Journal of Engineering and Applied Sciences 13 (18): 7689-7692, 2018
ISSN: 1816-949X

The Effect of Calcium Oxide-Nanoparticles on the Function of the Kidney Organ in the Rats

Shurooq Wesam Al-Shaibani
Department of Basic Science, Faculty of Dentistry, University of Kufa, Kufa, Iraq

Abstract: The existent study was achieved to calculate the toxicity of Calcium Oxide Nanoparticles (CaO-NPs) powder on normal rats following 10 days of oral administration as compared to control. In this study, the adult male albino rats were randomly chosen into (the experimental and control) groups n = 3 which were the orally managed with (50 and 100) mg/kg body weight of (CaO-nanoparticles). The toxic effects were calculated by changes kidney weights and of serum-biochemical considerations such as: Glucose, Blood Urea Nitrogen (BUN), the blood urea, the uric acid and the creatinine. The serum biochemical indicators were experimented in the rats, after 10 days of the post experience. The changes of the serum particular considerations indicated that the kidney were significantly affected in both the experimental groups. The changes among the levels of the total glucose, the blood urea nitrogen, the uric acid and creatinine which that the indicates renal damage in (CaO-nanoparticles) treated male rats. Values shows that the oral administration of (CaO-nanoparticles) may lead to the renal toxicity in the experimental rats. The present study planned to calculate toxic effect of CaO-NPs on biochemical changes in male rats.

Key words: Nanoparticles, CaO, biochemical parameters, male rats, glucose, experimental groups

INTRODUCTION

The main attitude of nanotechnology has resulted in a decline of the particle size which improves the cellular interest competences and donates original the physical properties that are theoretically beneficial in the biomedical research (Stark, 2011; Tholouli *et al*., 2008). In the toxicological studies of a critical experience to (NPs), the changes of the specific enzyme levels which clearly signals damage in special the cells and the organs (Moss and Wong, 2006; Shi *et al*., 2013).

A variety of NPs based therapeutic have improved the efficacy and reduced the toxicity of the drugs then making them the potential applicants to overcome the departure and the purification of the cells, the biological obstructions and directed the drug delivery agents (Eifler and Thaxton, 2011; Cheng *et al*., 2012; Biju, 2014). The significance of the healthcare, a large number of the studies have been completed to make operative conjugation of the biomolecules onto the inorganic nanoparticles.

These NPs with long-term belonging have not been obviously examined and are related with the inflammation, the immunogenicity, the toxicity, long-term tissue destruction and carcinogenesis there for, it's critical to institute such the kind of the inorganic NPs that have the prospective to minimize unfavorable effects due to long-term exposure, these nanoparticles can expand the short-term therapeutics by regulating their the circulation, the biodegradation and the stability on in vivo studies (Huang *et al*., 2011). Calcium oxide nanoparticles has the significant attention due to it's the his to compatibility (Leonardo *et al*., 2006), antimicrobial possible (Mohammadi and Dummer, 2011) and tissue dissolution (Hasselgren *et al*., 1988), although, only a few researches have been arrived the biochemical properties of calcium oxide nanoparticles, they show CaO-NPS powder (Sawai *et al*., 1995; Sawai and Yoshikaw, 2004) has no detailed endocrine disruptive achieve. Some researcher have been reported that calcium oxide nanoparticles show acute toxicity, sub-acute the severe hepatic and he tubular degenerations were detected in liver and kidney organs (Butt *et al*., 2015).

Thus, in the existent study, CaO-nanoparticles were organized the using organic precipitation activity. The resulted NPs were used in biochemical considerations such as the bio-labeling and the cytotoxicity after oral administration in the animals rats.

MATERIALS AND METHODS

Calcium oxide nanopowder was purchased from Iraqi Nanomaterials Pioneers Company (Najaf, Iraq). Its characteristics are the crystallite size was measured using Scherrer equation and it found that the average crystallite size (D) of synthesized calcium oxide nano particles was

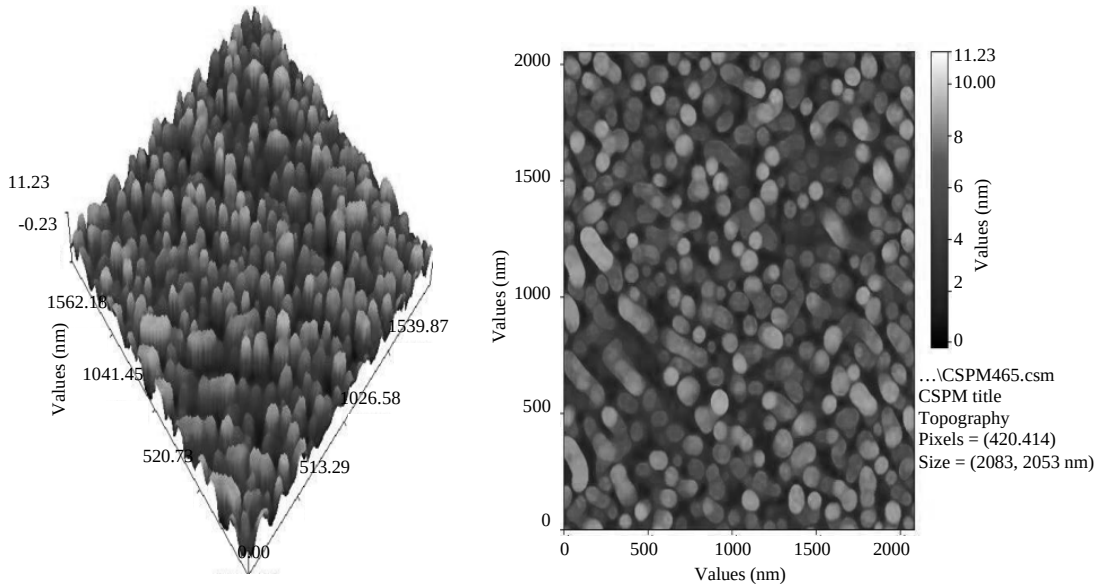

Fig. 1: 3-D and 2-D images of synthesis calcium oxide nano particles

46 nm 2- and 3-D AFM images of the synthesized calcium oxide nanoparticles indicate that the particles of calcium oxide were distributed in regions from 15-65 nm as shown in Fig. 1.

It can be seen in the surface images that the topography of the nanoparticle is fairly regular. The average particle sizes were found to be 52 nm, the average roughness was 1.84 nm and the root mean square found to be 2.14 nm.

The preparation of nanoparticle suspension: A stock solution of the suspension was prepared by the suspending CaO-nanoparticles in the bi-distilled water.

The experimental design and procedure: The experiment was using 9 male waster albino rats weighing 150-340 g. Animals were obtained from University of Karbala. The animals were housed in clean cages and were preserved under straight laboratory situations temperature, humidity (13 h light/11 h dark cycle). The distilled water and marketable food minutes for the rats were available. After one week acclimation, the suspension of (CaO-NPs) were orally uptake by male rats daily for ten day. They were housed in Science Faculty laboratory. Animals rats were randomly dived into (3 groups), each group excluding three rats (n = 3): The control group treated with 0.9% saline only and the experimental groups treated with (CaO-NPs) suspension 50 and 100 mg/kg of body weight managed the orally through the intragastric oral intubation tube for 10 serial days. On the 11th day all the animals were sacrifice. Blood was collected from heart and the serum was separated by the centrifuge.

These samples were stored until the analysis. After collecting blood samples kidneys were removed carefully, weighted to evaluate organ weight. The kidney functions parameter including glucose, Blood Urea Nitrogen (BUN), blood urea, uric acid and the creatinine were measured by an automatic Fujifilm (Dry chem N×500), made in Japan (2014) and Mini Vidas (2000).

Statistical analysis: Results were presented as program of SPSS, including model factorial experiments with complete randomized design, comparison were done between groups by using Least Significant Differences (LSD) $p<0.05$ was declare as significant statistically (Reitman and Frankel, 1957).

RESULTS AND DISCUSSION

The effect of CaO-NPs on kidney weights: Figure 2 show decreased in kidney weights in experimental groups 50 and 100 mg/kg but it is no significant as compared with that of control.

The effect of CaO-NPs on levels of (glucose, BUN, blood urea, creatinine and uric acid) on the blood in male rats: The glucose levels were significantly increased in the experimental group (50 mg/kg) as compared with that of control as show in Fig. 3. Although, Fig. 4-6 show significantly increased in only experimental group 50 mg/kg as compared with control in Blood Urea Nitrogen (BUN), blood urea and creatinine levels but the experimental group (100 mg/kg) show was not

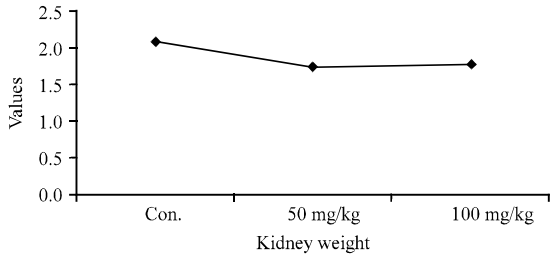

Fig. 2: The kidney weights levels in male rats for these groups

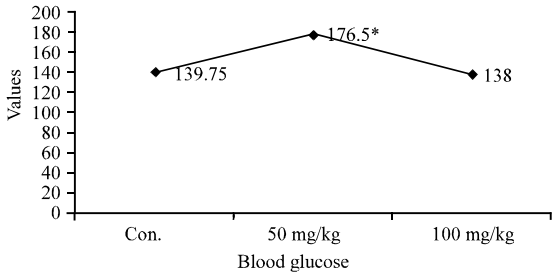

Fig. 3: The blood glucose levels in male rats for these groups

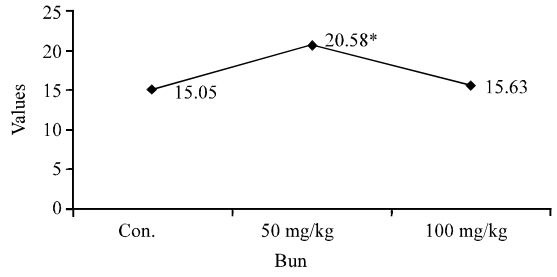

Fig. 4: The blood urea nitrogen levels in male rats for these groups

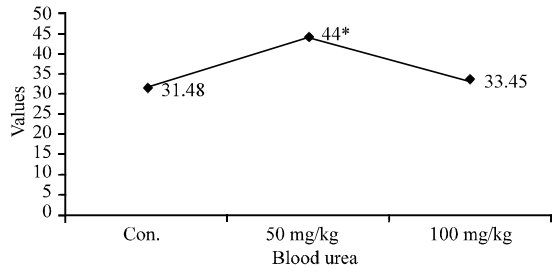

Fig. 5: The blood urea levels in male rats for these groups

significantly as compared with control in blood glucose, Blood Urea Nitrogen (BUN), blood urea and creatinine levels. Uric acid levels was decreased significantly in both experimental groups as compared with control as show in Fig. 7.

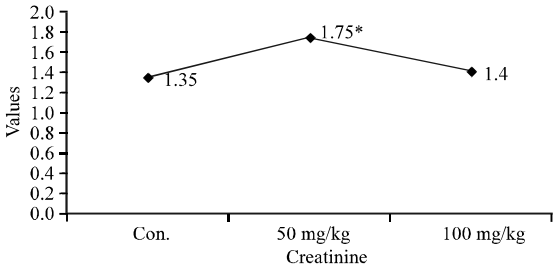

Fig. 6: The creatinine levels in male for these groups

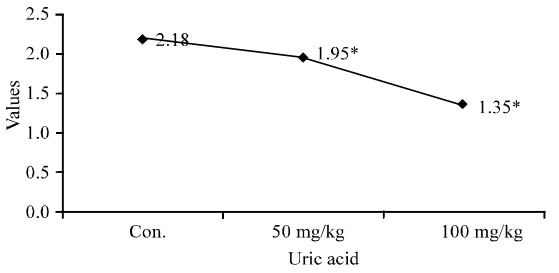

Fig. 7: The uric acid levels in male rats for these groups

Blood biochemical assessments are often used in identification disease of the liver and the kidney. They are also broadly used in checking response to exogenous toxic exposure. Blood glucose are suitable indicators for pancreas and liver function, the liver damage and pancreatic lesions could be induced by excess oral CaO-NPs administration. Kidney has been known to remove the unsafe substances from blood, thus, nanoparticles absorb in to the circulatory system and can be filtered by the renal system (Schipper *et al*., 2009; Gao *et al*., 2012). However, the kidney dysfunction was found in animal rats treated with CaO-NPs because of an increased level of the blood urea nitrogen.

CONCLUSION

Furthermore, the increased levels of The blood urea nitrogen in serum is directly associated with sign of the glomerulonephric toxicity, the swelling in the renal glomerulus, the renal tubules crammed with proteinic fluids because of hold up of CaO-NPs in the kidneys organ these results agreed with other research but in different nanoparticles (Vasantharaja *et al*., 2014; Najafzadeh *et al*., 2013). The blood urea nitrogen and creatinine are suitable indicators of the renal function. If kidney function (falls), the blood urea nitrogen and creatinine levels will (rise), thus, significantly increased blood urea nitrogen and creatinine, blood urea and uric acid level in the nano calcium oxide group in this existent study indicated that (the renal dysfunction) be the most

likely caused by calcium oxide nanoparticles administration. Kidney organs has been known to remove the unsafe substances from the blood, thus, nanoparticles absorb into the circulatory system and can be filtered by renal system (Butt *et al*., 2015).

REFERENCES

Biju, V., 2014. Chemical modifications and bioconjugate reactions of nanomaterials for sensing, imaging, drug delivery and therapy. Chem. Soc. Rev., 43: 744-764.

Butt, A.R., S. Ejaz, J.C. Baron, M. Ikram and S. Ali, 2015. CaO nanoparticles as a potential drug delivery agent for biomedical applications. Dig. J. Nanomater. Biostruct., 10: 799-809.

Cheng, Z., A. Al Zaki, J.Z. Hui, V.R. Muzykantov and A. Tsourkas, 2012. Multifunctional nanoparticles: Cost versus benefit of adding targeting and imaging capabilities. Sci., 338: 903-910.

Eifler, A.C. and C.S. Thaxton, 2011. Nanoparticle therapeutics: FDA approval, clinical trials, regulatory pathways and case study. Biomed. Nanotechnol., 1: 325-338.

Gao, G., Y. Ze, B. Li, X. Zhao and T. Zhang *et al*., 2012. Ovarian dysfunction and gene-expressed characteristics of female mice caused by long-term exposure to titanium dioxide nanoparticles. J. Hazard. Mater., 243: 19-27.

Hasselgren, G., B. Olsson and M. Cvek, 1988. Effect of calcium hydroxide and sodium hypochlorite on the dissolution of necrotic porcine muscle tissue. J. Endod., 14: 125-127.

Huang, H.C., S. Barua, G. Sharma, S.K. Dey and K. Rege, 2011. Inorganic nanoparticles for cancer imaging and therapy. J. Controlled Release, 155: 344-357.

Leonardo, M.R., M.E. Hernandez, L.A. Silva and M. Tanomaru-Filho, 2006. Effect of a calcium hydroxide-based root canal dressing on periapical repair in dogs: A histological study. Oral Surg. Med. Pathol. Radiol. Endodontology, 102: 680-685.

Mohammadi, Z. and P.M.H. Dummer, 2011. Properties and applications of calcium hydroxide in endodontics and dental traumatology. Intl. Endodontic J., 44: 697-730.

Moss, O.R. and V.A. Wong, 2006. When nanoparticles get in the way: Impact of projected area on *in vivo* and *in vitro* macrophage function. Inhalation Toxicol., 18: 711-716.

Najafzadeh, H., S.M. Ghoreishi, B. Mohammadian, E. Rahimi and M.R. Afzalzadeh *et al*., 2013. Serum biochemical and histopathological changes in liver and kidney in lambs after zinc oxide nanoparticles administration. Vet World, 6: 534-537.

Reitman, S. and S. Frankel, 1957. A colorimetric method for the determination of serum glutamic oxalacetic and glutamic pyruvic transaminases. Am. J. Clin. Pathol., 28: 56-63.

Sawai, J. and T. Yoshikawa, 2004. Quantitative evaluation of antifungal activity of metallic oxide powders (MgO, CaO and ZnO) by an indirect conductimetric assay. J. Applied Microbiol., 96: 803-809.

Sawai, J., H. Igarashi, A. Hashimoto, T. Kokugan and M. Shimizu, 1995. Evaluation of growth inhibitory effect of ceramics powder slurry on bacteria by conductance method. J. Chem. Eng. Jpn., 28: 288-293.

Schipper, M.L., G. Iyer, A.L. Koh, Z. Cheng and Y. Ebenstein *et al*., 2009. Particle size, surface coating and PEGylation influence the biodistribution of quantum dots in living mice. Small, 5: 126-134.

Shi, H., R. Magaye, V. Castranova and J. Zhao, 2013. Titanium dioxide nanoparticles: A review of current toxicological data. Part. Fibre Toxicol., 10: 1-15.

Stark, W.J., 2011. Nanoparticles in biological systems. Angew. Chem. Intl. Ed., 50: 1242-1258.

Tholouli, E., E. Sweeney, E. Barrow, V. Clay and J.A. Hoyland *et al*., 2018. Quantum dots light up pathology. J. Pathol., 216: 275-285.

Vasantharaja, D., V. Ramalingam and G.A. Reddy, 2014. Oral toxic exposure of titanium dioxide nanoparticles on serum biochemical changes in adult male Wistarrats. Nanomed. J., 2: 46-53.