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The Effect of Nano-Magnesium Compound on Some Physiological Characteristics and the Method of Preserving Juices at Room Temperature

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ABSTRACT

The study was conducted in graduate laboratories at the College of Agriculture - Tikrit University and in a laboratory outside the College of Agriculture - Tikrit University. It included a statement of the diagnosis of microbes present in juices stored at room temperature in the winter, as well as an estimate of the preservation rate of the nano-magnesium compound in limiting or reducing the effect of pathogenic microbes on the juices and preserving them in a good manner.

The results also showed the effect of using nanomagnesium for natural beetroot and orange juice, which led to a significant decrease in the reduction of pathogenic microbes that cause spoilage of the juices, as the contaminated microbes were identified with the Vitic device for the aforementioned juices, and the well-characterized NPs were used for multiple biomedical applications, including bactericidal activity against isolates, Klebsiella oxytoca and Staphlococcus lentus Our results showed that both MgO-NPs were highly effective against multidrug-resistant isolates compared to conventional antibiotics and caused a large zone of inhibition against Klebsiella oxytoca and Staphlococcus. lentus. The results showed that nanoparticles at concentrations of 1, 2, 3, and 4% of each of magnesium particles (Mg-NPs) were effective in their ability to inhibit S. aureus, Staphylococcus, Staphlococcus lentus, and Klebsiella oxytoca. Adding magnesium nanoparticles to bacterial cultures of S. lentus showed that the area of inhibition diameter was in the range of 8, 10, 15 and 17 mm, while magnesium nanoparticles showed an area of inhibition on non-bacterial isolates of 10, 14, 18 and 27 mm at concentration Higher, while the results of using magnesium nanoparticles against the bacteria Staphlococcus lentus and Crohnbacter sakazakii group indicated that the area of inhibitory diameter was 8, 10, 15 and 17 mm, while the area of inhibitory diameter using magnesium nanoparticles against the same bacteria at a higher concentration was about 14, 16, 22. and 30 mm, which indicates that the sensitivity of the bacterial species S. aureus to magnesium nanoparticles was more than in the case of the lower concentration. The same applies to the inhibitory effect against Klebsiella oxytoca bacteria. Kristof). and his group 2010 (The results showed that the occurrence of hypercholesterolemia in laboratory animals (T2) caused a significant increase ($p<0.05$) in the numbers of Cortisol, TSH, and LH, which became Ug/dl 0.01, IU/Ml 0.01, and IU/l 0.8, respectively, compared to their values. In control treatment animals, which were at Ug/dl l6.05, IU/ml 0.75, and IU/L 5.9%, respectively. The use of each compound (T3) or (T4) or their nanocomplex (T5) in treating the effects of the incidence of hypercholesterolemia in the values of blood image parameters had a positive and significant effect in returning the values of these parameters to their normal state or close to it. The values of Cortisol, TSH, and LH were in the case of oral administration to rats from T3 at Ug/dl 0.01 and IU/Ml 0.02. IU/l 0.8, respectively, compared to the infection. In the case of oral administration of T4, the values of animal standards for rats were Ug/dl 0.01, IU/Ml 0.01, and IU/l 0.9. As for the case of oral administration of T5, they were at Ug/dl. 0.01, IU/Ml 0.02, and IU/Ml 0.8, respectively, as it was noted from the results that the sensory evaluation scores were superior to the models treated with the compounds compared to the untreated models, i.e. the control samples. It is noted that the juice treated with magnesium (0.3) gm/20 ml and stored for (10) days It excelled and obtained the highest sensory evaluation scores compared to the rest of the treatments, which indicates that the models treated with magnesium showed efficiency in improving the characteristics of natural juice through its ability to reduce the degree of turbidity and reduce the amount of dissolved solids in the juice, as well as reduce the color and pH of the juice, and this is reflected in the evaluation. Sensory perception of juice through studied sensory attributes such as flavor, which is one of the most important sensory attributes.

Keywords- nano-magnesium and microbes in beetroot and orange juice, dosing rats with nano-magnesium, inhibitory effectiveness of nano-microbes

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I. INTRODUCTION

There are alternative and vital discoveries aimed at developing a sustainable process for producing nanomaterials.

Recently, in our study, nanoparticles (Mgo-NPs) have been used to lower cholesterol (**Haris et al.,2023)** l. This element has not been used in reducing cholesterol before, but it is considered economical and environmentally friendly(Adeleke& Babalola 2020). To create magnesium oxide nanoparticles (MgO-NPs) for multi-faceted biomedical applications (García et al 2022). In the study, mushroom extract was used for the PDA medium (**Buzea et al 2007)**. Broth Asperglus terus and for the synthesis of MgO-NPs (**Kalimuthu et al 2008)**. The well-characterized NPs have been used for multiple biomedical applications including bactericidal activity against Klebsiella oxytoca and Staphlococcus lentus isolates. Our results showed that both MgO-NPs were highly effective against multidrug-resistant isolates compared to conventional antibiotics and induced a large zone of inhibition against Klebsiella(Abdo et al 2022). oxytoca and Staphlococcus. lentus. Due to the environmentally friendly methods, non-toxic and biocompatible nature, MgO-NPs can be exploited as a potential candidate for multiple biomedical applications Metal nanoparticles (MNPs) have fascinated the scientific community for decades and are greatly exploited in nanotechnology (**Bharde et al 2006)**. Their unique physical and chemical properties such as high stability, reactivity and thermal properties Excellent photovoltaic properties make metal nanoparticles ideal materials to be exploited for broad-spectrum applications in energy, environment and medicine. Due to the environmentally friendly methods, non-toxic and biocompatible nature, MgO-NPs can be exploited as a potential candidate for multiple biomedical applications**(Le et al 2023).** Metal nanoparticles (MNPs) have fascinated the scientific community for decades. They are greatly exploited in nanotechnology. Their unique physical and chemical properties such as high stability, reactivity and excellent photothermal properties make metal nanoparticles ideal materials to be exploited for broad-spectrum applications in energy, environment and medicine(**Das et al 2013)**.

II. WORKING METHODS

How to prepare juices

Juices were collected from local markets, and the juice extract was prepared according to the previously used method, whereby the washed beetroot and orange fruits were ground and the appropriate amount of beets and juice were placed in a conical flask to prepare a volume of 100 ml per 20 g and kept for two weeks at room temperature, then the juice was filtered twice and dried. At a temperature of 37-40ºC and store in tightly sealed bottles at room temperature, then use nano-juice at a rate of 1g per 200ml of distilled water.

Bacterial antibiotic susceptibility testing: Antibiotics disk diffusion susceptibility test protocol **(Kalimuthu et al 2008)**.

The standard method (3) was used to test the sensitivity of isolates to antibiotics using Acar-Muller-Hinton and Agati:

• Bacterial cultures were prepared by transferring one colony to 5 ml of nutrient broth medium and incubating at a temperature of 37°C for 18-24 hours.

• The turbidity of the growth was compared with the turbidity of the prepared standard constant turbidity solution, which gives an approximate number of cells (1.5 x 108) cells/ml.

• Spread 0.1 ml of the above culture on Mueller-Hinton medium using a sterile Spreder diffuser and leave to dry at room temperature for 10-15 minutes.

• The antibiotic tablets were then transferred with forceps to the dishes, 5-6 tablets per dish. The plates were incubated at 37°C for 24 hours**(Ayelign et al 2017)**

• The results were compared by measuring the zones of inhibition around antibiotic tablets, and the results were interpreted with what was stated in the National Committee for Clinical Laboratory Standards**(Lorian, 2005).**

III. STATISTICAL ANALYSIS

The data was analyzed using a complete randomized design to study the effect of parameters on some of the studied characteristics. The significant differences between the means were compared using the Duncan multinomial test and below a significant level (0.05), and the statistical program (4) was used in the statistical analysis.

IV. RESULTS AND DISCUSSION(Satlin et al 2020)

Inhibitory activity of nanoparticles against test bacteria: The results in Table (1) showed that nanoparticles at concentrations of 1, 2, 3, and 4% of each of magnesium particles (Mg-NPs) were effective in their ability to inhibit S. aureus, Staphylococcus, Staphlococcus lentus, and Klebsiella oxytoca.

(Lalitha, 2004). Adding magnesium nanoparticles to bacterial cultures of S. lentus showed that the area of inhibition diameter was in the range of 8, 10, 15 and 17 mm, while magnesium nanoparticles showed an area of inhibition on non-bacterial isolates of 10, 14, 18 and 27 mm at concentration Higher, while the results of using magnesium nanoparticles against the bacteria Staphlococcus lentus and Crohnbacter sakazakii group indicated that the area of inhibitory diameter was 8, 10, 15 and 17 mm, while the area of inhibitory diameter using magnesium nanoparticles against the same bacteria at a higher concentration was about 14, 16, 22. and 30 mm, which indicates that the sensitivity of the bacterial species S. aureus to magnesium nanoparticles was more than in

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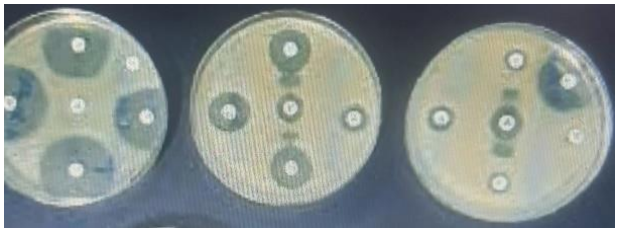
the case of the lower concentration. The same applies to the inhibitory effect against Klebsiella oxytoca bacteria**(White et al , 2001)**

Table 1. Area of inhibition diameter (mm) of nanomaterials against test bacteria species.

				Type of nanomaterials and antibiotics	**Type of bacteria tested**
4%	**3%**	**%2**	**%1**		
Mm					
27	**18**	**14**	**10**	**MgNPs**	***Klebsiella oxytoca.***
4	**9**	**7**	**6**	**FLUCONAZOLE**	
			10	**Itraconazole ((50mcg Discs))**	
	16	**13**	**14**	**Amphotericin B(50mcg Discs)**	
		7	**12**	**Ketoconazol((50mcg Discs))**	
15	**10**	**6**	**9**	**Clotrimazol(50mcg Discs)**	***. Staphlococcus lentus***
17	**15**	**10**	**8**	**MgNPs**	
11	**4**	**5**	**6**	**Grisofolvin ((50mcg Discs))**	

•
Concentrations of Mg NPs were 4.3.2.1 mg/ml.%
•Mg-NPs
= •Magnesium nanoparticles...

CLOTRIMAZOL against Staphlococcus lentus compared to



4.1 Sensory Evaluation:

The results are shown in Table (2) of the sensory evaluation results for the natural orange and beetroot juice treated with magnesium and the statin compound and not treated. It was noted from the results that the sensory evaluation scores for the models treated with the compounds were superior compared to the untreated models, that is, the control samples**(Mukhtar et al 2022**) . It is noted that the juice treated with magnesium was (0.3) g/20 ml. Stored for (10) days, it excelled and obtained the highest sensory evaluation scores compared to the rest of the treatments, which indicates that the models treated with magnesium showed efficiency in improving the characteristics of natural juice through its ability to reduce the degree of turbidity and reduce the amount of dissolved solids in the juice, as well as reduce the degree of color and sugar**(RAMADAN, M.F. and MOERSEL, J.T. 2007).** The pH of the juice, and this is reflected in the sensory evaluation of the juice through the sensory characteristics studied, such as flavor, which is one of the most important sensory characteristics that reflects the consumer's desire to prefer natural juice over artificial juice. The effect of treatment with a statin compound was also reflected in the pH degree, the amount of dissolved solids, and the color of the natural juice, as it is One of the important and distinctive sensory characteristics of natural juices for the consumer(**Knipe et al 2013)**

The table below shows a limited decrease in the values of some sensory attributes of functional drinks (flavor, texture, acidity, and appearance). The differences occurring in the values and for all the attributes studied may be explained by the nature of their components and the variation in their concentration ratios and sources of production. It may agree with what was mentioned (7) that there are several factors that may explain The differences and changes occurring in the characteristics and compositions of fermented products among them and their effect on the physiological, sensory and functional characteristics in general, including the type and composition of the fermented raw materials, the proportions of their components, the bacterial strain present, and the conditions of the production process(**Bharde et al,2013)**.

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Table 2: Sensory evaluation: for oranges

general admission **20 درجة**	The flavor **20 درجة**	Texture **20 درجة**	the color **20 درجة**	The appearance **20 درجة**	Storage period (day)	Attributes/parameters
14.38d	**17.73a**	**12.85c**	**14.28c**	**16.56 c**	**0**	Natural orange juice
14.52d	**17.65a**	**11.39d**	**14.47c**	**16.29c**	**5**	
14.45d	**17.60a**	**11.41d**	**14.68c**	**15.71c**	**10**	
16.24b	**17.85a**	**13.88c**	**16.07b**	**17.92b**	**0**	Natural orange juice with magnesium (0.3) g/20 ml
15.08c	**17.45a**	**14.02b**	**16.68b**	**17.11b**	**0**	Natural orange juice with magnesium (0.5)g/20ml
15.28c	**17.49a**	**14.57b**	**17.12a**	**17.30b**	**5**	
15.87c	**17.53a**	**15.00a**	**17.47a**	**17.35b**	**10**	

Table 3: Sensory evaluation of beets

general admission **20 درجة**	The flavor **20 درجة**	Texture **20 درجة**	The color **20 درجة**	Appearance **20 درجة**	Storage period)day(	Attributes/parameters
14.38d	**17.73a**	**12.85c**	**14.28c**	**16.56 c**	**0**	Beetroot juice Natural
14.52d	**17.65a**	**11.39d**	**14.47c**	**16.29c**	**5**	
14.45d	**17.60a**	**11.41d**	**14.68c**	**15.71c**	**10**	
16.24b	**17.85a**	**13.88c**	**16.07b**	**17.92b**	**0**	Natural beet juice with magnesium (0.3) g/20 ml
16.92b	**17.93a**	**14.25b**	**17.11a**	**18.55a**	**5**	
17.34a	**17.97a**	**14.93b**	**17.38a**	**18.70a**	**10**	
15.08c	**17.45a**	**14.02b**	**16.68b**	**17.11b**	**0**	Natural beet juice with magnesium **(0.5)**g/20 ml
15.28c	**17.49a**	**14.57b**	**17.12a**	**17.30b**	**5**	
15.87c	**17.53a**	**15.00a**	**17.47a**	**17.35b**	**10**	

4.2 Biodynamic Experiment

The effect of oral administration of either nanomagnesium oxide or Statin alone or as a nanocomplex of both on the level of some hormones in rats.

The effect of oral administration of either MgONPs or Statin particles alone or linked to a nanocomplex on the blood image parameters of laboratory rats induced by hypercholesterolemia has been shown in Table (4-11)(**Das ,2013)**. The results showed that the occurrence of hypercholesterolemia in laboratory animals (T2) caused a significant increase ($p<0.05$) in the numbers of Cortisol, TSH, and LH, which became Ug/dl 0.01, IU/Ml 0.01, and IU/l 0.8, respectively, compared to their values in treated animals. The control was at Ug/dl l6.05, IU/ml 0.75, and IU/L 5.9. % respectively. The use of T3 or T4 or their nanocomplex (T5) in treating the effects of hypercholesterolemia on the values of blood image parameters has had a positive and significant effect in returning the values of those parameters to their normal state or close to it. The values of Cortisol, TSH, and LH in the case of oral administration to rats from T3 were Ug/dl 0.01, IU/Ml 0.02, and IU/l 0.8, respectively, compared to infection. In the case of oral administration of T4, the values of animal standards for rats were Ug/dl. /dl 0.01, IU/Ml 0.01 and IU/l 0.9, while the case of oral administration of T5 was at Ug/dl 0.01, IU/Ml 0.02 and IU/l 0.8, respectively.

There is no comparative study on the use of nanomagnesium and a statin compound as a cholesterol lowerer.

The effect of increasing the rates of blood image parameters for Cortisol, TSH, and LH in the case of hypercholesterolemia in laboratory rats could be due to very high levels of cholesterol leading to its accumulation on the walls of the coronary arteries, leading to their hardening and narrowing in what is known as atherosclerosis, resulting in atherosclerotic heart disease. Coronary artery disease and the accompanying cases of angina pectoris, where it causes damage to the arteries, leading to the inability to deliver blood and oxygen in quantities sufficient for the functioning of the heart muscle (myocardial ischemia), which in turn leads to an increased risk of heart attacks**(Ding et al 2016).** High levels of cholesterol also increase peripheral circulatory impairment by causing Narrowing of the arteries that deliver blood to the legs. High levels of cholesterol also increase peripheral circulatory impairment by causing narrowing of the arteries that deliver blood to the legs. The results were similar to what was mentioned

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by(**Cappuccino et al ,2014)**. As for the case of treatment using the Statin compound, it returns cholesterol to Its natural state. It is also believed that the effect of MgO_NPs particles could be a result of the effectiveness of these particles in lowering cholesterol. The same situation could be common and result from the effect of both Statin and nanoparticles in the positive effect of reducing these standards and returning them to their natural state through their association as a strong complex in Resistance to the enzyme responsible for high cholesterol

Table 4: The effect of oral administration of either nanomagnesium oxide or Statin alone or in the form of a nanocomplex of both on the level of some hormones in rats(Duncan,1995).

LH (IU/L)	TSH (IU/ml)	Cortisol (µg/dl)	Transaction code	Typeof transaction
5.9b ± 0.9	0.75a ± 0.01	6.05c±0.01	**T1**	**the control**
0.8 ± 8.3a	0.01 ± 0.72a	0.01±8.08a	**T2**	**The infected**
0.8 ± 4.8c	0.02 ± 0.70a	0.01±7.28b	**T3**	**The treatment**
0.9 ± 5.3b	0.01 ± 0.77a	0.01±6.14c	**T4**	
0.8 ± 4.7c	0.02 ± 0.74a	0.01±6.16c	**T5**	

For different letters in one year, we see that there are significant differences between the rates at a significance level of 0.05. ±=standard error. T1 = negative control, T2 = hypersensitivity group, T3 = treatment with 0.25 mg nanomagnesium oxide
T4 = CPU with 0.02 mg statin/animal, T5 = CPU with 0.25 mg nanomagnesium with statin**(Linet al, 2020).**

V. CONCLUSIONS

1-It was demonstrated that the ability of the isolate to produce the statin compound could be further developed by changing the environmental and physical conditions of production to reach tenfold at the end of determining the optimal conditions.
2- It was found that the Mg-NPs particles as well as the statin compound were effective in their ability to inhibit the two types of bacteria tested, Staphlococcus lentus and Klebsiella oxytoca, and the ability to inhibit increased with increasing concentration from 2.5, 5.0, and 10 mg/ml.

Recommendations

1. Testing other raw materials suitable for liquid and solid fermentations to produce the statin compound from the isolate under study.
2. The possibility of studying the expansion of productivity of the statin compound from the laboratory scale to the commercial and economic scale using solid and liquid fermenters and using the isolation and optimal conditions that were reached in this study.

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