RESEARCH PAPER

Nanomedicine Effects on Controlling the Obesity Through Innovations in Clinical Nutrition

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ABSTRACT

Today, nanotechnology is known as one of the newest methods in improving the quality and health of food. The purpose of this article is to examine nutrition and the effect of nanomedicines in controlling obesity and improving nutrition. Polymer Nano capsules have a special ability to store and release the carrier substance. In general, in obesity nutrition therapy, there are points that should be considered to achieve effective and appropriate weight loss. In this article, in order to lose weight by 5-10%, which can be considered as a healthy weight loss, methods of reducing carbohydrates and low fat have been evaluated along with the use of nutritional nanomedicines that can provide nutrients to the body. Also, the method of using nanomedicines to treat obesity has been investigated, which is based on targeting fat cells and safely separating bad fat accumulation from healthy fat metabolism using nanomedicines. The fact that adipose tissue in the body is not continuous and is instead stored in fragments has proven that targeting the concentrated fat that leads to obesity in a specific way and at a precise point with nanomedicines can be used in treatment. Obesity is effective. The results showed that the use of nutritional nanomedicines can improve people's health in terms of absorption of minerals and vitamins by about 30%. In this article, different types of nanomedicines are examined along with their different applications.

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INTRODUCTION

Nanotechnology has entered all aspects of human life. From aerospace and computer to engineering and life sciences. Undoubtedly, you cannot find a branch of science in which nanotechnology has no application. Especially the effects of this technology in the field of nanomaterials and medicine have been very impressive [1-3]. The design and manufacture of biosensors, smart materials and nanomedicines are among the things that are always heard about, nowadays it can be said that Nano has entered our lives [4].

Nanotechnology and food health: Nanotechnology has been very influential in the field of medicine and health, and most of its applications in medicine and pharmaceuticals can

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be summarized in drug delivery to cancer [5]. The impact of nanotechnology and its applications in the field of agriculture and food industries is countless. These applications can be used in various ways, including improving the taste and color of food, food health, food packaging and storage, and food production and food processes.

Nano technology using various methods, especially, a) surface disinfection and antimicrobial, b) antioxidant protection, c) regulation and control of enzyme activity can be effective in food preservation. In the food quality control process, it can be used by planning Nanosensors (nanowires, etc.) and nanofilters (nanoparticles and nanofibers) can be used to evaluate the health of food [6-8].

In order for our body to benefit from the distribution of food components in it, the nutrients must go to a specific place in the body and be activated in that place. Controlling and engineering the release of nutrients in the body is one of the research fields of nanotechnology. These foods, which are called “food and medicine”, their active components are distributed in the body by nanocapsules. Because one of the ways to preserve an active food component is to put it in a protective cover. This coating can be designed in such a way that it dissolves when stimulated by a suitable stimulus and the active substance inside is released through the coating. For example, the George Weston Food Institute in Australia has produced a type of bread called “Tip Top Up” bread, which contains oil from omega-3 fatty acids obtained from tuna. But the tuna oil is placed inside the microcapsule, so the consumer does not feel the taste of the fish oil, and it is released only when the oil reaches the stomach and the capsule is digested. This technology is also used in yogurt and baby food (Fig. 1).

According to the statistics of the World Health Organization, approximately one billion and three hundred million adults in the world are obese and overweight, and the prevalence of obesity has reached 10-40% in most European countries. The information shows that 54% of the adult communities in America are obese and overweight [9]. In Iraq, the prevalence of obesity and overweight is increasing at an alarming rate. Epidemiological studies show that the prevalence of overweight, obesity and metabolic syndrome in Iraq is equal to (or more than Europe and the United States of America) [10]. The high prevalence of obesity and overweight explains the potential effect of lifestyle factors such as diet on their etiology. So far, most studies have been conducted in the field of diet and its relationship with obesity. have focused on the intake of nutrients or food items separately) [11] while nowadays it is recommended to examine the diet as a food pattern because in this case all aspects of the diet of people can be evaluated in a better way, also Food intakes of people include diets consisting of various types of foods with complex combinations of nutrients [12]. Due to the lack of discovery of all food compounds and interactions among nutrients, the application of dietary models can

Fig. 1. Schematic of Nano capsules delivery.

cause concern about confounding parameters and interactions between food and nutrients [13, 14]. Considering that the dietary model shows dietary behaviors, it can provide more details about the nutritional etiology of chronic cases, and by determining the dietary model, more practical solutions can be found regarding the prevention of overweight, obesity and other diseases related to them.

It seems that changes in eating habits, including more use of high-calorie sources such as foods that are quickly prepared, ready meals and snacks, are among the influential causes of obesity. Studies on the relationship between obesity and diet have often focused on the intake of macronutrients and fiber. Clinical studies have shown that reducing fat intake is related to weight loss, but observational studies do not support this hypothesis [15]. It should be noted that different anthropometric indicators have been used in different studies regarding obesity. Body 2 and the ratio of waist circumference to hip circumference (abdominal obesity) is one of the most important anthropometric risk factors associated with obesity and chronic diseases caused by it, such as type 2 diabetes, cardiovascular diseases, blood pressure, and some types of cancer [16]. Regarding obesity and overweight, BMI has often been used as a measure of obesity. Some studies state that BMI is not an accurate measurement method for body fat and may not always provide accurate information about changes in body fat and body composition. Based on BMI, there is a possibility that people with high body fat and low fat-free mass are in the normal range of the population [17]. These studies have used the amount of body fat mass to determine obesity, and some have used a standard that separates body fat mass. taking into account and expressing it in relation to height and independently of fat-free mass, body fat mass index 3, which is obtained by dividing the amount of body fat mass (kg) by the square of height (square meter), has been used.

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According to the various criteria mentioned in order to evaluate obesity, it is necessary to examine the relationship of each of these criteria with food patterns. The results of studies show an inverse relationship between following dietary patterns rich in dairy products with fat mass and body fat mass index [21], while studies that examined obesity and overweight based on BMI often indicate the role of following dietary patterns rich in fiber have been in preventing the occurrence of obesity and overweight) [18]. Also, different results have been observed in the examination of the dietary pattern in different age groups (have been associated with a greater risk of obesity and overweight based on BMI) [19] and in the study of children's eating patterns, it was found that snacks played an important role in providing energy and nutrients for children's daily intake, and this caused its share from some meals. The main food, especially breakfast, should be increased in children's diet, and since snacks make up about 40% of children's daily energy needs, and most of these snacks are confectionery products, they can contribute to overweight and obesity in children have a significant role) [16]. Also, in the study of the consumption pattern of young people, the high intake of bread and cereals has a

direct relationship with abdominal obesity. Weight in different age groups is following an unhealthy and unbalanced diet, and also considering that studies examining diet in the form of food patterns have introduced a more effective way to control obesity and overweight, the present study aims to introduce nanomedicines impact on deist's efficacy as the available evidence between obesity and different food patterns.

MATERIALS AND METHODS

The statistical population of this cross-sectional survey consisted of all men and women aged 20 to 64 in Iraq, and according to the results of the 2023 census, their total number was exactly 10000 people. (5500 of them are women and 4500 are men). The sample size was 384 people using Cochran's formula, but it increased to 350 people due to eliminating the effect of missing codes. Considering the nature of the research, a multi-stage cluster sampling method has been used. First, the study area was divided into 10 urban areas, then blocks were selected according to the population of each area, and in the last step, houses were randomly selected from each block. After determining the sample size, due to the importance and sensitivity of this stage of the research and also to increase the accuracy of completing the questionnaires, a group of experts who were mostly undergraduate students of social sciences was used. After justification and preliminary training in the field of the topic and research objectives, this group went to the relevant areas and proceeded to complete the questionnaire.

The questions of the questionnaire were designed based on the theoretical framework of the research and the experimental background, and after the preliminary test and the necessary corrections, they were given to the respondents. Statistical data processing was done using SPSS software. The dependent variable of the research was obesity, which was measured by body mass index (BMI). This index is obtained by dividing the weight by the square of the height. According to the definition of the World Health Organization for the classification of obesity and overweight, people with a body mass index less than 5.18 are underweight, between 5.18-25.5 have a normal weight, between 25-30 are overweight and more than 30 are obese.

A new strategy for treating obesity has been proposed by targeting specific fat deposits with cationic nanomaterials [21] that can prevent the unhealthy accumulation of larger fat cells. Unlike liposuction, which removes fat, these substances regenerate it. The first study focuses on visceral obesity, or belly fat, while the second focuses on subcutaneous fat and obesity-related chronic inflammation. In these studies, scientists found that adipose tissue contains large amounts of negatively charged extracellular matrix (ECM) to hold fat cells. The researchers hypothesized that positively charged molecules would find a highway system in the network of negatively charged extracellular matrix. So they injected PAMAM generation 3 (P-G3), a positively charged nanomaterial, into obese mice. P-G3 rapidly diffused throughout the tissue, and this strategy was successful in targeting visceral fat.

The researchers went on to explain that P-G3 interrupted the fat storage program in fat cells and the mice lost weight. Considering P-G3's consistent function in neutralizing negatively charged pathogens such as DNA/RNA cellular debris to reduce inflammation, this result was much unexpected. In [22] stated that our approach is unique and is far from pharmaceutical or surgical approaches. We used a cationic charge to rejuvenate healthy fat cells, a technique that no one has ever used to treat obesity.

RESULTS AND DISCUSSION

One of the important points of nutritional therapy in weight loss programs is that the goal of weight loss must be determined first. In most cases, weight loss of 5-10% of the patient's weight can be effective and associated with health within 3 months. This amount of weight loss has been confirmed because it is associated with a reduction in the risk factors of cardiovascular disease, including dyslipidemia, hypertension, and diabetes mellitus. One of the diseases caused by obesity is diabetes and cardiovascular risks, which are presented in Table 1. The results of the research showed that weight loss in the prevention of diabetes for people who have glucose intolerance, a 7% reduction in weight, can reduce the risk of glucose intolerance by 58%. In this research, the main criterion for weight loss for the investigated cases is maintaining body mass in the range of 20-25.

Increasing the waist circumference in people with normal weight can also increase the

probability of the disease. So in addition to BMI the shape of the body can be important factor. The rate of metabolism decreases by about 2% for every decade of life, which is an average of 100 kilocalories. About 22 kilocalories are needed to maintain one kilogram of body weight in people who have normal weight, so it is expected that the energy consumed in a 100 kilogram person's body is equivalent to 2200 kilocalories per day. According to the 20% tolerance of this case based on genetics, gender and age, the maximum amount of this energy will be 2620 and the minimum will be 1860 kcal. A reduction of 500 kcal per day can reduce 1 kg of weight in a week. But this process decreases with weight loss and matching body weight and harmony. There are several methods to estimate energy consumption in the body, in this article the WHO method is used, which is presented in Table 1. Total energy consumption is calculated by basic energy consumption multiple by movement factor.

For cases who are overweight, it is important that they find it difficult to lose and maintain weight, because following the diet, the body's metabolism rate is reduced, and as a result, as shown in Fig. 2, the excess weight returns easily after the diet. . With weight loss, the environmental signals of hormones that regulate appetite are changed. Gastrointestinal peptides such as ghrelin, which control bone, and gastric inhibitory polypeptides, which increase energy storage, increase following initial diet-induced weight loss. Other things that

Table 1. The effect of obesity on the possibility of diabetes and obesity

	BMI	Obesity rate	Probability of diseases	Waist
Lightweight	Less than 18.5	-	-	-
normal	18.5-20	-	-	Low
Overweight	25-30	I	Up to 10 %	High
obesity	30-35	II	Up to 20 %	Very High
severe obesity	35-40 & Higher	III	Up to 35 %	Extremely high

Table 2. Calculation of metabolism based on age and sex

18-30 Male	(0.063*weight +2.9)*7200 kcal/month
31-61 Male	(0.048*weight +3.65)*7200 kcal/month
18-30 Female	(0.062*weight +3.04)*7200 kcal/month
31-61 Female	(0.034*weight +3.54)*7200 kcal/month
Movement factor	Low: 1.3; Mean: 1.5; High: 1.7

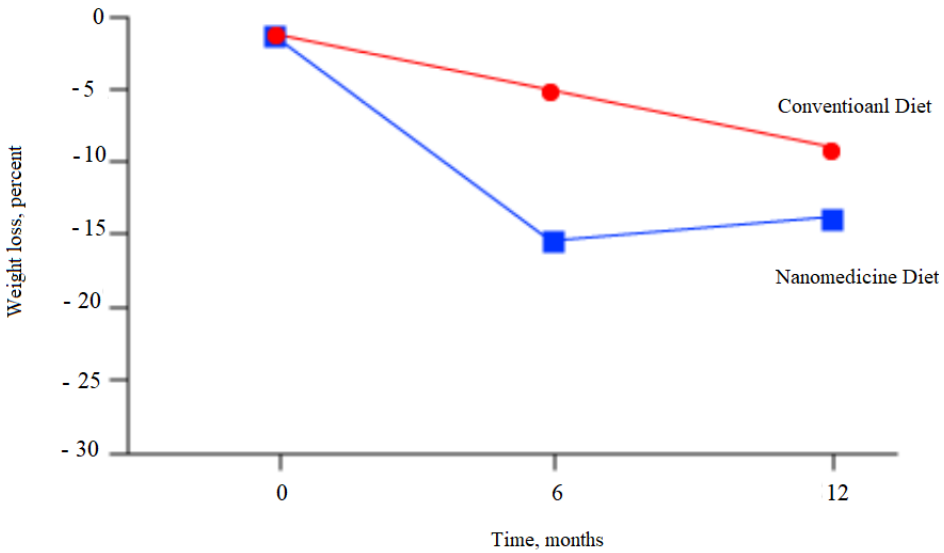

Fig. 2. Comparison of average weight loss in normal

Table 3: comparison Conventional and nanomedicine diets

Diet	Measured variables		
	Reduced weight (3 months)	Reduced weight (6 months)	maintain weight (12 months)
Nanomedicine diet	7%	13 %	10%
Conventional diet	8 %	11 %	6%
T-test	Kendall's tau-c = -0.602		Sig = 0.000

inhibit food intake, such as lipids, peptide YY, cholecystokinin, and pancreatic polypeptide are reduced. This hormonal adjustment will lead to weight gain, which will be resistant for at least one year after the fasting diet.

In order to investigate the effect of nanomedicines on the diet performance, the comparison of the conventional carbohydrate diet and nanomedicine diet with micronutrient which prevents the formation of large fats and provides the substances needed by the body to regulate hormones was presented in table 3.

It was obvious that the nanomedicines diets can reduce the fats gradually and keep the weight as the target was deduced, whilst the conventional diet rate is sharp which can harmful for heart and body metabolism.

CONCLUSION

It should always be noted that slow and stable weight loss over a long period of time is the safest and most effective way to lose weight and dispose of it. Any obese person may see improvement in their health even by losing a little weight. For people with chronic obesity, moderate weight loss (5-10%) can be enough to produce positive changes in health status, such as lowering blood pressure, blood lipids, and blood sugar. Although recommended diets for weight loss have much in common, there is no one diet plan that works for everyone trying to lose weight and improve their health, and providing nutrients and eliminating fat is one of the most important. It is the most basic methods that can be achieved by using nanomedicines. In the method of dietary regimen combined with Nanomedicine, people's dietary needs and preferences are different, and naturally, the type of nutrition in one person can be different and so called unique. Therefore, it is suggested that the effect of nanomedicine and its different doses be further evaluated according to the level of obesity and age of people.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this manuscript.

REFERENCES

1. Trandafir LM, Dodi G, Frasinariu O, Luca AC, Butnariu LI, Tarca E, et al. Tackling Dyslipidemia in Obesity from a Nanotechnology Perspective. Nutrients. 2022;14(18):3774.
2. Shende P, Narvenker R. Herbal nanotherapy: A new paradigm over conventional obesity treatment. Journal of Drug Delivery Science and Technology. 2021;61:102291.
3. Hu F, Sun D-S, Wang K-L, Shang D-Y. Nanomedicine of Plant Origin for the Treatment of Metabolic Disorders. Frontiers in Bioengineering and Biotechnology. 2022;9.
4. Hassanpour M, Salavati-Niasari M, Safardoust-Hojaghan H. Sol-gel synthesis and characterization of Co3O4/CeO2 nanocomposites and its application for photocatalytic discoloration of organic dye from aqueous solutions. Environmental Science and Pollution Research. 2020;28(6):7001-7015.
5. Vij M, Dand N, Wadhwa P. A Review on the Applications of Nano-medicines in Treatments of Metabolic Diseases. Recent Innovations in Chemical Engineering (Formerly Recent Patents on Chemical Engineering). 2021;14(4):299-319.
6. Sharma N, Behl T, Singh S, Kaur P, Zahoor I, Mohan S, et al. Targeting Nanotechnology and Nutraceuticals in Obesity: An Updated Approach. Current Pharmaceutical Design. 2022;28(40):3269-3288.
7. Guardiola-Márquez CE, Santos-Ramírez MT, Segura-Jiménez ME, Figueroa-Montes ML, Jacobo-Velázquez DA. Fighting Obesity-Related Micronutrient Deficiencies through Biofortification of Agri-Food Crops with Sustainable Fertilization Practices. Plants. 2022;11(24):3477.
8. Paolino D, Mancuso A, Cristiano MC, Froiio F, Lammari N, Celia C, et al. Nanonutraceuticals: The New Frontier of Supplementary Food. Nanomaterials. 2021;11(3):792.
9. Gomes CdC, Passos TS, Morais AHA. Vitamin A Status Improvement in Obesity: Findings and Perspectives Using Encapsulation Techniques. Nutrients. 2021;13(6):1921.
10. McClements DJ. Nanotechnology Approaches for Improving the Healthiness and Sustainability of the Modern Food Supply. ACS Omega. 2020;5(46):29623-29630.
11. Martin D. Reflections on Emerging Technologies in Nanomedicine. Erciyes Medical Journal. 2020.
12. Safardoust-Hojaghan H, Shakouri-Arani M, Salavati-Niasari M. A facile and reliable route to prepare of lead sulfate nanostructures in the presence of a new sulfur source. Journal of Materials Science: Materials in Electronics.

2014;26(3):1518-1524.
13. Rosales TKO, Hassimotto NMA, Lajolo FM, Fabi JP. Nanotechnology as a Tool to Mitigate the Effects of Intestinal Microbiota on Metabolization of Anthocyanins. Antioxidants. 2022;11(3):506.
14. Sahoo M, Vishwakarma S, Panigrahi C, Kumar J. Nanotechnology: Current applications and future scope in food. Food Frontiers. 2020;2(1):3-22.
15. Durazzo A, Nazhand A, Lucarini M, Atanasov AG, Souto EB, Novellino E, et al. An Updated Overview on Nanonutraceuticals: Focus on Nanoprebiotics and Nanoprobiotics. International Journal of Molecular Sciences. 2020;21(7):2285.
16. Manconi M, Rezvani M, Manca ML, Escribano-Ferrer E, Fais S, Orrù G, et al. Bridging biotechnology and nanomedicine to produce biogreen whey-nanovesicles for intestinal health promotion. International Journal of Pharmaceutics. 2023;633:122631.
17. Szunerits S, Melinte S, Barras A, Pagneux Q, Voronova A, Abderrahmani A, et al. The impact of chemical engineering and technological advances on managing diabetes: present and future concepts. Chemical Society Reviews. 2021;50(3):2102-2146.
18. Mehra A, Chauhan S, Verma P, Kumar N. Latest advances of phytomedicine in drug delivery systems for targeting metabolic disorders. Drug Delivery Systems for Metabolic Disorders: Elsevier; 2022. p. 469-479. 7.00029-3
19. Chatterjee N, Dhar P. Nanoceuticals. Handbook of Nanotechnology in Nutraceuticals: CRC Press; 2022. p. 1-50.
20. Zhang Z, Li X, Sang S, McClements DJ, Chen L, Long J, et al. Polyphenols as Plant-Based Nutraceuticals: Health Effects, Encapsulation, Nano-Delivery, and Application. Foods. 2022;11(15):2189.
21. Koldemir-Gündüz M. Role of Nanoparticles in Precision Medicine and Targeted Drug Delivery. Biogenic Nanomaterial for Health and Environment: CRC Press; 2023. p. 64-75.