).



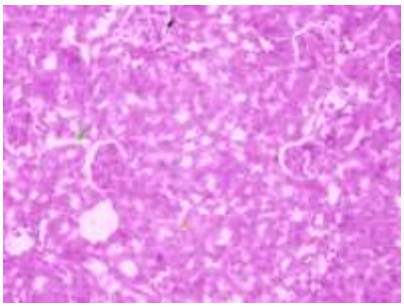
DEX1: By examining the histopathology of the knee joint of male rats in the treated group, it was noted that deep superficial cracks and the disappearance of cells from the superficial area and deficiency in the middle and deep area (black arrows) g. Cell enlargement, difference in size, and enlarged nuclei (green arrows), cell infiltration, hyperplasia, and destruction of the articular cartilage and the synovial layer (blue arrows).



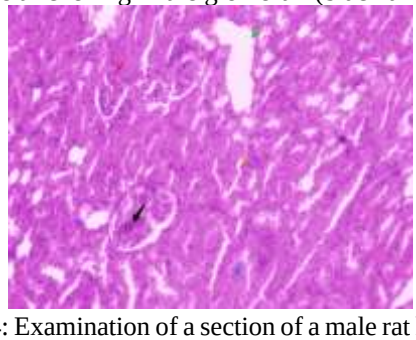
DEX4: Histopathological examination of the knee joint of male rats in the treated group showed an irregular distribution of chondrocytes (black arrows), severe infiltration of inflammatory cells (blue arrows), and synovitis (green arrows).



C: Examination of a section of the kidney of male rats in the control group showed normal histological structure of the glomeruli (black arrow) and normal convoluted tubules (green arrow).



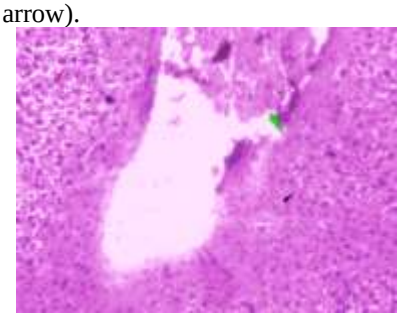
DEX1: Examination of a section of a male rat kidney showed swelling of the proximal tubules (green arrow), inflammatory cells (yellow arrow), and hyaline thickening in the glomeruli (black arrow).



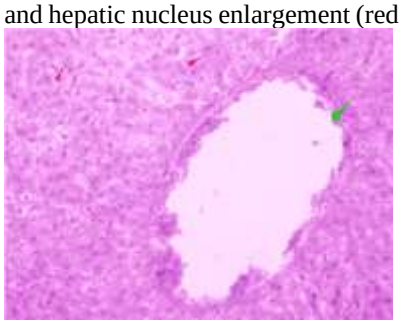
DEX4: Examination of a section of a male rat kidney showed congestion of the glomeruli (black arrow),

cloudy dilatation of the tubules (green arrow), marked swelling of the tubules (yellow arrow), mononuclear cell infiltration (red arrow), and necrosis of the cells (blue arrow).

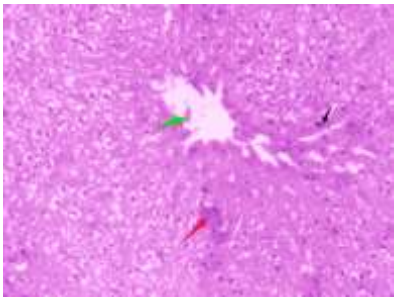
DEX1: Histopathological examination of male rat liver tissue shows congestion of the central vein (green arrow) with enlargement of hepatocytes (red arrow) and the appearance of binucleated cells (black arrow).



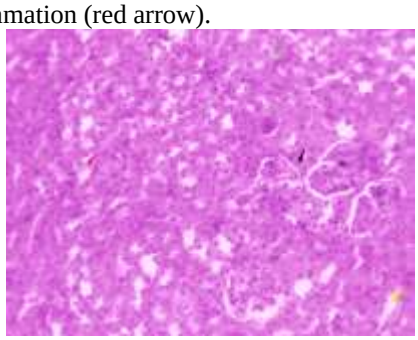
DEX4: Histopathological examination of male rat liver shows severe central vein enlargement and congestion (green arrow), cell necrosis (black arrow), and hepatic nucleus enlargement (red arrow).



C: Histopathological examination of liver tissues of male rats from the control group shows normal hepatocyte sheets with regular and overlapping sinuses (red arrow) and normal central vein (green arrow).



DEX3: Histopathological examination of male rat liver shows mild central vein congestion (green arrow), dark-stained hepatocyte nuclei (black arrow), and vascular congestion and lymphocytic inflammation (red arrow).



DEX3: Examination of a section of a male rat kidney showed mild inflammation around the glomeruli (black arrow), general swelling of the renal tubules (green arrow), cloudy dilatation of the tubules (yellow arrow), and moderate presence of acidic material within the lumen (red arrow).

DEX2: Histopathological examination of male rat tissues shows severe congestion of the central vein (green arrow), the presence of hepatocytes with dark nuclei (black arrow), and increased thickness of the muscular layer (red arrow).

4. Discussion

Table (1) indicated that Dexamethasone administration led to significant decreased T.cal, I.cal,Vit D_3 of the control (+) compared to normal rats (control-). Shrimp peels and oyster shells administration showed an increased T.cal, I.cal, and Vit D_3 in experimental groups Dex_1, Dex_2, Dex_3, with the highest level recorded in Dex_3, at doses 500 mg + 500 mg of shrimp and oysters. The difference in the 3 groups may be related to individual and environmental variations.

Norbert and Debra (2006) reported the importance of calcium and vitamin D_3 to reduce the risk of osteoporosis in later life, by saying that an adequate calcium intake and vitamin D_3 to a well-balanced diet is needed as a prime defense against bone loss with age. Shedeed (2018) added the importance of vitamin D deficiency as a common nutritional problem all over the world and being an international health problem, as Vit D_3 plays an important role in maintaining the rate of calcium and phosphorus absorption from the intestine.

Ibrahim (2024) have demonstrated that the addition of Vitamin D to the treatment of albino rats with induced osteoporosis with stem cells extracted

from adipose tissue resulted in a significant improvement than treatment with stem cell alone.

Moreover, a major systemic event was added by (Ryeaan, (2014) that Vit D is important in achieving the regulation and balance of calcium and phosphorus in formation and building of bones, in addition to playing a role in regulating nerve and muscle functions; muscle weakness, bone pain.

A point that should not be overlooked is that eating appropriate amounts of protein improves bone health and bone mass together with calcium and vitamin D.

Conversely, Ismail (2014) reported the importance of the physical activity, healthy lifestyle and health education programs that are used to promote healthy behaviors which are of effective means in the prevention and treatment of osteoporosis.

Table (1) data revealed that the control group (-) was normal in TCa, ICa and $VitD_3$ concentration and that of control ($+7Dex_4$) was the least concentration in male rats.

As for the experimental groups, shrimp shell and oysters administration induced a positive results in the concentration of T. Ca, ICa and vitamin D_3 and the highest concentration was expressive in the 500 mg dose of shrimp shell and 500 mg of oyster shell. These results indicated that the shrimp shell and oyster shell might be beneficial in case of osteoporotic cases in rats and in human as well.

In this study, there was direct connection amongst shrimp peel and oysters that support and strengthen bones as they contain minerals that contribute to strengthening bone density together with protein and vitamins, all together act as a group in inducing positive effect due to their nutritional effect leading to improvement of bone function together with related muscles (El Malky, 2017)

Moreover, Guyton and Hall (2006) added that vitamin D possess a strong effect to increase calcium absorption from the intestine, also affect bone deposition and bone absorption and vitamin D_3 is formed in the skin, by ultraviolet rays from the sun. Therefore, to be subjected to the sun for a while might prevent vitamin D deficiency. In addition, vitamin D ingestion in food is identical to the cholecalciferol formed in the skin (Dassouki, 2018).

Exposure of rats to intramuscularly injection with Dex (7 mg/1 Kg of bw) once a week for 4 weeks, induced different elevation in T. calcium and ionized calcium accompanied with Vitamin D_3 elevation.

The difference between (Ca) and ionized (ICa^{2+}) lies in their forms and how they exist in the blood. T. calcium, which measures all the calcium in the blood including: ionized calcium (free, active form) (~50%), protein bound calcium to albumin (~40%), calcium bound to anions like phosphate (~10%).

Moreover, (ICa) is physiologically important, what it shows is the true functional calcium level.

To know the key differences between T.Ca and I Ca1, is that the calcium protein bound to albumin, and ICa is more biologically active and in clinical observation ionized Ca is preferred for accurate assessment if a patient has abnormal albumin or clinical condition e.g. renal failure (Dickerson, 2001).

In this study, Table (1) revealed an elevated TCa, Ica and $VITD_3$ in case of males, the possible cause of this elevation might be due to the action of testosterone hormone, which may increase bone matrix and cause calcium retention, together with elevated protein, muscle mass, and muscle strength all of which are characteristics of males. This was also noted by Guyton andd Hall (2006)

Ismail (2014) added that adequate physical activity and a healthy lifestyle, and health education programs are used worldwide to promote healthy behaviors and help in the prevention and treatment of osteoporosis, and help in better health; while Al Karbuni (2001) added that shrimp may represent a distinct role in the main fish diet and commercial pattern in addition to its use in pharmaceutical, textile, and agricultural industries by extracting chitosan from its crusts.

It was also noted in Table (1) that T.Ca, ICa and Vitamin D3 attend the higher level in case of Dex 1 compared with Dex 2, Dex 3, this may be due to individual variation, and environmental, meaning that the optimum dose of shrimp peel and oyster shell was 500 mg and 500 mg compared to 1600 and 3000 mg in case of Dex 2 and Dex 3, due to environmental causes.

This important result may lead us to the bioeconomic importance of shrimp shell and oyster shell uses, due to the benefit of chitin and chitosan from shellfish waste to be applied in agriculture and biotechnology industries, waste water treatment and energy conversion, biomedical material development, industrial extraction methods (Delf, 2023; The Arab network for excellence and sustainability, 2023; Omran, 2006).

Dexa Rays demonstrated that dexamethasone decreased BMD of the rats and that shrimp peel and oyster shell administration led to a higher elevation in Dex 3 than Dex 4 and Dex (1) Dex (2), due to the higher doses used (3000 mg shrimp and 3000 mg oyster shell.

Histopathological studies of knee joint on male rats showed that

• In control groups possessed a normal articular cartilage,

• Absence of erosion or tearing of synovial membrane, without any inflammation or infiltration, with normal bone marrow.

The case was changed due to Dexamethasone administration, and symptom and pathology of

osteoporosis occur with histological signs like superficial cracks, cell infiltration.

In males with shrimp peel and oysters injection, it begins with moderate structural changes in the cartilage and moderate fibroblasts and collagen as a sign of tissue repair. With increasing doses (Dex 3), there is clear histological improvement and a decrease in cell infiltration, together with hyperactivity of fibroblasts, production of reticular fibers, and cartilage hyperplasia in males.

The impact of shrimp and oyster shell on the histopathology of the liver of male rats showed numerous effects due to the action of chitosan, as it may induce negative effect of the accompanied oxidative stresses, or induce normal liver architecture similar to control or even fatty liver, according to the preparation of shrimp peel or oysters (boiled or grilled).

This suggests that the method of preparation modulates its impact. Boiled or grilled seems benign, whereas fried may induce lipid accumulation or mild injury. Some scientific papers reported no liver abnormality at all. The important remark lies on doses, not the chitosan effect itself as it seems benign action and effect with no adverse liver effect.

No clear hepatic injuries of the male rats were reported in the study indicating that the use of shrimp peel and oyster shell might be safe for the health, and any side effect might be induced from the different types of cooking and the quantity of the diet ingested, many scientific paper are in line that the use of shrimp and oyster shell are important for the economic, and many countries recognized the potential of the blue economy to boost growth, jobs, investments, and reduce poverty. Mahdy (2017) reported that prawn shells will no longer end up in the garbage can. Delf (2022) added a sustainable blue economy allows society to derive value from its seas, oceans, and coastal areas, and that human activities must be managed in a way that ensure the health of the seas and oceans and protects economic productivity. Samir (2005) reported that cooked oysters or fried did not induce side effect, while raw oysters can induce damage to the liver and concluded that physicians must educate patients with chronic liver disease about the risk of raw oysters consumption and the harvesting methods which reduce contamination by bacteria V. vulificus must be utilized.

As concern, the effect of shrimp peel on the liver together with oyster shell, it was found that fish and sea food are the only foods that naturally contain omega 3 fatty acids EPA and DHA, both of which are very important for the liver health, specially salmon, trout, sardine, mackerel, herring and shrimp are the choices with the most of the essential fats (Kayla, 2023); she added that among 31 food that boost liver function, fishes are of the best natural food for liver health.

Dex (2) in male kidney of rats' necrosis of the cells, vacuolated cytoplasm, thickening of glomeruli.

In Dex (3) male rats, kidney showed, mild inflammation of glomeruli, swelling tubules with dilatation, and acidic material in the lumen

Many scientific papers agree that shell fish, shrimp and oysters are safe to the kidney health, as shrimp is low in phosphorus making it super beneficial for the kidneys National Kidney foundation (www.kidney.org), and that shell fish are safe for kidney and can be included at all stages of kidney diseases. One must be sure to buy shellfish from reliable vendor to avoid food borne illness.

Xuan Zhi. Et al (2015) reported the effects of low-molecular-weight-chitosan on the adenine-induced chronic renal failure rats in vitro and in vivo that shrimp and oysters shells are rich in minerals, calcium, chitin and trace elements which are used in biomedical research and traditional remedies their impact on kidney health depends on how they are processed, the dosage and the biological context (e.g. healthy or diseased kidney). They also added that:

Shrimp and oysters effects on kidney histology of rats are mild to moderate tubular degeneration, glomerular shrinkage, have been observed in high doses long-term administration of shell powders. However, low doses often show no histopathological changes or even protective effects, when processed to remove contaminations and combined with antioxidants.

Conclusion:

The results of this study about the effects of a mixture of shrimp peels extract and shellfish of some types of oysters on experimental rats with osteoporosis induced with dexamethasone revealed the following conclusions:

1- Dexamethasone administration induced significant decreased levels of T. Cal, I Cal and VIT D_3 in the serum of rats.
2- Shrimp peels and oyster shell injections led to increased T. Cal I Cal and VIT D_3 levels in different concentrations, Dex (4) reported the higher results might be due to Individual causes of rats or environmental causes.
3- Dexa imaging reported: dexamethasone decreased BMD of the rats while shrimp peel and oysters shell induced higher levels in cases of Dex 3 than Dex 4 and decreased Dex 1, Dex 2, BMD due to different doses with higher levels in males.
4- The effect of shrimp and oysters shell on the histopathology of the liver showed different effect related to the impact of chitosan, as it might be somewhat harmful due to the oxidation stresses or induce normal liver architecture, according to the preparation of shrimp and oysters shell (boiled or grilled)
5- The effect on the histopathology of the kidney showed mild to moderate tubular degeneration,

glomerular shrinkage in higher doses, long-term administration, but low doses often show no histopathological change or even protective effect.

Recommendation

It is recommended the following:

1- To get calcium (dietary or supplemental) and VIT D_3 per individual need

2- If considering oyster and shrimp calcium choose supplements that are tested for purity and heavy metal, taken in safe dose (1000-1900 mg calcium per day but individualized.

3- Coordination with other osteoporosis treatments and medications to avoid health risks.

4- Physical activities must accompany supplements in cases of osteoporosis together with health education programs.

5- Eating appropriate amount of protein

6- The results may lead to the Bio-economic importance of shrimp and oyster shell due to the benefit of chitosan and chitin from the waste in agriculture and biotechnology industry, wastewater treatment, Energy conversion and biomedical material development

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