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(RESEARCH ARTICLE)

Evaluation of serum activity of aspartate transaminase, alanine transaminase and alkaline phosphatases in Sudanese with long standing type 2 diabetes mellitus

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Abstract

Background Diabetes, the most common non- communicable disease in Sudan, is having an increasing impact or rates of morbidity and mortality. The spread of sedentary lifestyle and adoption of western dietary habits-high in refine carbohydrates and fat- are driving an increase in the number of people with obesity related type 2 diabetes. The study aims to evaluate the plasma activities in enzymes (AST, ALT and ALP) in Sudanese with long standing diabetes mellitus type 2 compared with healthy subjects (non diabetics) as a control group. Method a cross-sectional study conducted during the period from April to September 2009, compared plasma activities of Aspartate, Alanine Transaminases and Alkaline Phosphatase of 40 Sudanese patients with type 2 diabetes mellitus (as a test group), and 30 apparently healthy volunteers (as a control group). Participants in this study were from Bahri Diabetic Centre in Sudan. Age and gender of test group were matched with control group. The plasma activities of AST, ALT and ALP were measured using A 25 auto analyzer from Roche/ Hitachi Company, Germany. Results in this study forty patients with diabetes mellitus type 2, in addition to 30 healthy volunteers as a control group were enrolled in this study. Age and gender of the test group were matched with the control group Plasma AST, ALT showed insignificant difference, whereas plasma ALP was significantly raised in the test group compared to the control group: (61.08 ± 19.625) versus (57.23 ± 14.616) U/L (P= 0.415); for plasma AST. (64.15 ± 18.972) versus (62.07 ± 14.605) U/L (P= 0.825); for plasma ALT. (278.73± 88.963) versus (161.50 ± 81.708) U/L (P= 0.000); for plasma ALP. In the test group, both plasma AST and ALT showed no correlation with the duration of the disease, while plasma ALP showed a weak positive correlation with the duration of diabetes mellitus. Conclusions in this study we found that Sudanese patients with type2 diabetes mellitus have a high incidence of abnormal ALP levels. Timely diagnosis and management of the abnormal liver parameters may help to minimize liver-related morbidity and mortality in the diabetic population.

Keywords: Type2 diabetes mellitus; Alanine aminotransferase (ALT); Aspartate transaminase (AST); Alkaline phosphatase (ALP); Sudan.

1. Introduction

Diabetes mellitus is a group of metabolic disorders characterized by hyperglycemia resulting from defect in insulin, insulin action or both (1).

Most people always have some glucose in the blood to be used by cells for energy. Blood glucose originates from food ingested, the liver and muscle cells. However, an excessive amount of glucose chronically present in the blood causes a variety of series health complications.

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Diabetics have excessive blood glucose because of deficiency in the production or utilization in insulin hormone. Insulin is produced by the Beta cells of the pancreas in response to elevated glucose in the blood after meal (2).

Insulin binds to receptors in the body cells to allow the passage of glucose into cell as an energy source. Insulin stimulates cell to remove glucose from the blood, stimulates the liver to mobilize glucose, and thus causes the blood sugar level to return to normal.

Diabetics have either a deficiency of insulin of defective insulin receptor binding.

As a result, the cells of the body are unable to the glucose energy and are essentially starved, despite the energy source present in the blood. Because glucose is not entering the cells, it remains in the blood causing high blood sugar, or hyperglycemia (3).

Chronic diabetes mellitus can lead to serious problems in the eyes, kidneys, nervous system, gum and teeth. One of the most serious complications caused by diabetes in heart disease (4).

Diabetes mellitus is the most common non- communicable disease in Sudan, is having an increasing impact or rates of morbidity and mortality.

The aim of this study is to assess the plasma activities of Aspartate, Alanine transaminases and alkaline phosphatase in Sudanese patients with long standing type 2 diabetes militate Objectives of this study divided into general objective, to evaluate the plasma activities in enzymes (AST, ALT and ALP) in Sudanese with long standing diabetes mellitus type 2 compared with healthy subjects (non diabetics) as a control group and specific objectives, to measure the plasma activities of AST, ALT and ALP enzymes in Sudanese with long standing diabetes mellitus type 2,more over to assess the relationship (if any) between plasma activity of AST, ALT and ALP with the duration of the disease (in years).

2. Material and methods

2.1. Study design

This is a descriptive, cross sectional and hospital-based study.

2.2. Study area

The study was done in the Diabetic Centre, Bahry.

2.3. Study period

This study was carried during the period of April to September 2009.

2.4. Study population

Diabetics type 2 as a test group, and apparently healthy (non diabetic) subjects as a control group.

2.5. Inclusion criteria

Long standing diabetic patients type 2 (10 years and more) were included as a test group in this study and healthy volunteers as a control group.

2.6. Exclusion criteria

Those with renal disease, heart disease, bone disease, acute pancreatitis, viral hepatitis and obstructive biliary disease had been excluded from this study.

2.7. Sample size

Forty patients with diabetes mellitus type 2 and 30 apparently healthy (non diabetic) subjects as a control group were included in this study. Both the control group and the test group were matched in age and gender.

2.8. Ethical consideration

Permission of this study was obtained from the local authorities in the area of the study.

The objectives of the study were explained to all individuals participating in this study.

An informed consent was obtained from all participants in the study.

2.9. Instrument

A25 auto analyzer: A 25 auto analyzer was used to measure and report the plasma levels of AST, ALT and ALP activities. This auto analyzer: Is fully automated, computerized and includes three basic components: The operating arm, the dispensing system, the reading cells and detection.

2.10. Materials required

Disposable syringes, Li heparin containers, alcohol swabs, cotton and marker pens, a centrifuge, reagents, saline (non buffered), system cleaning solution, sample cups, printer, and printer paper.

2.11. Blood collection

From each subject participating in this study, 3 ml of venous blood were obtained by vein puncture using a disposable syringe and transferred to a lithium heparin container for plasma preparation. The plasma was separated by centrifugation at 3000 r. p.m. for 10 minutes and stored at -20 Cº for estimation of plasma level of Aspartate, Alanine transaminases and Alkaline phosphatase activities.

2.12. Biochemical measurement

Plasma levels of AST, ALT and ALP were measured by using Biosystem A25 auto analyzer.

2.13. Quality control

The precision and accuracy of all methods used in this study were checked each time a batch was analyzed by including commercially prepared control sera which were purchased from Biosystem Company, S.A. Costa Brava 30, Barcelona (Spain).

2.14. Statistical analysis

The data collected in this study was analyzed using SPSS computer analysis program. The means and standard deviation of the plasma AST, ALT and ALP activities were obtained, and the test was used for a comparison (p. value of <0.05 was significant). Linear regression analysis was used to assess correlation between the duration of diabetes mellitus (in years) and the plasma AST, ALT and ALP activities.

3. Results

Forty patients with diabetes mellitus type 2, in addition to 30 healthy volunteers as a control group were enrolled in this study. Age and gender of the test group were matched with the control group.

3.1. Plasma Aspartate transaminase

Table 1 shows insignificance difference between the means of plasma Aspartate transaminase of the test group (n=40) and the control group (n=30) Mean: (61.08) versus (57.23) U/L.

Figure 1 shows no correlation between the level of Aspartate transaminase activity and the duration of diabetes mellitus type 2 (in years), r=0.00

3.2. Plasma Alanine transaminase

Table 1 shows insignificance difference between the means of plasma Alanine transaminase of the test group and the control group Mean: (64.15) versus (62.07) U/L.

Figure 2 shows no correlation between the level of Alanine transaminase activity and the duration of diabetes mellitus type 2 (in years), r=0.00.

3.3. Plasma Alkaline phosphatase

Table (1) shows significance difference between the means of plasma Alkaline phosphatase of the test group and the control group Mean: (278.73) versus (161.5) U/L.

Figure 3 shows weak positive correlation between the level of Alkaline phosphatase activity and the duration of diabetes mellitus type 2 (in years).

Table 1 Comparison of the means of the plasma aspartate transaminase, alanine transaminase and alkaline phosphatase between the test and control group.

Variable	Test group Mean±SD Range n=40	Control group Mean±SD Range n=40	P value
Aspartate transaminase U/L	61.08 ± 19.625 (38-102)	57.23 ± 14.619 (40-100)	0.415
Alanine transaminase U/L	64.15 ± 18.972 (37-121)	62.07 ± 14.605 (41-106)	0.825
Alkaline phosphatase U/L	278.73 ± 88.963 (70-411)	161.50 ± 81.708 (60-303)	0.000

The table shows the mean and range in brackets.
t-test was used for comparison.
P-value <0.05 is considered significant.

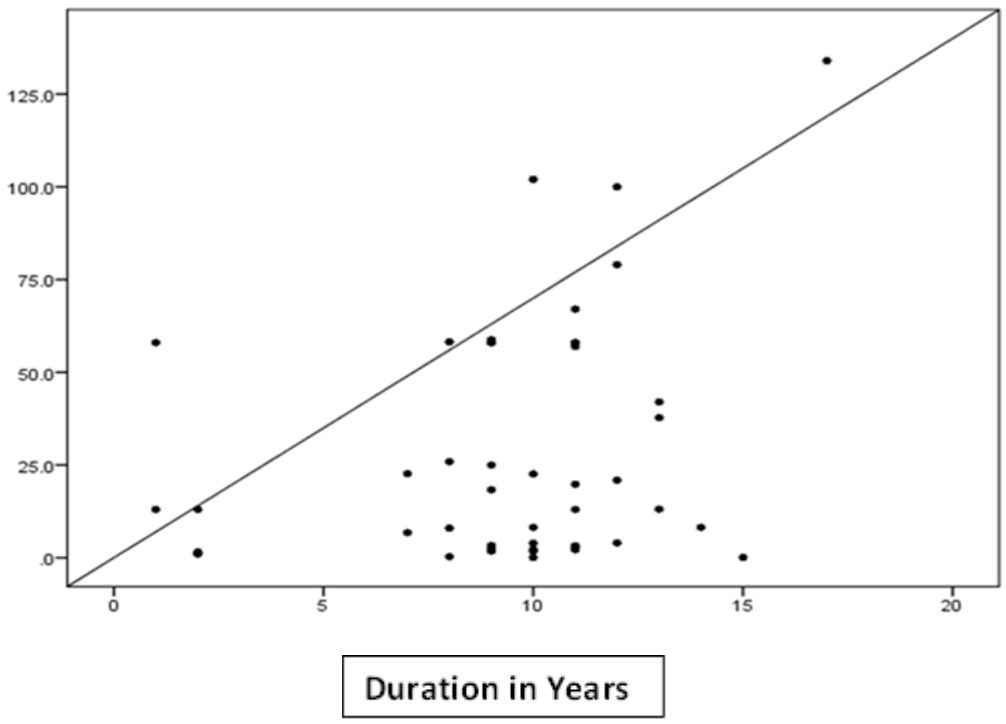

Figure 1 Shows no correlation between the level of aspartate transaminase activity and the duration of diabetes mellitus type 2 (in years), r=0.00

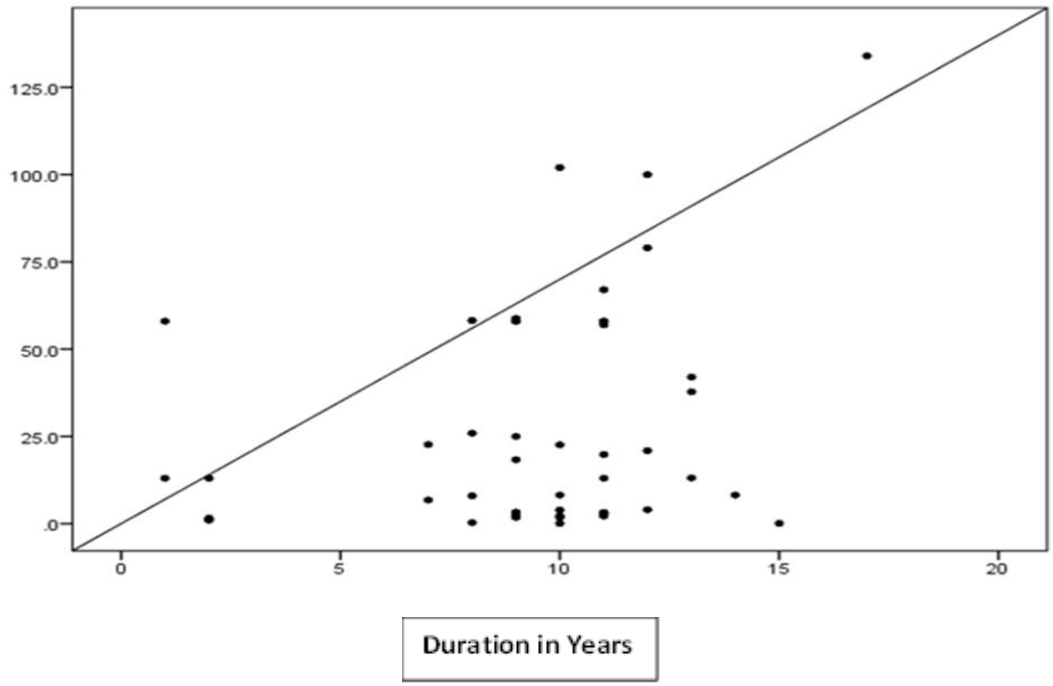

Figure 2 Shows no correlation between the level of alanine transaminase activity and the duration of diabetes mellitus type 2 (in years), r=0.00

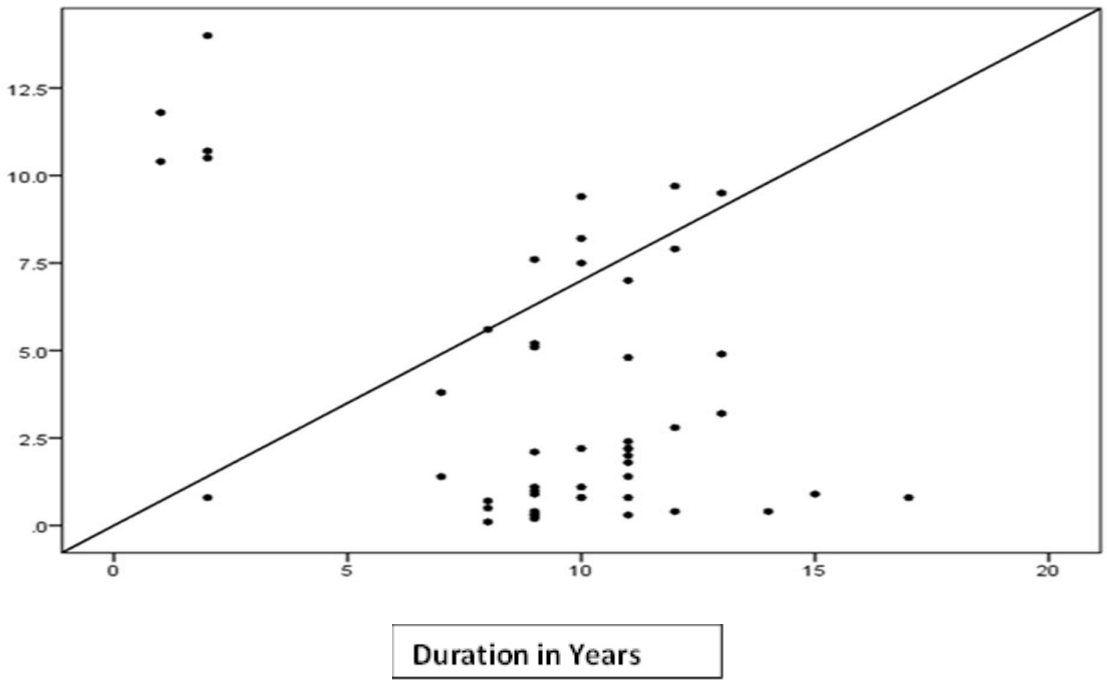

Figure 3 Shows weak positive correlation between the level of alkaline phosphatase activity and the duration of diabetes mellitus type 2 (in years).

4. Discussion

In 2008 according to the World Health Organization, at least 141 people worldwide were suffering from diabetes mellitus type 2. It is incidence is increasing rapidly, and it is estimated that by the year 2030, this number will be doubled. Diabetes mellitus occurs though out the world but is more common (especially type 2) in the developed countries. The greatest increase in prevalence is, however, expected to occur in Asia and Africa, where most patients will likely be found by 2030.

The increase in incidence of diabetes in developing countries following the trends of urbanization and lifestyle changes, perhaps most importantly "a western style" diet. This has suggested an environmental effect, but there is little understanding of the mechanisms at present (5), (6),(7).

Diabetes is in the top 10, and perhaps in the top 5 of the most significant diseases in the developed world and gaining in significance there and elsewhere (8).

Diabetes, the most common non- communicable disease in Sudan, is having an increasing impact or rates of morbidity and mortality. The spread of sedentary lifestyle and adoption of western dietary habits-high in refine carbohydrates and fat- are driving an increase in the number of people with obesity related type 2 diabetes (8).

Knowledge of diabetes epidemic in Sudan is limited. The most recent data come from a small study that was carried out in 1996. The results of that study indicated a prevalence of 3.4%, but recent estimates place the diabetes population at around 2 million- around 95% of whom have type 2 diabetes (9), (10).

In Sudan, there is no related published data plasma Aspartate transaminase, Alanine transaminase and Alkaline phosphatase activities in Sudanese's with diabetes mellitus type 2, so this study tends to compare the results with that obtained from other previous studies in other countries.

The results of this study showed insignificant difference between the mean of plasma activity of Alanine transaminase of the test group compared with that of control group. The mean of the test group is insignificantly elevated as shown in (table 3-1, figure 3.2).

This result is disagree with a study done by Y. Li et al (11). who found that there was an elevation in plasma Aspartate and Alanine transaminase activity in patients with diabetes mellitus type 2 .Although elevated ALT or AST levels increased incident type 2diabetes risk, addition of ALT levels into the prediction model did not improve the discrimination of type 2 diabetes (11).

Several prospective studies have reported that ALT was associated with incident diabetes (12), but this association was not significant in a study of 4,201 French men and women (14). Hanley et al (13)., Fraser et al (12)., and Schneider et al (15). found that AST independently predicted incident diabetes in 906 non-Hispanic Americans, 3,041 British women, and 9,337 Americans (7,495 white and 1,842 black), respectively. However, others showed that AST did not predict incident of diabetes (16), (17).

This present study showed a significant increase in the mean of plasma activities of alkaline phosphatase of the test group when compared with that of the control group ($p<0.05$) as shown in (table 3-1, figure 3.3), this may be due to effect of long standing of diabetes mellitus on bone causing diabetic bone disease(18) . These results agree with a study done by Chen SC et al(19), who found that there was an elevation in plasma alkaline phosphatase activity in patient with long standing diabetes mellitus type 2.More over association of ALP and types 2 diabetes .explain by Ching-Lung Cheung, our study sheds light on the mechanism of elevated BAP. While insulin resistance is known to be a risk factor for vascular calcification, the mechanism is not completely

understood. In the current study, we showed that multiple HOMA2 indices and insulin levels are robustly associated with BAP rather than total alkaline phosphatase. Although total alkaline phosphatase could be elevated due to obesity, insulin resistance, fatty liver, and Hepatosteatosis, no significant association was observed between HOMA2-IR and total alkaline phosphatase in the fully adjusted model. This may be explained by the fact that other liver markers included in the model were more specific to liver dysfunction; ALT, AST, and GGT also showed significant associations ($P<0.05$) with HOMA2-IR in the fully adjusted model. When ALT, AST, and GGT were removed from the fully adjusted model, the association between alkaline phosphatase and HOMA2-IR became significant ($P = 0.015$) (22). On other hand, other studies found no significant association between ALP and incident diabetes (20), (21).

The present results disagree with a study done by. Tas (19) who reported that there was no significant difference between the diabetics and the control group in the plasma level of ALP. Also, the study showed a weak positive correlation between the levels of plasma ALP activities and the duration of diabetes mellitus (in years). According to Chen SC et al (19), the level of plasma Alkaline phosphatase activity is more correlated with the level of fasting plasma glucose rather than the duration of diabetes mellitus.

5. Conclusion

This study concluded that: Sudanese patients with type2 diabetes mellitus have a high incidence of abnormal ALP levels. Timely diagnosis and management of the abnormal liver parameters may help to minimize liver-related morbidity and mortality in the diabetic.

Compliance with ethical standards

Acknowledgments

Grateful thank to the patients and healthy who agreed to participate in this study.

Disclosure of conflict of interest

There was no conflict of interest in this study.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Bishop ML, Edward PF and Larry S. (2017). Carbohyderates.*Clinical Chemistry; Principles, procedures, correlations* 8th ed. Lipincott & Wilkin; Philadelphia,. PP 743-765.

[2] American Diabetes Association. (2011). Diagnosis and classification of diabetes mellitus. Diabetes Care, 34 Suppl 1(Suppl 1), 62-69.

[3] National Diabetes Data Group. (1979). Classification and diagnosis of diabetes mellitus and other categories of glucose intolerance. Diabetes, 28, 1039-57.

[4] D Wooton. (1982). Microanalysis in medical biochemistry, London, sixth edition ch, 8, 250-260.

[5] Agus S and Cox R. (1966). Griffin, M. Inhibition of Alkaline phosphatase by cysteine and it is Analogues, Biochim Biophys Acta, 118-363.

[6] Burtis CA and Ashwood ER. (1999). Teitz text book of clinical chemistry .3rd edition, WBSaunders co, 501-613.

[7] Low MG and Zilversmit DB. (2006). Alkaline phosphatase and exchange surfaces. J Clin Chem.

[8] American Diabetes Association. (2009).Total prevelance of diabetes and pre diabetes. retrieves on; Marach. USA, 3-17.

[9] Narayan K, Boyle J, Tompson T, Sorensen S and Williamson D. (2003). life time risk for diabetes mellitus in the united states 2 JAMA, (14).

[10] Mekenzie J. (2006). Plasma liver enzymes source. Clinical endocrinology , 35 (5), 40-44.

[11] Y. Li, Jing wang and Xu.Han. (2019). / Annals of Hepatology, 18, 298–303.

[12] Fraser A, et al. (2009). Alanine aminotransferase, gamma-glutamyltransferase, and incident diabetes: the British Women's Heart and Health Study and meta-analysis. Diabetes Care, 32, 741–750.

[13] Hanley AJ, et al. (2004). Elevations in markers of liver injury and risk of type 2 diabetes: the insulin resistance atherosclerosis study. Diabetes, 53, 2623–2632.

[14] Andre P, et al. (2005). Hepatic markers and development of type 2 diabetes in middle aged men and women: a three-year follow-up study - The DESIR study (Data from an Epidemiological Study on the Insulin Resistance syndrome). Diabetes & Metabolism, 31, 542–550,

[15] Schneider ALC, et al. Liver enzymes, race, gender and diabetes risk: the Atherosclerosis Risk in Communities (ARIC) Study. Diabetic Med, 30, 926–933.

[16] Sattar N et al. (2004). Elevated alanine aminotransferase predicts new-onset type 2 diabetes independently of classical risk factors, metabolic syndrome, and C-reactive protein in the west of Scotland coronary prevention study. Diabetes, 53, 2855–2860.

[17] Ozarova B et al. (2002). High alanine aminotransferase is associated with decreased hepatic insulin sensitivity and predicts the development of type 2 diabetes. Diabetes, 51, 1889–1895.

[18] Siddiqi SS, Borse AG, Pervez A and Anjum S. (2017). A study of bone turnover markers in gestational diabetes mellitus. Indian journal of endocrinology and metabolism, 21(1), 38.

[19] Chen SC, Tsai SP, Jhao JY, Jiang WK, Tsao CK and Chang LY. (2017). Liver fat, hepatic enzymes, alkaline phosphatase and the risk of incident type 2 diabetes: a prospective study of 132,377 adults. Scientific reports, 5, 7(1), 1-9.

[20] Perry IJ, Wannamethee SG and Shaper AG. (2019). Prospective study of serum gamma-glutamyltransferase and risk of NIDDM. Diabetes Care, 21, 732–737.

[21] Nannipieri M, et al. (2005). Liver enzymes, the metabolic syndrome, and incident diabetes: The Mexico City Diabetes Study. Diabetes Care, 28, 1757–1762.

[22] Cheung CL, Tan KC, Lam KS and Cheung BM. (2013). The relationship between glucose metabolism, metabolic syndrome, and bone-specific alkaline phosphatase: a structural equation modeling approach. The Journal of Clinical Endocrinology & Metabolism, 1, 98(9), 3856-63.

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