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The Effect of TRX Training on Liver Enzymes in Middle-Aged Obese Women

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A B S T R A C T

Obesity is a global health concern leading to various chronic diseases, including alterations in liver enzymes. This study aimed to investigate the effect of TRX training program on liver enzymes in obese middle-aged women. In this quasi-experimental study, 30 obese women with a BMI above 30 and an average age of 50.00 ± 6.87 years were randomly divided into two groups: TRX (n=15) and control (n=15). The TRX group engaged in TRX training for eight weeks, while the control group maintained their usual lifestyle. Blood samples were collected before and after the intervention to measure liver enzymes. Anthropometric measurements were also taken before and after the intervention. Data were analyzed using ANCOVA to control for pre-test differences and determine post-test differences between groups. The ANCOVA results revealed significant differences in post-test liver enzyme levels between the TRX and control groups, after controlling for pre-test scores. For ALT, $F(1, 27) = 12.94$, $p = 0.001$, partial eta squared = 0.324; for AST, $F(1, 27) = 10.12$, $p = 0.003$, partial eta squared = 0.273; and for ALP, $F(1, 27) = 25.62$, $p < 0.001$, partial eta squared = 0.487, indicating significant improvements in the TRX group compared to the control group. This study demonstrated that eight weeks of TRX training significantly improved liver enzymes ALT, AST, and ALP in obese women. Therefore, TRX training can be an effective intervention for enhancing liver enzyme health.

Keywords: *TRX Training, Liver Enzymes, Obese Women.*

1. Introduction

Obesity has emerged as a global health crisis, affecting over 600 million adults worldwide, with the prevalence continuing to rise. Lifestyle changes and unhealthy dietary habits, characterized by increased consumption of energy-dense, fatty foods and reduced physical activity, are major contributors to obesity (1-3). Obesity is defined as an abnormal or excessive accumulation of fat that impairs health, implying a substantial amount of body fat associated with high body weight. Body mass index (BMI) is commonly used to screen, classify, and define overweight and obesity, correlating directly with body fat mass. Consequently, overweight and obesity result from an abnormal or excessive accumulation of body fat, due to an increase in the size and number of fat cells (2, 4).

Overweight and obesity have become fundamental public health concerns and significant governmental issues, now ranked as the fifth leading cause of death globally. The World Health Organization reports that the prevalence of obesity is increasing at an alarming rate in both developed and developing countries (3). Data from the National Health and Nutrition Examination Survey (NHANES) in the United States indicates that two out of three adults are overweight or obese (1). Obesity is recognized as a chronic, well-established disease that affects individuals in all aspects of life. Associated health conditions include metabolic syndrome and cardiovascular diseases, often exacerbated by overweight and obesity (1-3).

In addition to the well-established link between obesity and chronic diseases, substantial evidence accumulated over the past two decades has demonstrated that obesity is a definitive risk factor for liver disease (1). In this context, the role of adipose tissue, particularly the central obesity phenotype (upper body) associated with increased visceral fat, has been implicated in the pathogenesis of non-alcoholic fatty liver disease (NAFLD). Hepatic fat accumulation is largely dependent on free fatty acids (FFAs) released from adipose tissue. Visceral adipose tissue exhibits greater lipolytic potential compared to more abundant skeletal adipose tissue, and the direct release of FFAs from visceral fat stores into the circulation contributes to liver injury mechanisms (1, 3, 5-7). The resulting inflammation in the liver leads to elevated serum levels of liver enzymes, serving as biomarkers of liver cell damage (3). Given the diverse biochemical functions performed by the liver, assessing changes in these enzymes is a common approach to evaluating liver function (1, 8, 9). These enzymes include aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (ALP) (10-12).

AST is an enzyme primarily found in the liver and, to a lesser extent, in muscles (8, 13). It catalyzes the transfer of an amino group from the amino acid aspartate to α-ketoglutarate to produce oxaloacetate and pyruvate, with its release into the extracellular space occurring only upon cell death, leading to increased blood levels (1, 14). ALT is a cytosolic enzyme predominantly located in liver and kidney cells (10, 15), and serum ALT levels are considered a reliable indicator of liver disease (11, 14). Alkaline phosphatase (ALP) is a hydrolytic enzyme responsible for transferring phosphate groups from nucleotides, proteins, and alkaloids. Its metabolic functions include bone formation, lipid transport, and amino acid utilization for aerobic energy production at the cellular membrane (1). Researchers have demonstrated a direct correlation between liver enzyme levels and increasing body weight (1, 14, 15).

Due to the complications and comorbidities associated with overweight and obesity, experts and healthcare professionals have consistently advocated for non-pharmacological approaches, such as exercise and physical activity, for weight management and the prevention of obesity-related diseases (16). Resistance training is one of the effective exercise modalities. Various methods and equipment exist for resistance training, which can be broadly categorized into three types: weight-based resistance training, machine-based resistance training, and bodyweight resistance training (17-19). TRX suspension training, a form of bodyweight resistance training, utilizes specialized straps or bands to enhance overall fitness and athletic performance, and is rapidly gaining popularity among the general population. Muscle contractions in TRX exercises are primarily generated through the distance between the central axis of the straps (1, 3, 20, 21).

While extensive research has explored the impact of aerobic and resistance training on liver enzymes, a comprehensive investigation into the effects of TRX training on liver enzymes and body composition in obese women was lacking at the time of this study. Therefore, this research aimed to address this gap by examining the influence of a TRX training program on body composition and liver enzymes in obese women.

2. Methods and Materials

2.1. Study Design

This quasi-experimental study employed a two-group, pre-test/post-test design. The population consisted of obese women residing in Qom, Iran. Thirty participants were selected using a convenience sampling method.

2.2. Participant Recruitment and Informed Consent

During the initial session, participants received a detailed explanation of the study and underwent pre-test assessments. Informed consent was obtained from all participants.

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2.3. *Inclusion and Exclusion Criteria*

Inclusion Criteria:

- Willingness and full commitment to participate in the study
- Unconditional cooperation with the researcher
- BMI ≥ 30
- No prior experience with TRX training

Exclusion Criteria:

- Onset of illness or injury
- Non-compliance with the researcher's instructions
- Use of medications, alcohol, or tobacco
- Group Allocation and Pretest Assessments

After obtaining informed consent and collecting baseline data, participants were randomly divided into two groups of 15 each: control and experimental. Initial assessments included measurements of height, weight, and body composition. Blood samples were collected from both groups for pre-test evaluation of liver enzymes.

2.4. *TRX Training Protocol*

Familiarization Session: Participants in the experimental group initially attended an orientation session to familiarize themselves with the training program and its execution. The primary objective of this session was to introduce participants to TRX resistance exercises using TRX bands. Additionally, a one-repetition maximum (1RM) test, based on the Brzycki equation, was conducted to assess muscle strength and introduce the movements.

Eight-Week Training Program: The experimental group underwent an eight-week training program consisting of three sessions per week, each lasting 90 minutes. Each training session included a 15-minute warm-up, 65 minutes of specific exercises, and a 10-minute cool-down with stretching exercises. The specific program for the experimental group consisted of eight exercises: chest press, lunges, plank, hamstrings, squats, biceps, and triceps.

TRX Structure and Intensity: The experimental group performed the exercises in three sets with a one-minute rest between sets and a three-minute rest between exercises. The number of repetitions for each TRX exercise remained constant throughout the program but varied for each individual based on their 1RM. The exercises were performed at an intensity of 65-80% of 1RM, corresponding to a perceived exertion of 5-8 on a 10-point Borg scale. Overload was applied by increasing the intensity by one unit every two weeks.

Neuromuscular Adaptation and 1RM Reassessment: To account for neuromuscular adaptations and increased muscle strength, participants' 1RM was recalculated every two weeks, and training program intensity was adjusted accordingly based on the new 1RM.

2.5. *Blood Sampling*

To assess biochemical variables, blood samples were collected in two stages: before the start of training (week zero) and at week eight (48 hours after the completion of training). In the first stage, participants in all groups were asked to refrain from any strenuous exercise for two days before the test and to maintain their normal diet. Then, 10 ml of blood was drawn from an antecubital vein in the left arm in a sitting and resting position after 12 hours of fasting at Boali Laboratory in Qom. After this stage, the subjects in the experimental group underwent an eight-week training program. To evaluate liver function indices, including AST, ALP, and ALT, the Delta Darman Part kit was used via the enzymatic colorimetric method.

2.6. *Body Composition Assessment*

Weight and Body Mass Index (BMI) assessments were performed using the Zeus model body composition device from South Korea, with a measurement accuracy of 0.1. This device passes an electric current through the body and, based on the conductivity of different body tissues such as fat, muscles, bones, and water, accurately determines their amounts. For the assessment, participants were required to wear very light clothing, remove socks and metal jewelry, and stand on the device for a short time. After entering initial information such as gender, age, and height, the participant held the two handles on the device to perform the analysis.

2.7. *Statistical Analysis*

The Shapiro-Wilk test was used to check the normality of the data, and independent and paired t-tests were used for statistical analysis. All statistical data were analyzed using SPSS version 26, and Excel 2013 was used to create the charts.

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3. Findings and Results

The study included 30 obese middle-aged women, divided into two groups: TRX (n=15) and control (n=15). The TRX group had an average weight of 80.22 kg (SD = 8.33), a BMI of 32.59 (SD = 2.37), a waist-to-hip ratio (WHR) of 0.90 (SD = 0.05), an average age of 51.42 years (SD = 6.13), and an average height of 159.21 cm (SD = 4.39). The control group had an average weight of 81.01 kg (SD = 7.93), a BMI of 32.93 (SD = 2.33), a WHR of 0.91 (SD = 0.09), an average age of 49.85 years (SD = 7.62), and an average height of 158.71 cm (SD = 3.15). These baseline characteristics indicate that the groups were comparable in terms of weight, BMI, WHR, age, and height.

Table 1 presents the mean and standard deviation for liver enzyme levels (ALT, AST, and ALP) in both the TRX and control groups at pretest and posttest stages.

Table 1

Descriptive Statistics

Group	Enzyme	Stage	Mean ± Standard Deviation
TRX	ALT	Pretest	21.68 ± 1.68
		Posttest	18.46 ± 2.35
	AST	Pretest	24.21 ± 1.27
		Posttest	22.16 ± 1.40
	ALP	Pretest	913.00 ± 43.72
		Posttest	867.50 ± 39.66
Control	ALT	Pretest	19.67 ± 1.60
		Posttest	20.96 ± 2.52
	AST	Pretest	23.42 ± 0.38
		Posttest	23.23 ± 0.55
	ALP	Pretest	933.50 ± 29.63
		Posttest	948.50 ± 29.86

The TRX group showed a decrease in ALT levels from a pretest mean of 21.68 (SD = 1.68) to a posttest mean of 18.46 (SD = 2.35). AST levels in the TRX group decreased from a pretest mean of 24.21 (SD = 1.27) to a posttest mean of 22.16 (SD = 1.40). ALP levels also decreased from a pretest mean of 913.00 (SD = 43.72) to a posttest mean of 867.50 (SD = 39.66). In the control group, ALT levels increased from a pretest mean of 19.67 (SD = 1.60) to a posttest mean of 20.96 (SD = 2.52). AST levels remained relatively stable, with a pretest mean of 23.42 (SD = 0.38) and a posttest mean of 23.23 (SD = 0.55). ALP levels in the control group showed a slight increase from a pretest mean of 933.50 (SD = 29.63) to a posttest mean of 948.50 (SD = 29.86).

Prior to conducting the ANCOVA, several assumptions were assessed to ensure the validity of the analysis. The Shapiro-Wilk test was used to assess the normality of the distribution of liver enzyme levels. Results indicated that the assumption of normality was met for ALT (W = 0.967, p = 0.311), AST (W = 0.972, p = 0.389), and ALP (W = 0.964, p = 0.279). Homogeneity of variances was confirmed using Levene's test, which showed no significant differences in the variances of ALT (F(1, 28) = 1.232, p = 0.278), AST (F(1, 28) = 1.098, p = 0.305), and ALP (F(1, 28) = 1.452, p = 0.239) between the TRX and control groups. Additionally, the assumption of homogeneity of regression slopes was tested and confirmed, as the interaction term between the covariate (pre-test scores) and the group was not significant for ALT (F(1, 26) = 1.345, p = 0.256), AST (F(1, 26) = 1.167, p = 0.289), and ALP (F(1, 26) = 1.569, p = 0.222). These results indicate that the assumptions for ANCOVA were satisfactorily met, allowing for a valid interpretation of the analysis.

Table 2 presents the ANCOVA results for the liver enzyme levels, controlling for pretest scores.

Table 2

Summary of ANCOVA Results

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Enzyme	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Effect Size (Partial Eta Squared)
ALT	Pretest	30.45	1	30.45	6.78	0.015	0.201
	Group	58.12	1	58.12	12.94	0.001	0.324
	Error	135.21	27	5.01			
AST	Pretest	25.30	1	25.30	5.60	0.025	0.172
	Group	45.78	1	45.78	10.12	0.003	0.273
	Error	122.16	27	4.52			
ALP	Pretest	4908.36	1	4908.36	8.92	0.007	0.248
	Group	14082.21	1	14082.21	25.62	0.000	0.487
	Error	14860.97	27	550.41			

The ANCOVA analysis revealed that after controlling for pretest scores, there were significant differences between the TRX and control groups for all liver enzymes at the posttest stage. For ALT, the type III sum of squares was 58.12, $F(1, 27) = 12.94$, $p = 0.001$, indicating a significant group effect. For AST, the type III sum of squares was 45.78, $F(1, 27) = 10.12$, $p = 0.003$, also showing a significant group effect. Similarly, for ALP, the type III sum of squares was 14082.21, $F(1, 27) = 25.62$, $p < 0.001$, indicating a significant difference between the groups. These results suggest that the TRX training program had a significant impact on the liver enzyme levels in the experimental group compared to the control group.

4. Discussion and Conclusion

The present study aimed to investigate the effect of a TRX training program on liver enzymes in obese women. The results demonstrated significant differences in the serum levels of alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (ALP) between the pre-test and post-test in the TRX training group. Additionally, a significant difference was observed between the post-test results of the control and TRX training groups. These findings align with previous research (1, 3, 4, 8-11, 13, 15-19).

Extensive research on the effectiveness of physical activity and exercise on serum liver enzyme levels suggests that improvements occur through various mechanisms. Regular physical activity has been shown to reduce liver damage and the release of aminotransferases such as ALT, AST, and ALP (1, 3, 10, 11). Exercise suppresses lipogenesis and increases the transport of triglycerides from fat cells to liver cells, reducing hepatic fat infiltration (8, 9, 13). It also enhances mitochondrial fatty acid beta-oxidation and the expression of lipid metabolism genes such as CPT1 and PPAR-alpha (4, 11, 15). These effects decrease intracellular fat accumulation, which is associated with reduced serum liver enzyme levels.

Exercise also reduces liver inflammation by decreasing macrophage and lymphocyte infiltration and reducing the production of pro-inflammatory cytokines such as TNF-alpha and IL-6 (8-10). This improves gut barrier integrity and endotoxemia, thereby reducing inflammatory signals like NF-kB (1, 9-11) Additionally, exercise enhances antioxidant capacity by increasing superoxide dismutase (SOD) enzyme activity and glutathione levels, and improves mitochondrial function in liver cells, thus reducing reactive oxygen species that can cause inflammation (1, 8-11, 15).

Both aerobic and resistance exercises have been shown to enhance liver lipid mobilization by increasing adipose tissue lipolysis and fatty acid oxidation (1, 8-11, 13, 15). This type of physical activity also promotes mitochondrial biogenesis and function, and reduces oxidative stress and inflammatory cytokines such as IL-1beta and TNF-alpha (1, 10). Exercise further increases serum enzyme clearance by enhancing the expression of membrane transporters like organic anion transporter (OAT2) in liver cells (9). Suspension resistance training, such as TRX, similarly provides an effective intervention by stimulating these mechanisms through increased calorie expenditure and improved insulin sensitivity (16). Thus, various forms of exercise combat fatty liver and inflammation, systematically reducing the release of liver enzymes.

However, some previous research has reported mixed and contradictory results regarding the effect of exercise, particularly resistance training, on serum liver enzyme levels (17). These inconsistencies could be attributed to differences in the intensity, volume, frequency, duration, and other aspects of resistance training interventions between studies, which could affect physiological adaptations.

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The present study had several limitations. One notable limitation was the small sample size, as middle-aged obese women with busy schedules were reluctant to participate. Therefore, further research is needed to determine the appropriate exercise intensities, optimal doses, and timing for TRX resistance training and other relevant assessment methods for liver inflammation predictors. More detailed studies should be conducted in specific populations to address the mechanisms of action and factors contributing to the discrepancies in results.

Overall, physical activity has a positive effect on the function of various organs. The results of this study indicated significant differences in liver enzyme levels between the pre-test and post-test in the TRX training group, as well as significant differences between the TRX and control groups at post-test. Thus, a period of TRX training appears to have a significant impact on liver enzymes in obese women.

Authors' Contributions

M.A. conceptualized the study, designed the research methodology, and supervised the overall project implementation. E.G. conducted the TRX training sessions, managed participant recruitment, and collected blood samples and anthropometric measurements. E.S.E. performed the data analysis using ANCOVA, interpreted the results, and contributed to the drafting and revising of the manuscript. A.S. supported data collection, assisted with the statistical analysis, and helped in drafting the manuscript. All authors participated in discussing the findings, critically reviewed the manuscript for important intellectual content, and approved the final version for publication.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study adhered to the ethical guidelines for research with human subjects as outlined in the Declaration of Helsinki.

References

1. Lorestani AZ, Rahmati M, Mirnasuri R. Effect of 12 Weeks of Aerobic Training on Liver Enzymes, Thyroid Hormones, and Anthropometric Indices of Obese Children. Zahedan Journal of Research in Medical Sciences. 2020;22(2). [DOI]
2. Malínská H, Hüttl M, Oliyarnyk O, Marková I, Poruba M, Rácová Z, et al. Beneficial Effects of Troxerutin on Metabolic Disorders in Non-Obese Model of Metabolic Syndrome. Plos One. 2019;14(8):e0220377. [PMID: 31404079] [PMCID: PMC6690532] [DOI]
3. Park JH, Kim H-j, Han A, Kang D-m, Park S. Effects of Aerobic Exercise Training on the Risk Factors for Liver Diseases in Elderly Women With Obesity and Impaired Fasting Glucose: A Pilot Study. Physical Activity and Nutrition. 2019;23(1):21-7. [PMID: 31010271] [PMCID: PMC6477817] [DOI]
4. Smart NA, King N, McFarlane JR, Graham PL, Dieberg G. Effect of Exercise Training on Liver Function in Adults Who Are Overweight or Exhibit Fatty Liver Disease: A Systematic Review and Meta-Analysis. British Journal of Sports Medicine. 2016;52(13):834-43. [PMID: 27317790] [PMCID: PMC6029644] [DOI]
5. Kasper P, Martin, Anna, Lang, Sonja, Kütting, Fabian, Goeser, Tobias, Demir, Münevver, Steffen, Hans-Michael. NAFLD and cardiovascular diseases: a clinical review. Clinical Research in Cardiology. 2021;110(7):921-37. [PMID: 32696080] [PMCID: PMC8238775] [DOI]
6. Liu D, Ji Y, Zhao J, Wang H, Guo Y, Wang H. Black rice (Oryza sativa L.) reduces obesity and improves lipid metabolism in C57BL/6J mice fed a high-fat diet. Journal of Functional Foods. 2020;64:103605. [DOI]
7. Wu N, Sarna LK, Hwang S-Y, Zhu Q, Wang P, Siow YL, et al. Activation of 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase during high fat diet feeding. Biochimica et Biophysica Acta (BBA) - Molecular Basis of Disease. 2013;1832(10):1560-8. [PMID: 23651731] [DOI]
8. Kaynar Ö. Effect of Sparring Training Model on Liver Enzymes and Muscle Damage in Boxers. Journal of Education and Training Studies. 2019;7(3S):114. [DOI]
9. Keymasi Z, Sadeghi A, Pourrazi H. Effect of Pilates Training on Hepatic Fat Content and Liver Enzymes in Middle-

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E-ISSN: 2981-2569

Aged Men With Non-Alcoholic Fatty Liver Disease. Baltic Journal of Health and Physical Activity. 2020;12(1):32-40. [DOI]
10. Rengers TA, Orr SC, Marks C, Hew-Butler T, Choi MD, Butcher S, et al. Effects of High-Intensity Interval Training Protocols on Liver Enzymes and Wellness in Women. Journal of Sports Medicine. 2021;2021:1-10. [PMID: 34007845] [PMCID: PMC8110421] [DOI]
11. Seyyed A, Ghajari H. The Effect of High-Intensity Interval Training on Liver Enzymes in Active and Inactive Women. Journal of Archives in Military Medicine. 2019;7(3). [DOI]
12. Shepard MJ, Bracken MB. The Effect of Methylprednisolone, Naloxone, and Spinal Cord Trauma on Four Liver Enzymes: Observations From NASCIS 2. Spinal Cord. 1994;32(4):236-45. [PMID: 8022633] [DOI]
13. Erdoğan R. Investigation of the Effects of Volleyball Training on Athletes' Liver Enzymes and Muscle Damage Markers. Journal of Pharmaceutical Research International. 2021:1-6. [DOI]
14. Megabiaw F, Eshetu T, Kassahun Z, Aemero M. Liver Enzymes and Lipid Profile of Malaria Patients Before and After Antimalarial Drug Treatment at Dembia Primary Hospital and Teda Health Center, Northwest, Ethiopia. 2021. [DOI]
15. Shiri F, Monazzami A, Azizi M. Effects of Six-Week Endurance Training in Liver Enzymes, Lipid Profile, Interleukin-6 and High-Sensitivity C-Reactive Protein (Hs-Crp) Responses in People With a Family History of Coronary Artery Disease. Journal of Archives in Military Medicine. 2021;9(2). [DOI]
16. Hajinia M, Haghighi A, Asgari R. The effect of high-intensity resistance training on Irisin and Fibroblast growth factor 21 levels in overweight men. Journal of Sabzevar University of Medical Sciences. 2021;28(3):457-65.
17. de Lima NS, De Sousa RAL, Amorim FT, Gripp F, Diniz e Magalhães CO, Henrique Pinto S, et al. Moderate-intensity continuous training and high-intensity interval training improve cognition, and BDNF levels of middle-aged overweight men. Metabolic Brain Disease. 2022;37(2):463-71. [PMID: 34762211] [DOI]
18. Ensari I, Motl RW, Pilutti LA. Exercise training improves depressive symptoms in people with multiple sclerosis: Results of a meta-analysis. Journal of Psychosomatic Research. 2014;76(6):465-71. [PMID: 24840141] [DOI]
19. Eslami R. Effects of concurrent training on chemerin, irisin, insulin resistance and lipid profile in children girls with overweight. Journal of Practical Studies of Biosciences in Sport. 2019;7(14):117-27. [DOI]
20. Javed A, Anas M, Abbas M, Khan AI. Flexible Human Resource Management And Firm Innovativeness: The Mediating Role Of Innovative Work Behavior. Journal of HRM. 2017;20(1).
21. Lashgari S, Sanatkaran A, Rafiee S. The Effect of Pilates and TRX Exercises on Non-Athletic Women's Mood. Egyptian Academic Journal of Biological Sciences E Medical Entomology & Parasitology. 2018. [DOI]

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