Protective effect of Cortisone and Hydrocortisone drugs on lysosomal damages induced by bacterial endotoxin in wistar rats

Article · February 2019

CITATIONS
0

READS
71

1 author:

Mostafa Madmoli
Dezful University of Medical Sciences
52 PUBLICATIONS **331** CITATIONS

SEE PROFILE

RESEARCH

23(96), March - April, 2019

ISSN 2321–7359 EISSN 2321–7367

Medical Science

Protective effect of Cortisone and Hydrocortisone drugs on lysosomal damages induced by bacterial endotoxin in wistar rats

Yaser Eshaghimilasi[1], Ramin Tavakoli[2], Mansoor Khaledi[3], Hoshang Roshanmehr[2], Mohammad Aberomand[2], Ghorban Mohammadzadeh[4], Mostafa Madmoli[5], Shahdokht Rastegar[2]✉

Objectives: **Bacterial endotoxin as biological stress by multiple organs failure causes lysosomal enzyme leakage. Lysosome as a basic cytoplasmic organelle in animal tissues contains hydrolytic enzymes capable of degrading various cellular constituents. In this study protective effect of Cortisone acetate and hydrocortisone 21-sodium hemisuccinate on lysosomal damage and its association with change level of serum and hepatic acid phosphatase activity investigated.** ***Methods:*** **In this study, 30 rats equally divided to Control, tolerance and Endotoxin groups. The tolerance group (12.5 mg/kg body weight intramuscularly injection Cortisone acetate for 3 days and on the 4th day, the intravenous injection 12.5 mg/kg of hydrocortisone 21-sodium hemisuccinate). The induce endotoxin shock in rats with 2.5 mg/kg body weight intravenous injection of Salmonella endotoxin. Partial purification and beta-glucuronidase activity were determined by sephadexG75 chromatography and Polyacrylamide Gel Electrophoresis.** ***Results:*** **The results of this study shown a significant different in level serum and homogenate acid phosphatse activity in Tolerance group compared with the other groups (P<0.05). Also enzyme especial activity in all steps of purification, in Endotoxin group was more than the other groups (P<0.05).** ***Conclusion:*** **Endotoxin shock as biological stressor by induction of lysosomal enzymes into the cell plays an important role in deterioration of cells. Also, it seems that protection of these particles by injection of cortisone acetate and hydrocortisone 21-sodium hemisuccinate can a significant resistance to induced stress by endotoxin shock.**

INTRODUCTION

Bacterial endotoxin as biological stressor lead to physiological responses in Animal and human (1-6). Lysosomes as cellular organelles sensitive to stress have a basic role in a collection of cellular processes (7-9), such as programmed cell death, autophagy, (6, 10-12) endocytosis, exocytosis, apoptosis (10, 13, 14), therefore bacterial endotoxin, high vitamin A (15-17) and irradiation by deteriorate membrane lysosomal cause releasing harmful enzymes (18, 19). So can say anoxia as an outcome of the event by disrupted in membrane lysosomes causes that hydrolase liberate into the cell. These enzymes by affect on cellular protein, nucleic acid, and polysaccharides significantly intensify the damages and help to expansion its irrevocability (18). Injection of bacterial endotoxin can elevates hydrolase lysosomal in liver and muscle (19). The few doses of bacterial endotoxins can by deteriorate lysosome cause liberation of enzymes to large granule fraction liver (20) and glucocorticoids drugs partially reduced tissue damages by stabilizing the membrane lysosomal and inhibit release hydrolase (18). This study do in order to investigate effect of Cortisone acetate and Hydrocortisone sodium hemisuccinate on lysosome stability (21, 22). In this study acid phosphatase activity as biomarker stress enzyme estimated in serum and liver in three groups, also in order to determine effect cortisone and hydrocortisone drugs on the response of lysosomes to biological stress, partially purified enzyme be done. The present study, designed for the biochemical assay to determine the effects of bacterial endotoxin and glucocorticoid drugs inside the body.

[1]Clinical Biochemistry Research Center, Basic Health Sciences Institute, Shahrekord University of Medical Sciences, Shahrekord, Iran; [2]Student Research Committee, Toxicology Research Center, Department of Clinical Biochemistry, Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran; [3]MS.c. in Medical Microbiology, Department of Microbiology and Immunology, Shahrekord University of Medical Sciences, Shahrekord, Iran; [4]Hyperlipidemia Research Center, Department of Clinical Biochemistry, Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran; [5]Emergency Medical Technician, Dezful University of Medical Sciences, Dezful, Iran

✉*Corresponding Author:* Shahdokht Rastegar, Student Research Committee, Toxicology Research Center, Department of Clinical Biochemistry, Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

MATERIALS & METHODS

Chemicals and Reagents

Salmonella enteritidis endotoxin, p-nitrophenylephosphate (pNPP), Cortisone Acetate and Hydrocortisone sodium hemisuccinate were purchased from Sigma Chemical Co.

Animals

In this study 30 male rats about 1.5 months old between 160 and 190 mg were used. The male rats were purchased from House animal of Ahvaz

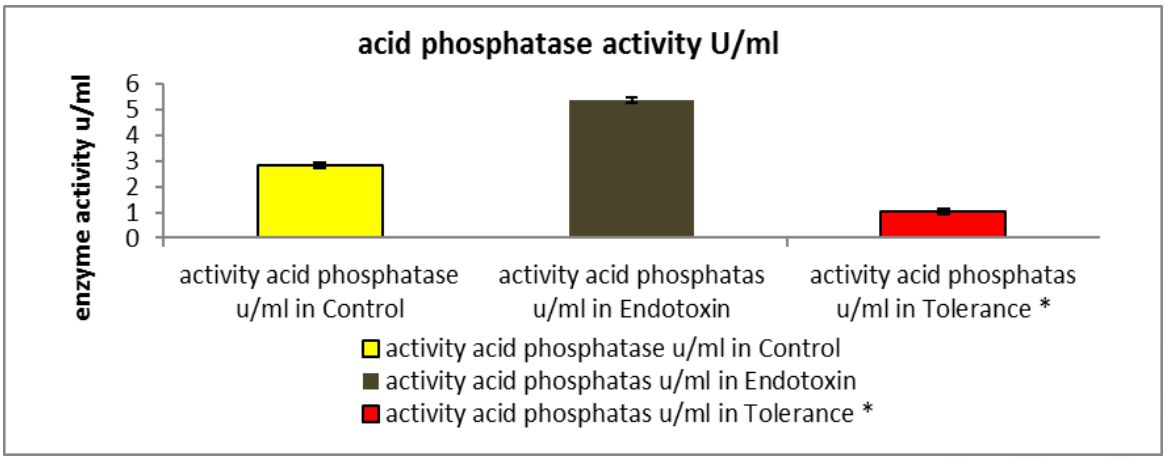

Figure 1 Determine level serum acid phosphatase activity in three groups Control, Tolerance, Endotoxin.

Jundishapur University of Medical Sciences, Ahvaz. All rats were maintained in standard condition with regular temperature control (23 ± 2^{0}C), a 12:12 h light dark cycle, free access to water and food, and relative humidity of 55 ± 5%.

Experimental design

These rats were equally divided into three groups (n= 10/group). Control group was treated with normal saline, the rats of tolerance group received Cortisone acetate (12.5 mg/kg, intramuscularly injection) for 3 days and on the 4th day they received hydrocortisone 21-sodium hemisuccinate (12.5 mg/kg, intravenous injection) and then an hour later Salmonella enteritidis endotoxin (2.5 mg/kg, intravenous injection) was injected (20), Endotoxin group (2.5 mg/kg, intravenous injection, Salmonella endotoxin). One hour afterward (23), sample blood taken from the ventricle left heart and serum was separated with centrifuged at 10000 g for 20 minutes at 40°C (24-26).

Preparation of a Liver Granular Fraction

Step 1: After separate liver, it was minced in ice and Sucrose (0.25 M) until the release of gross blood. **Step 2:** livers were weighed and homogenized at 1:10 w/v homogenate in sucrose (0.25 M) and 650 mL buffer at 900 rpm by Homogenizer device, for 5 minutes at 4°C. **Step 3:** The homogenate was centrifuged at 800 g for 10 minutes at 4°C, the supernatant was separated. **Step 4:** The supernatant was centrifuged at 15,000 g for 20 minutes, the supernatant was separated. **Step 5:** The supernatant of step four was again centrifuged at 15,000 g for 20 minutes. **Step 6:** The pellet of Step 5 was separated and homogenized in a glass Homogenizer than 1:5 w/v in sucrose for 5 minutes at 40°C and incubated at 37°C for 40 minutes. **Step 7:** The homogenate of Step 6 centrifuged at 15,000 g for 20 minutes and supernatants were assayed for the activities of lysosomal enzymes (15, 18, 20, 27, 28).

Partial Purification acid phosphatase Enzyme

Ammonium sulfate precipitation: The supernatant of step 7 was subjected to fractionation of ammonium sulfate precipitation. The acid phosphatse precipitated in a saturation range of 30–80% was centrifuged at 10,000 ×g for 20 min. (29-31).

Gel Filtration Chromatography on Sephadex G-75: Dialyzed ammonium sulfate fraction was applied to the column of gel filtration Sephadex G-75 (32). Absorbance was read at 280 nm and beta-glucuronidase activity assay was read at 405 nm (33, 34). The liquid enzyme was concentrated to a volume of 5 mL by dialysis bag on sucrose (32, 35, 36). Protein concentrations were determined by Bradford method (37).

Polyacrylamide Gel Electrophoresis: purity and homogeneity of the enzyme were show by electrophoresis in SDS-PAGE also protein migration on this gel indicated by Coomassie Brilliant blue or Silver staining (38, 39). Acid phosphatse activity was determined by King-Armstrong method and p-nitrophenylephosphate (pNPP) as substrate (40-43). Specific activity was expressed as U/mg protein and Unit of enzyme activity (44, 45).

Ethical principles

This article is a result of the research project of Ahvaz Jundishapur University of Medical Sciences with the code (IR.AJUMS.REC.1395. 118) in student research committee of this University), (http://proposal. ajums.ac.ir/).

Statistical analyses

Statistical analysis was performed with SPSS version 18. Data was analyzed using descriptive statistical methods including mean and standard deviation, and compared by one-way analysis of variance (ANOVA) followed by Tukey's post hoc test. The significant level was set at $P < 0.05$.

RESULTS

Comparison of serum level of acid phosphatase in Control, Tolerance and Endotoxin shock groups: We in this study indicate serum level of acid phosphatase after of induce bacterial endotoxin increase in the tolerance and endotoxin groups. But, in tolerance group was low enzyme activity due to resistance created by cortisone and hydrocortisone drugs. Figure 1 show average of enzyme activity in serum rats. This results shows that induced tolerance by Cortisone acetate and Hydrocortisone 21-sodium hemisuccinate decreases enzyme activity in serum.

Evaluation protein concentration and acid phosphatase activity of step, sephadex G75 Chromatography: This founds in figure 2 show a similar relationship between serum level acid phosphatase activity with liver homogenates. The data showed that there is significant difference in enzyme activity in suspensions obtained from liver in group and higher activity and concentration in group endotoxin than control and tolerance (Fig.2). Table 1 show the total protein and specific activity in various stages of purification enzyme in the three groups. Furthermore,

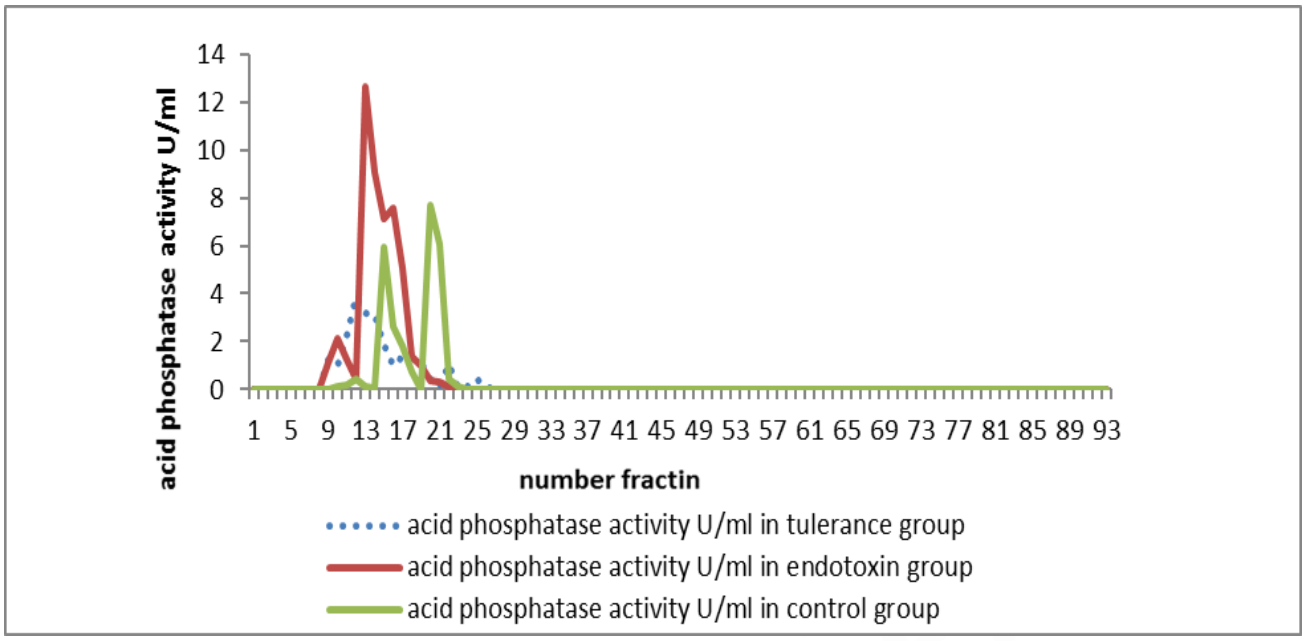

Figure 2 Comparison acid phosphatase activity in Control, Tolerance, Endotoxin groupse on sephadex G75.

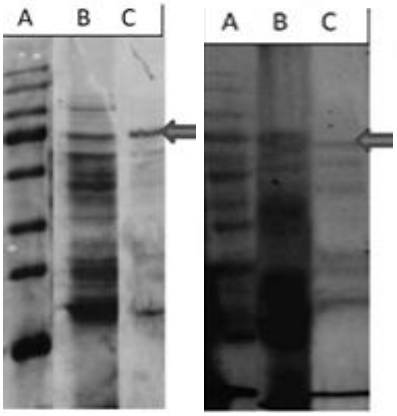

Figure. 3 **Endotoxin Group**

Figure. 4 **Tolerance Group**

Figure 3 & 4 Comparison polyacrylamide gel electrophoresis of the purified acid phosphatase enzyme from rat's liver in the Tolerance and Endotoxin group (A: ladder, B: Amoniumsulfate precipitate, C: Sephadex chromatography).

Table 1 Summary of pure acid phosphatase enzyme from rats liver Control, Endotoxin and Tolerance groups.

Purification step	Groups	Vol.ml	Total units	Specific activity u/mg	Recovery %	Purification folds
Saline extract	Control	1000	9764.3	6.06735	100	1
	Tolerance	1000	7849.4	5.0735	100	1
	Endotoxin	1000	12816.9	10.65151	100	1
Cantrificatio 15000 g3	Control	350	2422.1	5.995	24.805	0.688
	Tolerance	350	2209.7	4.9729	28.152	0.875
	Endotoxin	350	3271.5	6.850	25.525	0.929
Amoniumsulfate precipitate	Control	30	174.0	173.4353	1.782	37.226
	Tolerance	30	141.6	155.001	1.804	44.924
	Endotoxin	30	209.3	182.350	1.633	28.970
Dialyzed ammonium sulfate fraction	Control	25	101.4	175.714	1.038	36.833
	Tolerance	25	95.2	164.859	1.213	380261
	Endotoxin	25	142.2	190.137	1.109	40.487
SephadexG-75 chromatography	Control	20	36.0	260.124	0.368	45.280
	Tolerance	20	33.7	188.5751	0.429	52.365
	Endotoxin	20	53.0	294.933	0.414	58.340

the purity and homogeneity of the enzyme of sephadex G75 chromatography step as the latest step were checked by electrophoresis in SDS-PAGE and protein migration on this gel show by silver staining (37, 39). According to results of electrophoresis, the migration enzyme show as a single sharp band with a molecular weight of approximately 55 000 (KDa) by slab electrophoresis in three group control, tolerance (Fig. 4) and endotoxin shock (Fig. 3). Protein migration indicated a broader single band in the endotoxin group in comparing to control and tolerance, which its due to cell autolysis and more release lysosomal enzymes. So, this phenomenon approved increase enzyme specific activity in Endotoxin group and decrease specific activity in tolerance group (Table 1).

DISCUSSION

The various biochemical events are responsible for tissue injury, but little information was about cellular damages caused by bacterial endotoxin as biological stressor (46). The purpose of this study investigated protective effects Cortisone acetate and Hydrocortisone 21-sodium hemisuccinate on endotoxin induced lysosomal damages in wistar rats. This founds show that induced stress by bacterial endotoxin cause releases lysosomal enzymes in biological fluids (48). Present study shows bacterial endotoxin lead to significantly increase specific activity and protein concentration. On the other hand, induced tolerance by Cortisone acetate and Hydrocortisone 21-sodium hemisuccinate cause the lower liberation enzyme and the higher persistent in animals under acute biological stress. This founds from different steps purification enzyme (Table 1) indicated a considerable different and significant in total protein and enzyme activity in all steps purification in endotoxin group. it is Predicated that higher specific activity in endotoxin group is associated with autolysis cellular (48) and fragility membrane lysosomes, that its validity approved by earlier studies (46). This study approve attractive hypothesis Weissmann and Fell (47, 48), also Janoff theory (49). In addition, this result is consistent with previous studies do by Weismann, Gianetto, de Duve and Janoff that show endotoxin by enhancing permeability membrane influence lysosomes function and pretreatment glucocorticoids drugs can increase resistance to cell lysis and reduce intracellular activity (20, 23, 50). Dingle in studies on chondrocytes proteolytic activity noticed that Cortisone acetate and Hydrocortisone 21-sodium hemisuccinate postpone the action on cartilage matrix (15). Therefore, possibility Cortisone or Hydrocortisone drugs prevent of action stress on the tissue by inhibit hydrolase (51). Another hypothesis presented in this study was investigation purification enzyme and comparison of electrophoretic mobility of it on polyacrylamide gel. This distinct and broader band (in 55 KDa by using the marker protein or ladder) protein migration in endotoxin group is due to cell autolysis and lysosomal membrane disruption. Weight molecular acid phosphatase enzyme in papers was 55 KDa (52). Previous studies show increased enzymes activity as risk factors in Prostatic carcinoma, benign prostatic hypertrophy, prostatitis, multiple myeloma, Paget's disease, hyperparathyroidism, bone marrow metastases, sickle cell disease, thrombocytosis, lysosomal disorders, kidney disease, liver disease (cirrhosis), rape or aggression pathogenesis disease (52-55). But, relationship between biological stressor and enzymes requires further research on endocrine psychoanalysis (53). Therefore, this study could be considered as a controversial and new study, but unlike experimental variables, many of the biological variables are mutable, so we need to perform further studies on psychological and biological factors and their interaction with changes level enzymes under stress condition. Therefore, it seems that pretreatment with Cortisone acetate and Hydrocortisone 21-sodium hemisuccinate will reduce the release of enzymes and its cellular degeneration.

CONCLUSION

The results showed that bacterial endotoxin as biological stress can affect stability of lysosomes and Cortisone or Hydrocortisone drugs can acts through the protection of these subcellular particles against a variety of injurious agents by decrease liberation and reduce activity of lysosomal enzymes.

REFERENCE

1. Kroemer G, Jäättelä M. Lysosomes and autophagy in cell death control. Nature Reviews Cancer. 2005;5(11):886-97.
2. Aits S, Jäättelä M. Lysosomal cell death at a glance. The Company of Biologists Ltd; 2013.
3. Appelqvist H, Wäster P, Kågedal K, Öllinger K. The lysosome: from waste bag to potential therapeutic target. Journal of molecular cell biology. 2013;5(4):214-26.
4. Feng Y, He D, Yao Z, Klionsky DJ. The machinery of macroautophagy. Cell research. 2014;24(1):24-41.
5. Liu B, Du H, Rutkowski R, Gartner A, Wang X. LAAT-1 is the lysosomal lysine/arginine transporter that maintains amino acid homeostasis. Science. 2012;337(6092):351-4.
6. Saftig P. Lysosomes, Landes Bioscience/Eurekah. com. Springer Science+ Business Media, New York; 2005.
7. Palmieri M, Impey S, Kang H, di Ronza A, Pelz C, Sardiello M, et al. Characterization of the CLEAR network reveals an integrated control of cellular clearance pathways. Human molecular genetics. 2011;20(19):3852-66.
8. Sardiello M, Palmieri M, di Ronza A, Medina DL, Valenza M, Gennarino VA, et al. A gene network regulating lysosomal biogenesis and function. Science. 2009;325(5939):473-7.
9. Settembre C, Zoncu R, Medina DL, Vetrini F, Erdin S, Erdin S, et al. A lysosome-to-nucleus signalling mechanism senses and regulates the lysosome via mTOR and TFEB. The EMBO journal. 2012;31(5):1095-108.
10. Mindell JA. Lysosomal acidification mechanisms. Annual review of physiology. 2012;74:69-86.
11. Semenza GL, Artemov D, Bedi A, Bhujwalla Z, Chiles K, Feldser D, et al., editors. 'The metabolism of tumours': 70 years later. The Tumour Microenvironment: Causes and Consequences of Hypoxia and Acidity: Novartis Foundation Symposium 240; 2001: Wiley Online Library.
12. Bartrons R, Caro J. Hypoxia, glucose metabolism and the Warburg's effect. Journal of bioenergetics and biomembranes. 2007;39(3):223-9.
13. Settembre C, Fraldi A, Medina DL, Ballabio A. Signals from the lysosome: a control centre for cellular clearance and energy metabolism. Nature reviews Molecular cell biology. 2013;14(5):283-96.
14. Song Q, Wang X, Wang Y, Liang Y, Zhou Y, Song X, et al. Reduction responsive self-assembled nanoparticles based on disulfide-linked drug–drug conjugate with high drug loading and antitumor efficacy. Molecular pharmaceutics. 2015;13(1):190-201.
15. Dingle J. Studies on the mode of action of excess of vitamin A. 3. Release of a bound protease by the action of vitamin A. Biochemical Journal. 1961;79(3):509.
16. Lucy J, Dingle J, Fell HB. Studies on the mode of action of excess of vitamin A. 2. A possible role of intracellular proteases in the degradation of cartilage matrix. Biochemical Journal. 1961;79(3):500.
17. Weissmann G. Changes in connective tissue and intestine caused by vitamin A in amphibia, and their acceleration by hydrocortisone. The Journal of experimental medicine. 1961;114(4):581.

18. Weissmann G, Dingle Jt. Release of lysosomal protease by ultraviolet irradiation and inhibition by hydrocortisone. Experimental cell research. 1961;25(1):207-10.
19. Martini E. Increase of the cathepsin activity of the liver and of the skeletal muscle of rats treated either with 2, 4-dinitrophenol or with bacterial lipopolysaccharide. Cellular and Molecular Life Sciences. 1959;15(5):182-3.
20. Weissmann G, Thomas L. Studies on lysosomes: I. The effects of endotoxin, endotoxin tolerance, and cortisone on the release of acid hydrolases from a granular fraction of rabbit liver. The Journal of experimental medicine. 1962;116(4):433.
21. Himeno M, Nishimura Y, Tsuji H, Kato K. Purification and Characterization of Microsomal and Lysosomal β-Glucuronidase from Rat Liver by Use of Immunoaffinity Chromatography. European journal of biochemistry. 1976 Nov;70(2):349-59.
22. Shuster L, Schrier B. Acrylamide gel-sucrose gradient electrophoresis: A useful preparative method. Analytical biochemistry. 1967;19(2):280-93.
23. Janoff A, Weissmann G, Zweifach BW, Thomas L. Pathogenesis of experimental shock: IV. Studies on lysosomes in normal and tolerant animals subjected to lethal trauma and endotoxemia. The Journal of experimental medicine. 1962;116(4):451.
24. McClure DE. Clinical pathology and sample collection in the laboratory rodent. Vet Clin North Am Exot Anim Pract. 1999;2(3):565-90.
25. Ness RD. Clinical pathology and sample collection of exotic small mammals. Veterinary Clinics of North America: Exotic Animal Practice. 1999 Sep 1; 2(3): 591-620.
26. Lucas R, Lentz K, Hale A. Collection and preparation of blood products. Clinical techniques in small animal practice. 2004;19(2):55-62.
27. Dingle J, editor Section of Physical Medicine. Proc Roy Soc Med; 1962.
28. Fishman WH, Springer B, Brunetti R. Application of an improved glucuronidase assay method to the study of human blood β-glucuronidase. Journal of Biological Chemistry. 1948;173(2):449-56.
29. Louati H, Zouari N, Fendri A, Gargouri Y. Digestive amylase of a primitive animal, the scorpion: Purification and biochemical characterization. Journal of Chromatography B. 2010;878(11):853-60.
30. Gubern G, Canalias F, Gella FJ, Colinet E, Profilis C, Calam DH, et al. Production and certification of an enzyme reference material for pancreatic α-amylase (CRM 476). Clinica chimica acta. 1996;251(2):145-62.
31. Vesterberg O, Svensson H. Isoelectric fractionation, analysis, and characterization of ampholytes in natural pH gradients. Acta chem scand. 1966;20(3):820-34.
32. Kadkhodaei Elyaderani M, Malek Askar AM, Rostami M, Aberomand M, Khirollah A. Kinetic activity of isolated nitric-oxide synthase enzyme from sheep kidney. Journal of Mazandaran University of Medical Sciences. 2013;22(96):59-69.
33. Hsia D, Makler M, Semenza G, Prader A. β-Galactosidase activity in human intestinal lactases. Biochimica et Biophysica Acta (BBA)-Enzymology and Biological Oxidation. 1966;113(2):390-3.
34. Koldovský O, Noack R, Schenk G, Jirsová V, Heringová A, Braná H, et al. Activity of β-galactosidase in homogenates and isolated microvilli fraction of jejunal mucosa from suckling rats. Biochemical Journal. 1965;96(2):492.
35. Allen R, Moore D. A vertical flat-bed discontinuous electrophoresis system in polyacrylamide gel. Analytical Biochemistry. 1966;16(3):457-65.
36. Chrambach A, Reisfeld R, Wyckoff M, Zaccari J. A procedure for rapid and sensitive staining of protein fractionated by polyacrylamide gel electrophoresis. Analytical biochemistry. 1967;20(1):150-4.
37. Bradford MM. A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein-dye binding. Analytical biochemistry. 1976;72(1-2):248-54.
38. Weber K, Osborn M. The reliability of molecular weight determinations by dodecyl sulfate-polyacrylamide gel electrophoresis. Journal of Biological Chemistry. 1969;244(16):4406-12.
39. Rabilloud T. Mechanisms of protein silver staining in polyacrylamide gels: A 10-year synthesis. Electrophoresis. 1990;11(10):785-94.
40. Fisliman W, Springer B, Brunetti R. Application of tin improved glueuroi, id: tsc assay method to the study of human blood. J Biol Chem. 1948;173:449.
41. Szasz G. Comparison between p-nitrophenyl glucuronide and phenolphthalein glucuronide as substrates in the assay of β-glucuronidase. Clinical chemistry. 1967;13(9):752-9.
42. Himeno M, Hashiguchi Y. β-Glucuronidase of bovine liver purification, properties, carbohydrate composition. Journal of biochemistry. 1974;76(6):1243-52.
43. Plapp BV, Cole RD. Demonstration and partial characterization of multiple forms of bovine liver β-glucuronidase. Biochemistry. 1967;6(12):3676-81.
44. Diez T, Cabezas JA. Properties of Two Molecular Forms of β-Glucuronidase from the Mollusc Littorina littorea L. European Journal of Biochemistry. 1979;93(2):301-11.
45. Lineweaver H, Burk D. The determination of enzyme dissociation constants. Journal of the American Chemical Society. 1934;56(3):658-66.
46. Oe Duve C. Lysosomes, a new group of cytoplasmic particles. Subcellular Particles Ronald Press Co: New York. 1959.
47. Weissmann G, Fell H, editors. Protection by hydrocortisone of lysosomes and mammalian skin in vitro from damage induced by ultraviolet irradiation. Federation proceedings; 1962: federation amer soc exp biol 9650 rockville pike, bethesda, MD 20814-3998.
48. Fell HB, Thomas L. The influence of hydrocortisone on the action of excess vitamin A on limb bone rudiments in culture. The Journal of experimental medicine. 1961;114(3):343.
49. De Duve C, Wattiaux R. Functions of lysosomes. Annual review of physiology. 1966;28(1):435-92.
50. De Duve C, Pressman B, Gianetto R, Wattiaux R, Appelmans F. Tissue fractionation studies. 6. Intracellular distribution patterns of enzymes in rat-liver tissue. Biochemical Journal. 1955;60(4):604.
51. Wang P, Glass Hl, Goldenberg L, Stearns G, Kelly HG, Jackson Rl, et al. Serum vitamin A and carotene levels in children with rheumatic fever. AMA American journal of diseases of children. 1954;87(6):659-72.
52. Pohlmann R, Krentler C, Schmidt B, Schroder W, Lorkowski G, Culley J, et al. Human lysosomal acid phosphatase: cloning, expression and chromosomal assignment. The EMBO journal. 1988;7(8):2343-50.
53. Moss DW, Raymond FD, Wile DB. Clinical and biological aspects of acid phosphatase. Crit Rev Clin Lab Sci. 1995;32(4):431-67.
54. Hamedeh Bagheri, Parichehreh Yaghmaei, Mohamadhosein Modaresi, Azadeh Ebrahim-Habibi, Marjan Sabbaghian. Role of Cymene in the attenuation of fatty liver and UCP2 gene expression. Medical Science, 2018, 22(90), 232-242
55. Arzu Esen Tekeli, Hatice Yağmurdur, Erçin Öngen, Ahmet Tekeli, Gülnur Take, Deniz Erdoğan, Beyazit Dikmen. Histological and electron microscopic examination of the effect of Dexketoprofen Trometamol on liver in rats. Medical Science, 2017, 21(88), 329-335

Article Keywords
Endotoxin shock, Lysosomes, acid phosphatase, Cortisone

Acknowledgment
This article has been adapted from a research project approved by the code of U-95037 and ethics code ajums. IR.AJUMS.REC.1395.118 in the Student Research Committee University of Ahvaz Jundishapur University of medical sciences; we appreciate the student research committee for preparation of grant. In addition, authors thank all medical students who participated in this study and we would like to express our gratitude to those who have helped us in Clinical Biochemistry Research Center of Shahrekord University of Medical Sciences, Shahrekord, Iran.

Conflict of interest
There are no conflicts of interest in this study.

Article History
Received: 19 December 2018
Accepted: 25 January 2019
Published: March-April 2019

Citation
Yaser Eshaghimilasi, Ramin Tavakoli, Mansoor Khaledi, Hoshang Roshanmehr, Mohammad Aberomand, Ghorban Mohammadzadeh, Mostafa Madmoli, Shahdokht Rastegar. Protective effect of Cortisone and Hydrocortisone drugs on lysosomal damages induced by bacterial endotoxin in wistar rats. *Medical Science*, 2019, 23(96), 185-190

General Note
Avoid print-versions. If required, article is recommended to print as color digital version in recycled paper. *Save trees, save nature*