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Effect Of Energy Absorption On Morphological Changes In The Barrierprotective Structures Of The Gastrointestinal Tract In Chronic Kidney Diseases And Uremia

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ABSTRACT

The gastrointestinal tract is an active dynamic system that implements a number of important life support processes [30,2,57,87,203]. Impact of emergency situations on structures performing barrier-protective functions remain largely unexplored. In recent years, ideas about the role of the epithelium of the digestive tract have expanded, significant, and it has been found to be significant in loss of renal function [7,8,2]. Therefore, the epithelium of the gastrointestinal tract should be considered not only as a selective barrier to penetration of toxic substances into the interstitium, but also a key link in decontamination endogenous intoxication. The barrier-protective function of the digestive system is associated with border tissues, which have a strict morphological organization. These phenomena are as diverse as nature physical, chemical or biological aggression on the internal environment of the body can be various. Process layering data is important for practical use of the phenomenon of "layered defense", when stress or damage increases secretion and secretion, increases proliferation and desquamation of the epithelium, as well as migration of neutrophilic leukocytesfrom the bloodstream to the epithelial layer. [22].Under normal conditions, the gastrointestinal tract is considered a balanced ecosystem where there is a certain habitat - physical space. The state of the mucous membrane of the small intestine, the main participant in the absorption processes and excretion of metabolic products deserves the most attention. It has been found that oral administration enterosorbents (Karbovit and Polypefan) in intact rats does not cause mucosal changes membrane of the jejunum and ileum and does not affect the state of enterocytes. However, in some in some cases, ES enhances the secretion of goblet cells, especially in the apical part of the intestinal villi [22]. At the same time, a relatively large number of Pannet cells were registered in crypts, and Lamina the propria around them contains many immune-competent plasmocytes and neutrophils. Electron microscopic examination of various parts of the small intestine showed that when mercury chloride injected into rats, the number of microvilli of enterocytes was shortened and decreased, and the number mitotically dividing cells increased. In this case, there is a pronounced vacuolization of enterocytes observable; vacuoles glow with electronics and contain flocculent material. Side cells emptied, Pannett cells contain a small amount of secretory

granules. Characteristic feature of the effect of mercury poisoning on the mucous membrane of the small intestine is inhibition of the reaction of cells of the connective base. The protective barrier of the mucous membrane of the gastrointestinal tract consists of three levels: luminal, epithelial and connective tissue.

1. INTRODUCTION:

The luminal level is presented above the epithelial layer of mucous deposits, consisting of multicomponent mucus, secretions of the digestive glands, substances secreted by Pannett cells, etc. components. Intoxication with salts of heavy metals, pesticides and other toxic substances exo- andendogenous nature can cause profound disturbances, up to the loss of the epithelial layer [63,64,72,91].The connective tissue level has three characteristics; first, the extraordinary intensity of bilateral metabolic processes between the stroma and the epithelial lining, secondly, due to the content of significantly greater number of connective tissue cells, and thirdly, due to the formation of immune processes. Studies have confirmed that uremia poisoning in chronic renal failure occurs when constant penetration of UT into the bloodstream. This is also evidenced by chronic mercury intoxication experimental animals in which hemodynamic, dystrophic, focal, necrotic, inflammatory and sclerotic changes are observed [87]. However, we did not observe a clear idea of the sequence morphological restructuring of the hemato circulatory bed and tissue structures of the gastrointestinal tract. Without clarifying this mechanism, it is impossible to imagine the morphological basis of damage and Renoprotective role of ES in uremic aggression.

In our study, the duration of monitoring of the barrier-protective function of the gastrointestinal tract the path of the experimental animals was 3 months. The first data were obtained after 14 days of the experiment. Inflammatory and destructive changes in tissue structures, especially in the lining of the small intestine, as indicated intercellular swelling and in places thinning of enterocytes. Condition of microvessels: heterogeneous - together with blood, precapillaries and capillaries were spasmodically narrowed observed, as well as without vascular zones and extravasates. Diameter of precapillaries, capillaries, and postcapillaries of the mucous membrane in all parts of the small intestine exceeded the control by 26.5%, 43.7% and 43.8%, respectively (Fig. 1).

Figure: 1 CKD. Uremia 14 days. Inflammatory destructive changes, intercellular edema, stagnation and vasodilation. SEMx500

On the 30th day after poisoning with mercury salts, destructive-dystrophic changes in all small intestinal membranes are strengthened. This is evidenced by dormant and thinned capillaries and eccentrically located villi. Ulcers of various sizes are found on the surface of the mucous membrane. With 60-day uremia, the revealed disorders were aggravated. All wall membranes small intestine more distinctly thinned, degeneration intensified in the mucous layer, and the number of short villi increased. The lumen of the crypts became tortuous, areas with peeling the epithelial layer, microerosion appeared in the stroma (Fig. 4.2). It was an increase in the number of avascular zones and a decrease in the density of the vessel walls. These changes were characteristic of structural disorders of the duodenum.

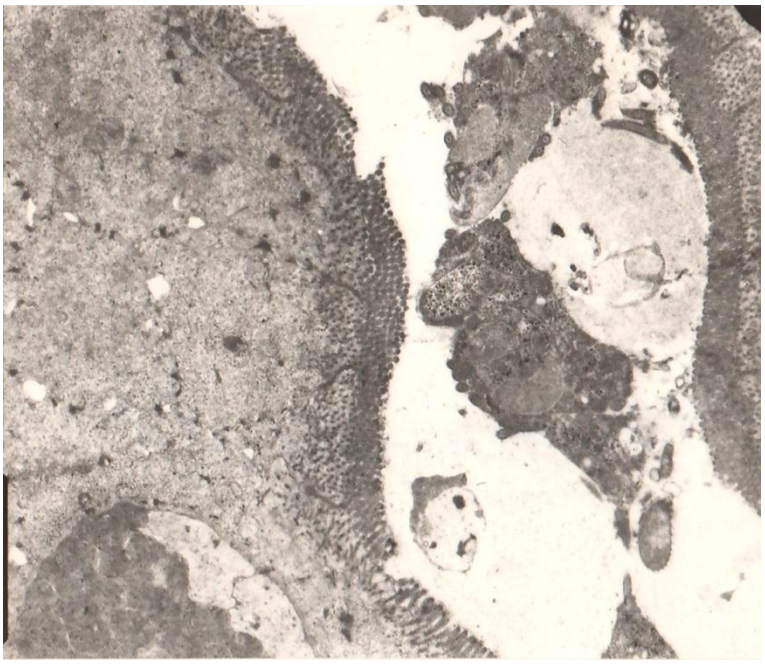

Figure: 2 CKD. Uremia 30 days. Increase in the number of avascular zones, decrease the density of the walls of blood vessels. Edema. SEMx500

On the 90th day of poisoning, the density of blood vessels decreased to 63% of the control. In capillaries, congestion and varicose veins. In general, everything points to a deep oppression of the hemocirculatory bed and morpho functional state of the small intestine. Distribution features of extra- and intraorganic vessels in various parts of the colon indicate differentiated severity of pathological processes that negatively affect normal functioning colon. In the early period (5-14 days) after sowing rats with mercury nitrate, inflammatory-reactive changes appear, accompanied by edema of all layers of the colon and basal intestines cells; diffuse infiltration; swelling of cells and eccentric arrangement of their nuclei or spasmodic vasoconstriction, their tortuosity and extravasation indicate a violation of vascular permeability vessel wall. The crypt stroma is edematous, with the presence of lymphoid and plasma elements.(Fig. 5.3). Throughout the colon, the epithelial layer of the crypts is stratified in places.

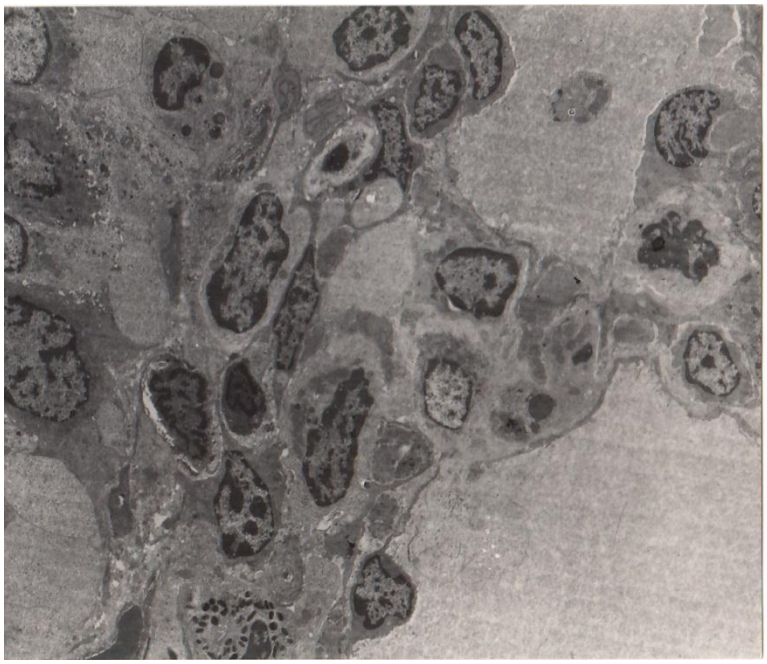

Figure: 3 CKD. Uremia 90 days. Colon. Vasoconstriction, diffuse infiltration and extravasates. Swelling of all layers and basal cells. SEMx500

Erosive or ulcerated areas are found in the proximal and middle sections. Due to edema the thickness of the intestinal membranes significantly exceeds the norm by 1.2 times. Crypts cylindrical, the lumen of which is filled with mucus, there is swelling of the stroma, infiltration and expansion of intercellular gaps. In the subsequent periods of the experiment, deep atrophic processes develop, which as evidenced by the thinning of all layers of the colon wall, a decrease in the epithelial, goblet and mitotic dividing cells. Microvessels are completely dilated or narrowed, which indicates the continuation of the vascular dystonia. Capillaries in all membranes are aneurysmically dilated, venous stasis persists, which contributes to the progression of tissue hypoxia (Fig. 4)..

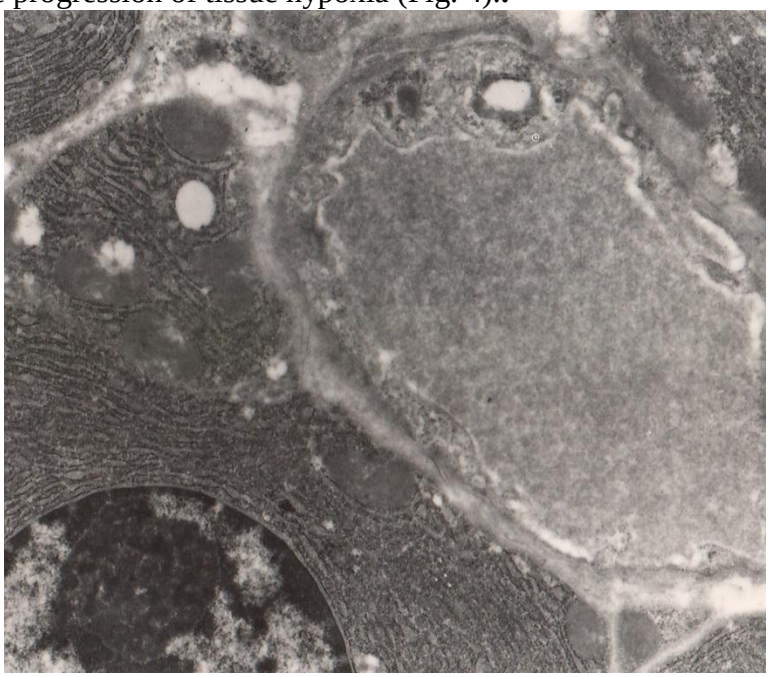

Figure: 4 CKD. Uremia 90 days. Reduction in the number of epithelial, lateral and mitoticdividing cells. Infiltration and swelling of the stroma.

Further, the picture of micro angiosclerosis develops. The number of epithelial and mitotic dividing cells decreased by 35-39% compared to control. These phenomena are more pronounced in proximal intestine. Consequently, one of the main factors in the development of atrophic processes in chronic renal failure, insufficiency, and CSS is hypoxia associated with capillary congestion and venous congestion (Fig. 5). These disorders lead to metabolic damage to the tissue structures of the small and large intestine, causing the severity of chronic renal failure and thus largely determine the outcome of uremic aggression.

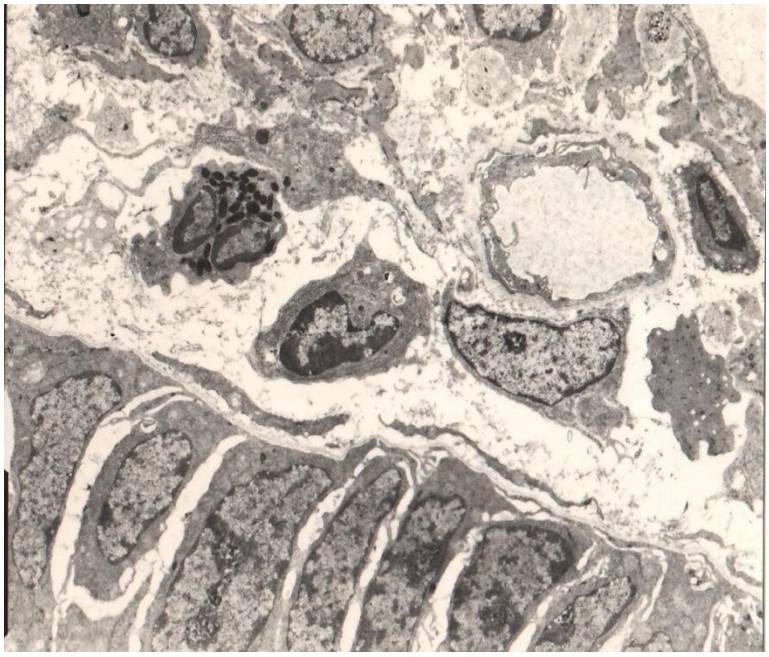

Figure: 5 CKD. Uremia 90 days. Capillarostasis and venous congestion. SEMx500

Analysis of the results of lesions of the gastrointestinal tract mucosa with mercury intoxication allows development of nephroprotection measures, taking into account the possibility of different areas gastro intestinal tract to remove Ut. It has been established that the role of the stomach in early stages of chronic renal failure replacing Ut elimination are apparently suppressed as you progress. The concept of the morphological features of the barrier-protective function of the digestive system tract in chronic renal failure and uremic intoxication allows you to establish the ratio of factors of aggression(Ut) and protective factors (enterosorbents), as well as to develop optimal treatment tactics chronic renal failure. It should be noted that Ut secreted in the digestive tract is absorbed already in the initial section, jejunum. Further, with blood and lymph, these substances are transferred to tissues that form intestinal barrier and glands, the secretions of which enter the digestive tract. Through the intestinal barrier, digestive juices, endogenous toxins again enter the intestines. Further recirculation coefficient characterizing the ratio of the amount of UT entering the gastrointestinal tract to its mass, absorbed in the initial part of the jejunum, exceeds 100%. This means that part metabolites that are absorbed by the lower intestine are involved in processing. Equilibrium the internal environment in these cases is maintained by creating a correspondence between absorption the rate Ut and the rate of their utilization and deposition. Physiological disposal processes intestinal metabolites are a key factor for inclusion in the treatment packages [30].Oral administration of enterosorbents Karbovit and Polyphepan to laboratory animals, showed their effectiveness in the absence of any negative changes in organ tissues. Login to the intestine, sorbents bind Ut and increase the luminal level of protection and regeneration processes, as evidenced by the appearance of full-blooded areas

of the mucous membrane with relatively normal structure (Fig. 4; 6; 7).

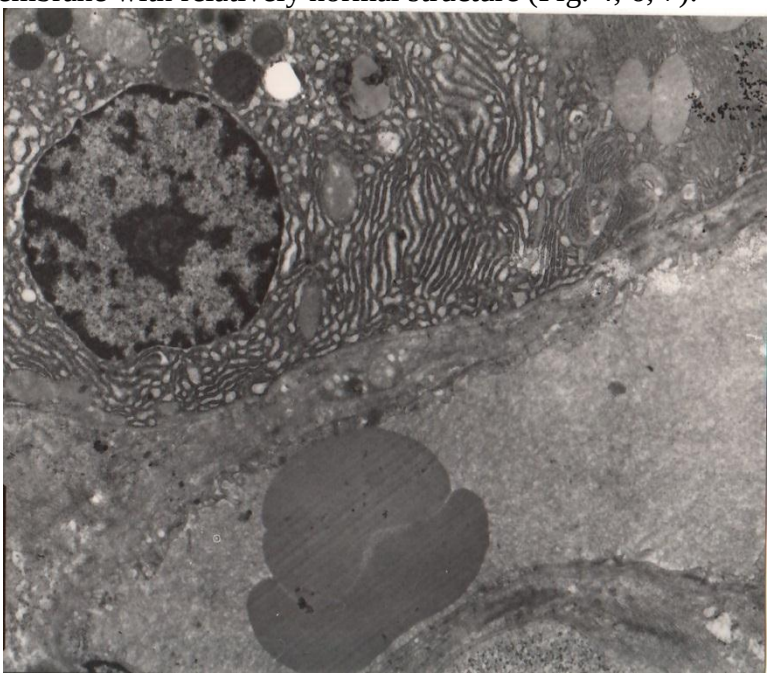

Figure: 6 CKD. Uremia. Enterosorption. Increased infiltration by macrophages and leukocytes SEMx500.

Carbovite actively absorbed toxic metabolites and more effectively blocked Ut than polypepam. Excretion of Ut increases the intensity of the reaction of connective tissue elements tissue, increases the number of lymphocytes, macrophages and eosinophils, as well as foci with edematous changes. In general, there is a tendency towards normalization of structures that create protective barrier (5.7) At the same time, the three-level principle of the organization's functioning persists throughout the gastrointestinal tract.

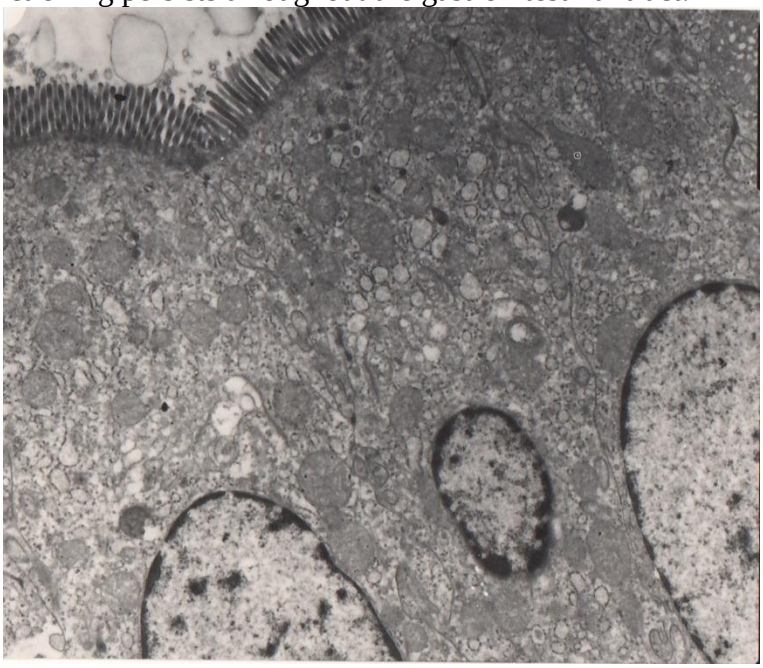

Fig. 7. CKD. Uremia. Enterosorption. Polypefan. An increase in the number of lymphocytes and mitotic cells. SEMx500.

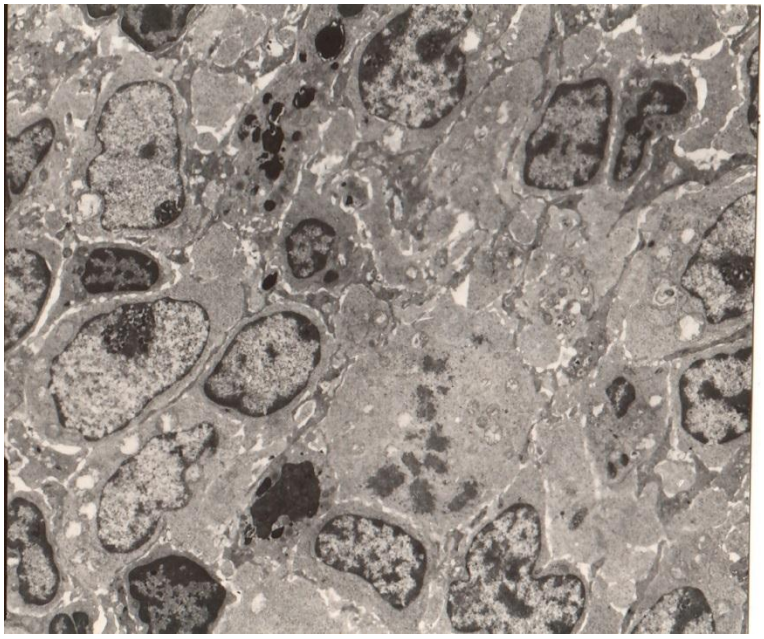

Figure: 8. Chronic renal failure. Uremia. Enterosorption. Carbovite. Thinning and fragmentation basement membrane. Dilation of blood vessels. SEMx500.

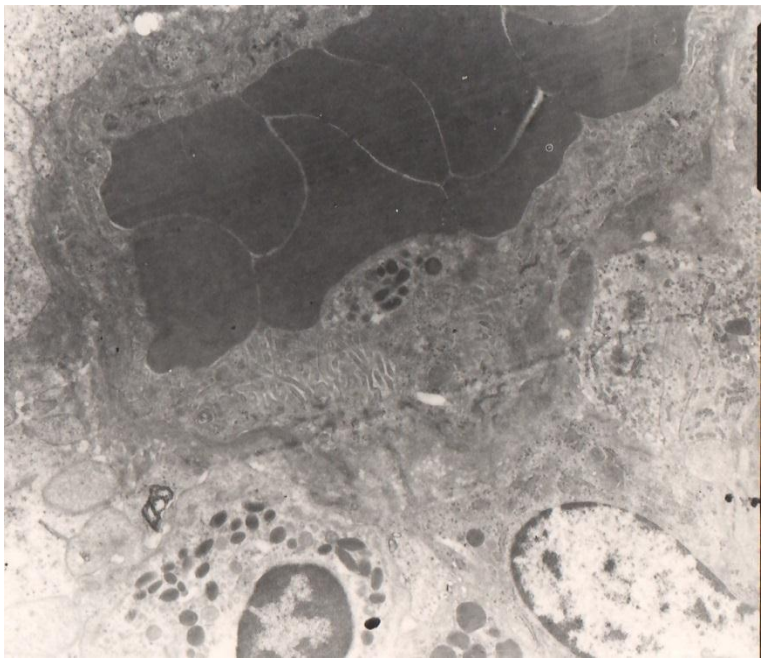

Figure: 9 CKD. Uremia. Enterosorption. Carbovite. Restoration of tissue structure intestines. Thickening of the walls of blood vessels and congestion of the mucous membrane.SEMx500.

Thus, oral administration of mercury chloride to experimental rats creates an adequate model of CKD and uremic syndrome, and also manifests itself in the corresponding disorders barrier-protective structure of the organs of the gastrointestinal tract. The use of enterosorbent "Karbovit" significantly blocks the changes caused by uremic poisoning, while the morphological picture epithelial cells are close to normal, and the structures of the connective tissue base are activated. Nevertheless, further study of the processes of structural protection of the mucous membrane of the gastrointestinal tract requires further study.is necessary for the development of new approaches to ET of progressive kidney disease.

REFERENCES:

[1] Kant, N., Saralch, S., & Singh, H. (2011). Ponderomotive self-focusing of a short laser pulse under a plasma density ramp. *Nukleonika*, *56*, 149-153.
[2] Patyar, S., & Patyar, R. R. (2015). Correlation between sleep duration and risk of stroke. *Journal of Stroke and Cerebrovascular Diseases*, *24*(5), 905-911.
[3] Khamparia, A., & Pandey, B. (2015). Knowledge and intelligent computing methods in e-learning. *International Journal of technology enhanced learning*, *7*(3), 221-242.
[4] Singh, A., Lin, Y., Quraishi, M. A., Olasunkanmi, L. O., Fayemi, O. E., Sasikumar, Y., ... & Kabanda, M. M. (2015). Porphyrins as corrosion inhibitors for N80 Steel in 3.5% NaCl solution: Electrochemical, quantum chemical, QSAR and Monte Carlo simulations studies. *Molecules*, *20*(8), 15122-15146.
[5] Singh, S., Kumar, V., Upadhyay, N., Singh, J., Singla, S., & Datta, S. (2017). Efficient biodegradation of acephate by Pseudomonas pseudoalcaligenes PS-5 in the presence and absence of heavy metal ions [Cu (II) and Fe (III)], and humic acid. *3 Biotech*, *7*(4), 262.
[6] Mia, M., Singh, G., Gupta, M. K., & Sharma, V. S. (2018). Influence of Ranque-Hilsch vortex tube and nitrogen gas assisted MQL in precision turning of Al 6061-T6. *Precision Engineering*, *53*, 289-299.
[7] Prakash, C., Singh, S., Pabla, B. S., & Uddin, M. S. (2018). Synthesis, characterization, corrosion and bioactivity investigation of nano-HA coating deposited on biodegradable Mg-Zn-Mn alloy. *Surface and Coatings Technology*, *346*, 9-18.
[8] Feng, X., Sureda, A., Jafari, S., Memariani, Z., Tewari, D., Annunziata, G., ... & Sychrová, A. (2019). Berberine in cardiovascular and metabolic diseases: from mechanisms to therapeutics. *Theranostics*, *9*(7), 1923.
[9] Bashir, S., Sharma, V., Lgaz, H., Chung, I. M., Singh, A., & Kumar, A. (2018). The inhibition action of analgin on the corrosion of mild steel in acidic medium: A combined theoretical and experimental approach. *Journal of Molecular Liquids*, *263*, 454-462.
[10] Sidhu, G. K., Singh, S., Kumar, V., Dhanjal, D. S., Datta, S., & Singh, J. (2019). Toxicity, monitoring and biodegradation of organophosphate pesticides: a review. *Critical Reviews in Environmental Science and Technology*, *49*(13), 1135-1187.
[11] Nanda, V., & Kant, N. (2014). Enhanced relativistic self-focusing of Hermite-cosh-Gaussian laser beam in plasma under density transition. *Physics of Plasmas*, *21*(4), 042101.
[12] Kotla, N. G., Gulati, M., Singh, S. K., & Shivapooja, A. (2014). Facts, fallacies and future of dissolution testing of polysaccharide based colon-specific drug delivery. *Journal of Controlled Release*, *178*, 55-62.
[13] Farooq, R., & Shankar, R. (2016). Role of structural equation modeling in scale development. *Journal of Advances in Management Research*.
[14] Singh, S., Ramakrishna, S., & Gupta, M. K. (2017). Towards zero waste manufacturing: A multidisciplinary review. *Journal of cleaner production*, *168*, 1230-1243.
[15] Mahla, S. K., Dhir, A., Gill, K. J., Cho, H. M., Lim, H. C., & Chauhan, B. S. (2018). Influence of EGR on the simultaneous reduction of NOx-smoke emissions trade-off under CNG-biodiesel dual fuel engine. *Energy*, *152*, 303-312.
[16] Nanda, V., Kant, N., & Wani, M. A. (2013). Self-focusing of a Hermite-cosh Gaussian laser beam in a magnetoplasma with ramp density profile. *Physics of Plasmas*, *20*(11), 113109.
[17] Kaur, P., Singh, S. K., Garg, V., Gulati, M., & Vaidya, Y. (2015). Optimization of spray drying process for formulation of solid dispersion containing polypeptide-k powder

through quality by design approach. *Powder Technology*, *284*, 1-11.
[18] Sharma, D., & Saharan, B. S. (2016). Functional characterization of biomedical potential of biosurfactant produced by Lactobacillus helveticus. *Biotechnology Reports*, *11*, 27-35.
[19] Wani, A. B., Chadar, H., Wani, A. H., Singh, S., & Upadhyay, N. (2017). Salicylic acid to decrease plant stress. *Environmental Chemistry Letters*, *15*(1), 101-123.
[20] Mishra, V., Patil, A., Thakur, S., & Kesharwani, P. (2018). Carbon dots: emerging theranostic nanoarchitectures. *Drug discovery today*, *23*(6), 1219-1232.
[21] Kumar, V., Pitale, S. S., Mishra, V., Nagpure, I. M., Biggs, M. M., Ntwaeaborwa, O. M., & Swart, H. C. (2010). Luminescence investigations of Ce3+ doped CaS nanophosphors. *Journal of alloys and compounds*, *492*(1-2), L8-L12.
[22] Pudake, R. N., Swaminathan, S., Sahu, B. B., Leandro, L. F., & Bhattacharyya, M. K. (2013). Investigation of the Fusariumvirguliformefvtox1 mutants revealed that the FvTox1 toxin is involved in foliar sudden death syndrome development in soybean. *Current genetics*, *59*(3), 107-117.
[23] Kapoor, B., Singh, S. K., Gulati, M., Gupta, R., & Vaidya, Y. (2014). Application of liposomes in treatment of rheumatoid arthritis: quo vadis. *The scientific world Journal*, *2014*.
[24] Haldhar, R., Prasad, D., & Saxena, A. (2018). Myristica fragrans extract as an eco-friendly corrosion inhibitor for mild steel in 0.5 M H2SO4 solution. *Journal of Environmental Chemical Engineering*, *6*(2), 2290-2301.
[25] Bordoloi, N., Sharma, A., Nautiyal, H., & Goel, V. (2018). An intense review on the latest advancements of Earth Air Heat Exchangers. *Renewable and Sustainable Energy Reviews*, *89*, 261-280.
[26] Sharma, P., Mehta, M., Dhanjal, D. S., Kaur, S., Gupta, G., Singh, H., ... & Chellappan, D. K. (2019). Emerging trends in the novel drug delivery approaches for the treatment of lung cancer. *Chemico-biological interactions*, *309*, 108720.
[27] Goga, G., Chauhan, B. S., Mahla, S. K., & Cho, H. M. (2019). Performance and emission characteristics of diesel engine fueled with rice bran biodiesel and n-butanol. *Energy Reports*, *5*, 78-83.
[28] Umashankar, M. S., Sachdeva, R. K., & Gulati, M. (2010). Aquasomes: a promising carrier for peptides and protein delivery. *Nanomedicine: Nanotechnology, Biology and Medicine*, *6*(3), 419-426.
[29] Sharma, A., Shree, V., & Nautiyal, H. (2012). Life cycle environmental assessment of an educational building in Northern India: A case study. *Sustainable Cities and Society*, *4*, 22-28.
[30] Kaur, T., Kumar, S., Bhat, B. H., Want, B., & Srivastava, A. K. (2015). Effect on dielectric, magnetic, optical and structural properties of Nd–Co substituted barium hexaferrite nanoparticles. *Applied Physics A*, *119*(4), 1531-1540.
[31] Datta, S., Singh, J., Singh, S., & Singh, J. (2016). Earthworms, pesticides and sustainable agriculture: a review. *Environmental Science and Pollution Research*, *23*(9), 8227-8243.
[32] Vij, S., & Bedi, H. S. (2016). Are subjective business performance measures justified?. *International Journal of Productivity and Performance Management*.
[33] Chawla, R., & Sharma, S. (2017). Molecular dynamics simulation of carbon nanotube pull-out from polyethylene matrix. *Composites Science and Technology*, *144*, 169-177.
[34] Prakash, C., & Uddin, M. S. (2017). Surface modification of β-phase Ti implant by hydroaxyapatite mixed electric discharge machining to enhance the corrosion resistance and in-vitro bioactivity. *Surface and Coatings Technology*, *326*, 134-145.
[35] Saxena, A., Prasad, D., & Haldhar, R. (2018). Investigation of corrosion inhibition

effect and adsorption activities of Cuscuta reflexa extract for mild steel in 0.5 M H2SO4. *Bioelectrochemistry*, *124*, 156-164.

[36] Prabhakar, P. K., Kumar, A., & Doble, M. (2014). Combination therapy: a new strategy to manage diabetes and its complications. *Phytomedicine*, *21*(2), 123-130.

[37] Wheeler, K. C., Jena, M. K., Pradhan, B. S., Nayak, N., Das, S., Hsu, C. D., ... & Nayak, N. R. (2018). VEGF may contribute to macrophage recruitment and M2 polarization in the decidua. *PLoS One*, *13*(1), e0191040.

[38] Singh, A., Lin, Y., Ansari, K. R., Quraishi, M. A., Ebenso, E. E., Chen, S., & Liu, W. (2015). Electrochemical and surface studies of some Porphines as corrosion inhibitor for J55 steel in sweet corrosion environment. *Applied Surface Science*, *359*, 331-339.

[39] Gill, J. P. K., Sethi, N., Mohan, A., Datta, S., & Girdhar, M. (2018). Glyphosate toxicity for animals. *Environmental Chemistry Letters*, *16*(2), 401-426.

[40] Kumar, V., Singh, S., Singh, J., & Upadhyay, N. (2015). Potential of plant growth promoting traits by bacteria isolated from heavy metal contaminated soils. *Bulletin of environmental contamination and toxicology*, *94*(6), 807-814.

[41] Patel, S. (2012). Potential of fruit and vegetable wastes as novel biosorbents: summarizing the recent studies. *Reviews in Environmental Science and Bio/Technology*, *11*(4), 365-380.

[42] Srivastava, G., Das, C. K., Das, A., Singh, S. K., Roy, M., Kim, H., ... & Philip, D. (2014). Seed treatment with iron pyrite (FeS 2) nanoparticles increases the production of spinach. *RSC Advances*, *4*(102), 58495-58504.

[43] Nagpal, R., Behare, P. V., Kumar, M., Mohania, D., Yadav, M., Jain, S., ... & Henry, C. J. K. (2012). Milk, milk products, and disease free health: an updated overview. *Critical reviews in food science and nutrition*, *52*(4), 321-333.

[44] Vaid, S. K., Kumar, B., Sharma, A., Shukla, A. K., & Srivastava, P. C. (2014). Effect of Zn solubilizing bacteria on growth promotion and Zn nutrition of rice. *Journal of soil science and plant nutrition*, *14*(4), 889-910.

[45] Lin, Y., Singh, A., Ebenso, E. E., Wu, Y., Zhu, C., & Zhu, H. (2015). Effect of poly (methyl methacrylate-co-N-vinyl-2-pyrrolidone) polymer on J55 steel corrosion in 3.5% NaCl solution saturated with CO2. *Journal of the Taiwan Institute of Chemical Engineers*, *46*, 214-222.

[46] Mahesh, K. V., Singh, S. K., & Gulati, M. (2014). A comparative study of top-down and bottom-up approaches for the preparation of nanosuspensions of glipizide. *Powder technology*, *256*, 436-449.

[47] Singh, G., Gupta, M. K., Mia, M., & Sharma, V. S. (2018). Modeling and optimization of tool wear in MQL-assisted milling of Inconel 718 superalloy using evolutionary techniques. *The International Journal of Advanced Manufacturing Technology*, *97*(1-4), 481-494.

[48] Chauhan, C. C., Kagdi, A. R., Jotania, R. B., Upadhyay, A., Sandhu, C. S., Shirsath, S. E., & Meena, S. S. (2018). Structural, magnetic and dielectric properties of Co-Zr substituted M-type calcium hexagonal ferrite nanoparticles in the presence of α-Fe2O3 phase. *Ceramics International*, *44*(15), 17812-17823.

[49] Sharma, A., Shahzad, B., Kumar, V., Kohli, S. K., Sidhu, G. P. S., Bali, A. S., ... & Zheng, B. (2019). Phytohormones regulate accumulation of osmolytes under abiotic stress. *Biomolecules*, *9*(7), 285.

[50] Balakumar, P., Chakkarwar, V. A., Kumar, V., Jain, A., Reddy, J., & Singh, M. (2008). Experimental models for nephropathy. *Journal of the Renin-Angiotensin-Aldosterone System*, *9*(4), 189-195.

[51] Singh, A., Lin, Y., Liu, W., Kuanhai, D., Pan, J., Huang, B., ... & Zeng, D. (2014). A study on the inhibition of N80 steel in 3.5% NaCl solution saturated with CO2 by fruit

extract of Gingko biloba. *Journal of the Taiwan Institute of Chemical Engineers*, *45*(4), 1918-1926.

[52] Kaur, T., Kaur, B., Bhat, B. H., Kumar, S., & Srivastava, A. K. (2015). Effect of calcination temperature on microstructure, dielectric, magnetic and optical properties of Ba0. 7La0. 3Fe11. 7Co0. 3O19 hexaferrites. *Physica B: Condensed Matter*, *456*, 206-212.

[53] Singh, P., Singh, A., & Quraishi, M. A. (2016). Thiopyrimidine derivatives as new and effective corrosion inhibitors for mild steel in hydrochloric acid: Electrochemical and quantum chemical studies. *Journal of the Taiwan Institute of Chemical Engineers*, *60*, 588-601.

[54] Anand, A., Patience, A. A., Sharma, N., & Khurana, N. (2017). The present and future of pharmacotherapy of Alzheimer's disease: A comprehensive review. *European journal of pharmacology*, *815*, 364-375.

[55] Saxena, A., Prasad, D., Haldhar, R., Singh, G., & Kumar, A. (2018). Use of Sida cordifolia extract as green corrosion inhibitor for mild steel in 0.5 M H2SO4. *Journal of environmental chemical engineering*, *6*(1), 694-700.

[56] Ahmadi, M. H., Ghazvini, M., Sadeghzadeh, M., Alhuyi Nazari, M., Kumar, R., Naeimi, A., & Ming, T. (2018). Solar power technology for electricity generation: A critical review. *Energy Science & Engineering*, *6*(5), 340-361.

[57] Kant, N., Wani, M. A., & Kumar, A. (2012). Self-focusing of Hermite–Gaussian laser beams in plasma under plasma density ramp. *Optics Communications*, *285*(21-22), 4483-4487.

[58] Gupta, V. K., Sethi, B., Upadhyay, N., Kumar, S., Singh, R., & Singh, L. P. (2011). Iron (III) selective electrode based on S-methyl N-(methylcarbamoyloxy) thioacetimidate as a sensing material. *Int. J. Electrochem. Sci*, *6*, 650-663.

[59] Mehta, C. M., Srivastava, R., Arora, S., & Sharma, A. K. (2016). Impact assessment of silver nanoparticles on plant growth and soil bacterial diversity. *3 Biotech*, *6*(2), 254.

[60] Gupta, V. K., Guo, C., Canever, M., Yim, H. R., Sraw, G. K., & Liu, M. (2014). Institutional environment for entrepreneurship in rapidly emerging major economies: the case of Brazil, China, India, and Korea. *International Entrepreneurship and Management Journal*, *10*(2), 367-384.

[61] Singh, A., Lin, Y., Obot, I. B., Ebenso, E. E., Ansari, K. R., & Quraishi, M. A. (2015). Corrosion mitigation of J55 steel in 3.5% NaCl solution by a macrocyclic inhibitor. *Applied Surface Science*, *356*, 341-347.

[62] Ansari, K. R., Quraishi, M. A., Singh, A., Ramkumar, S., & Obote, I. B. (2016). Corrosion inhibition of N80 steel in 15% HCl by pyrazolone derivatives: electrochemical, surface and quantum chemical studies. *RSC advances*, *6*(29), 24130-24141.

[63] Jnawali, P., Kumar, V., & Tanwar, B. (2016). Celiac disease: Overview and considerations for development of gluten-free foods. *Food Science and Human Wellness*, *5*(4), 169-176.

[64] Saggu, S., Sakeran, M. I., Zidan, N., Tousson, E., Mohan, A., & Rehman, H. (2014). Ameliorating effect of chicory (Chichorium intybus L.) fruit extract against 4-tert-octylphenol induced liver injury and oxidative stress in male rats. *Food and chemical toxicology*, *72*, 138-146.

[65] Bhatia, A., Singh, B., Raza, K., Wadhwa, S., & Katare, O. P. (2013). Tamoxifen-loaded lecithin organogel (LO) for topical application: development, optimization and characterization. *International Journal of Pharmaceutics*, *444*(1-2), 47-59.

[66] Singh, A., Lin, Y., Liu, W., Yu, S., Pan, J., Ren, C., & Kuanhai, D. (2014). Plant derived cationic dye as an effective corrosion inhibitor for 7075 aluminum alloy in

3.5% NaCl solution. *Journal of Industrial and Engineering Chemistry*, *20*(6), 4276-4285.

[67] Raza, K., Thotakura, N., Kumar, P., Joshi, M., Bhushan, S., Bhatia, A., ... & Katare, O. P. (2015). C60-fullerenes for delivery of docetaxel to breast cancer cells: a promising approach for enhanced efficacy and better pharmacokinetic profile. *International journal of pharmaceutics*, *495*(1), 551-559.

[68] Prabhakar, P. K., Prasad, R., Ali, S., & Doble, M. (2013). Synergistic interaction of ferulic acid with commercial hypoglycemic drugs in streptozotocin induced diabetic rats. *Phytomedicine*, *20*(6), 488-494.

[69] Chaudhary, A., & Singh, S. S. (2012, September). Lung cancer detection on CT images by using image processing. In *2012 International Conference on Computing Sciences* (pp. 142-146). IEEE.

[70] Mishra, V., Bansal, K. K., Verma, A., Yadav, N., Thakur, S., Sudhakar, K., & Rosenholm, J. M. (2018). Solid lipid nanoparticles: Emerging colloidal nano drug delivery systems. *Pharmaceutics*, *10*(4), 191.

[71] Singh, A. (2012). Hydroxyapatite, a biomaterial: its chemical synthesis, characterization and study of biocompatibility prepared from shell of garden snail, Helix aspersa. *Bulletin of Materials Science*, *35*(6), 1031-1038.

[72] Arora, S., & Anand, P. (2019). Binary butterfly optimization approaches for feature selection. *Expert Systems with Applications*, *116*, 147-160.

[73] Chhikara, N., Kushwaha, K., Sharma, P., Gat, Y., & Panghal, A. (2019). Bioactive compounds of beetroot and utilization in food processing industry: A critical review. *Food Chemistry*, *272*, 192-200.

[74] Singh, S., Kumar, V., Chauhan, A., Datta, S., Wani, A. B., Singh, N., & Singh, J. (2018). Toxicity, degradation and analysis of the herbicide atrazine. *Environmental chemistry letters*, *16*(1), 211-237.

[75] Baranwal, T., & Pateriya, P. K. (2016, January). Development of IoT based smart security and monitoring devices for agriculture. In *2016 6th International Conference-Cloud System and Big Data Engineering (Confluence)* (pp. 597-602). IEEE.

[76] Trukhanov, S. V., Trukhanov, A. V., Salem, M. M., Trukhanova, E. L., Panina, L. V., Kostishyn, V. G., ... & Sivakov, V. (2018). Preparation and investigation of structure, magnetic and dielectric properties of (BaFe11. 9Al0. 1O19) 1-x-(BaTiO3) x bicomponent ceramics. *Ceramics International*, *44*(17), 21295-21302.

[77] Singh, S., Singh, N., Kumar, V., Datta, S., Wani, A. B., Singh, D., ... & Singh, J. (2016). Toxicity, monitoring and biodegradation of the fungicide carbendazim. *Environmental chemistry letters*, *14*(3), 317-329.

[78] Bhyan, B., Jangra, S., Kaur, M., & Singh, H. (2011). Orally fast dissolving films: innovations in formulation and technology. *Int J Pharm Sci Rev Res*, *9*(2), 9-15.

[79] Saxena, A., Prasad, D., Haldhar, R., Singh, G., & Kumar, A. (2018). Use of Saraca ashoka extract as green corrosion inhibitor for mild steel in 0.5 M H2SO4. *Journal of Molecular Liquids*, *258*, 89-97.

[80] Panghal, A., Janghu, S., Virkar, K., Gat, Y., Kumar, V., & Chhikara, N. (2018). Potential non-dairy probiotic products–A healthy approach. *Food bioscience*, *21*, 80-89.

[81] Kumar, D., Agarwal, G., Tripathi, B., Vyas, D., & Kulshrestha, V. (2009). Characterization of PbS nanoparticles synthesized by chemical bath deposition. *Journal of Alloys and Compounds*, *484*(1-2), 463-466.

[82] Ansari, K. R., Quraishi, M. A., & Singh, A. (2015). Corrosion inhibition of mild steel in hydrochloric acid by some pyridine derivatives: an experimental and quantum chemical study. *Journal of Industrial and Engineering Chemistry*, *25*, 89-98.

[83] Singh, P. S., Singh, T., & Kaur, P. (2008). Variation of energy absorption buildup

factors with incident photon energy and penetration depth for some commonly used solvents. *Annals of Nuclear Energy*, *35*(6), 1093-1097.

[84] Ansari, K. R., Quraishi, M. A., & Singh, A. (2015). Isatin derivatives as a non-toxic corrosion inhibitor for mild steel in 20% H2SO4. *Corrosion Science*, *95*, 62-70.

[85] Singh, A., Lin, Y., Ebenso, E. E., Liu, W., Pan, J., & Huang, B. (2015). Gingko biloba fruit extract as an eco-friendly corrosion inhibitor for J55 steel in CO2 saturated 3.5% NaCl solution. *Journal of Industrial and Engineering Chemistry*, *24*, 219-228.

[86] Dey, A., Bhattacharya, R., Mukherjee, A., & Pandey, D. K. (2017). Natural products against Alzheimer's disease: Pharmaco-therapeutics and biotechnological interventions. *Biotechnology Advances*, *35*(2), 178-216.

[87] Ansari, K. R., Quraishi, M. A., & Singh, A. (2015). Pyridine derivatives as corrosion inhibitors for N80 steel in 15% HCl: Electrochemical, surface and quantum chemical studies. *Measurement*, *76*, 136-147.

[88] Patel, S. (2012). Threats, management and envisaged utilizations of aquatic weed Eichhornia crassipes: an overview. *Reviews in Environmental Science and Bio/Technology*, *11*(3), 249-259.

[89] Mia, M., Gupta, M. K., Singh, G., Królczyk, G., & Pimenov, D. Y. (2018). An approach to cleaner production for machining hardened steel using different cooling-lubrication conditions. *Journal of Cleaner Production*, *187*, 1069-1081.

[90] Kondrateva T.S. Biopharmaceutical studies of children's suppositories with phosphothiamine. Pharmacy.-Moscow, 1990.-No.5.-P.14-15.

[91] Maksudova F.Kh., Karieva E.S., Tursunova M.Kh. Study of the pharmacological properties of the combined gel of sodium diclofenac and benzketozone ./Infection, immunity and pharmacologists I.- Tashkent.-2015.-№5.C.160-163 /

[92] Maksudova F. Kh., Karieva E. S. In vitro equivalence evaluationce of diclofenac sodium generic medicinal preparation. // Pharmacy, a scientific and practical journal, special issue, St. Petersburg, 2016, pp. 461-464.

[93] Piotrovsky V.K. Model and model-independent methods for describing pharmacokinetics: advantages, disadvantages and interrelation. // Antibiotics and medical biotechnology. -Moscow, 1997.-№7.P.492-497.

[94] Kukes V.G., Sychev D.A. Clinical pharmacology. 5th ed ., Moscow, 2017, p. 478.

[95] Tillaeva U. M., Azizov U. M. Development of a methodology for isolating the amount of fensulcal determination from a biological object. Materials of the scientific-practical conference "Actual issues of education, science and production in pharmacy. Tashkent, 2009.-P.172 .

[96] Tillaeva U.M. Standardization and quality control of fensulcal in soft dosage forms. // Authors' dissertation for the study of the academician of the candidate of pharmaceuticals. Sciences . Tashkent. 2011.23 s.

[97] Golovkin V.A. On the importance of pharmacokinetics modeling for increasing the efficiency of biopharmaceutical research. // Optimization of drug supply and ways to increase the effectiveness of pharmaceutical science : Sat. Tez.dokl.-Kharkov, 1986.-P.61-62.

[98] Stefanova A.V. Preclinical studies of medicines. Kiev. -2002. -650 p.

[99] Dregan A., Charlton J., Chowienczyk P., Gulliford M. C. Chronic inflammatory disorders and risk of type 2 diabetes mellitus, coronary heart disease, and stroke: a population-based cohort study. Circulation. 2014;130(10):837–844. doi: 10.1161/CIRCULATIONAHA.114.009990. [PubMed] [CrossRef] [Google Scholar]

[100] Guarner V., Rubio-Ruiz M. E. Low-grade systemic inflammation connects aging, metabolic syndrome and cardiovascular disease. Interdisciplinary Topics in Gerontology. 2015;40:99–106. doi: 10.1159/000364934. [PubMed] [CrossRef] [Google

Scholar]
[101] Pawelec G., Goldeck D., Derhovanessian E. Inflammation, ageing and chronic disease. Current Opinion in Immunology. 2014;29:23–28. doi: 10.1016/j.coi.2014.03.007. [PubMed] [CrossRef] [Google Scholar]
[102] Todendi P. F., Possuelo L. G., Klinger E. I., et al. Low-grade inflammation markers in children and adolescents: influence of anthropometric characteristics and CRP and IL6 polymorphisms. Cytokine. 2016;88:177–183. doi: 10.1016/j.cyto.2016.09.007. [PubMed] [CrossRef] [Google Scholar]
[103] Minihane A. M., Vinoy S., Russell W. R., et al. Low-grade inflammation, diet composition and health: current research evidence and its translation. British Journal of Nutrition. 2015;114(7):999–1012. doi: 10.1017/S0007114515002093. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
[104] Salgado-Bernabé A. B., Ramos-Arellanol L. E., Guzmán-Guzmán I. P., et al. Significant associations between C-reactive protein levels, body adiposity distribution and peripheral blood cells in school-age children. Investigacion Clinica. 2016;57(2):120–130. [PubMed] [Google Scholar]
[105] Bawaked R. A., Schröder H., Ribas-Barba L., et al. Association of diet quality with dietary inflammatory potential in youth. Food & Nutrition Research. 2017;61(1, article 1328961) doi: 10.1080/16546628.2017.1328961. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
[106] Oriá R. B., Murray-Kolb L. E., Scharf R. J., et al. Early-life enteric infections: relation between chronic systemic inflammation and poor cognition in children. Nutrition Reviews. 2016;74(6):374–386. doi: 10.1093/nutrit/nuw008. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
[107] Hänsel A., Hong S., Cámara R. J. A., von Känel R. Inflammation as a psychophysiological biomarker in chronic psychosocial stress. Neuroscience & Biobehavioral Reviews. 2010;35(1):115–121. doi: 10.1016/j.neubiorev.2009.12.012. [PubMed] [CrossRef] [Google Scholar]
[108] Sharma R., Agrawal S., Saxena A., Sharma R. K. Association of IL-6, IL-10, and TNF-α gene polymorphism with malnutrition inflammation syndrome and survival among end stage renal disease patients. Journal of Interferon & Cytokine Research. 2013;33(7):384–391. doi: 10.1089/jir.2012.0109. [PubMed] [CrossRef] [Google Scholar]
[109] Roncero-Ramos I., Rangel-Zuñiga O. A., Lopez-Moreno J., et al. Mediterranean diet, glucose homeostasis, and inflammasome genetic variants: the CORDIOPREV study. Molecular Nutrition & Food Research. 2018;62(9, article 1700960) doi: 10.1002/mnfr.201700960. [PubMed] [CrossRef] [Google Scholar]
[110] Ketteler M., Block G. A., Evenepoel P., et al. Executive summary of the 2017 KDIGO Chronic Kidney Disease-Mineral and Bone Disorder (CKD-MBD) Guideline Update: what's changed and why it matters. Kidney International. 2017;92(1):26–36. doi: 10.1016/j.kint.2017.04.006. [PubMed] [CrossRef] [Google Scholar]
[111] Mihai S., Codrici E., Popescu I. D., et al. Inflammation and chronic kidney disease: current approaches and recent advances. In: Rath T., editor. Chronic Kidney Disease. Rijeka, Croatia: IntechOpen; 2018. [Google Scholar]
[112] Ramezani A., Raj D. S. The gut microbiome, kidney disease, and targeted interventions. Journal of the American Society of Nephrology. 2014;25(4):657–670. doi: 10.1681/ASN.2013080905. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
[113] Sabatino A., Regolisti G., Brusasco I., Cabassi A., Morabito S., Fiaccadori E. Alterations of intestinal barrier and microbiota in chronic kidney disease. Nephrology

Dialysis Transplantation. 2015;30(6):924–933. doi: 10.1093/ndt/gfu287. [PubMed] [CrossRef] [Google Scholar]

[114] McSorley S. T., Black D. H., Horgan P. G., McMillan D. C. The relationship between tumour stage, systemic inflammation, body composition and survival in patients with colorectal cancer. Clinical Nutrition. 2018;37(4):1279–1285. doi: 10.1016/j.clnu.2017.05.017. [PubMed] [CrossRef] [Google Scholar]

[115] Zambirinis C. P., Pushalkar S., Saxena D., Miller G. Pancreatic cancer, inflammation, and microbiome. Cancer Journal. 2014;20(3):195–202. doi: 10.1097/PPO.0000000000000045. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

[116] Bhatelia K., Singh K., Singh R. TLRs: linking inflammation and breast cancer. Cellular Signalling. 2014;26(11):2350–2357. doi: 10.1016/j.cellsig.2014.07.035. [PubMed] [CrossRef] [Google Scholar]

[117] Kuang A. G., Nickel J. C., Andriole G. L., Castro-Santamaria R., Freedland S. J., Moreira D. M. Both acute and chronic inflammation are associated with less perineural invasion in men with prostate cancer on repeat biopsy. BJU International. 2018 doi: 10.1111/bju.14428. [PubMed] [CrossRef] [Google Scholar]

[118] Gao Y., Zhang H., Li Y., Wang D., Ma Y., Chen Q. Preoperative increased systemic immune-inflammation index predicts poor prognosis in patients with operable non-small cell lung cancer. Clinica Chimica Acta. 2018;484:272–277. doi: 10.1016/j.cca.2018.05.059. [PubMed] [CrossRef] [Google Scholar]