Research Article

American Journal of Psychiatry Research & Reviews

Gender-specific cut-off values of Phosphatidylethanol in Blood to Identify Alcohol Dependence

Razvodovsky Y.E.*

International Academy of Sobriety, Grodno, Belarus.

***Correspondence Author:**
Razvodovsky Y.E, International Academy of Sobriety, Grodno, Belarus.

Received: 07 Aug 2026, **Accepted:** 11 Aug 2026, **Published:** 20 Aug 2026

Citation: Razvodovsky Y.E Gender-specific cut-off values of Phosphatidylethanol in Blood to Identify Alcohol Dependence. *American J Psy Res Rev*. 2026; 1(1), 01-04.

Summary

Aims. *To establish the gender-specific cut-off value of phosphatidylethanol (PEth) concentration in the blood for detecting alcohol dependence.* ***Methodology.*** *Using the method of high-performance liquid chromatography - tandem mass spectrometry (HPLC - MS), the concentration of PEth in the blood of 127 alcohol-dependent men and 25 alcohol-dependent women undergoing hospital treatment was determined. To assess the diagnostic accuracy and to establish the gender-specific cut-off values of PEth concentration, a ROC (receiver operating characteristic) analysis was performed. Statistical data processing was carried out using the Statistica 10.0 program.* ***Results.*** *ROC analysis identified a cut-off value of 495 ng/ml for men and 385 ng/ml for women, above which the likelihood of alcohol dependence was high. At this cut-off value, the model demonstrated strong performance with sensitivity of 99% and 100%, specificity of 96% and 98%, PPV of 98% and 96%, and NPV of 98% and 100% for men and women respectively.* ***Conclusion****. The results of the study indicate the high diagnostic reliability of PEth as a biochemical marker of alcohol dependence. Gender-specific cut-off values of PEth should be taken into account when using this biochemical marker in the detection of alcohol dependence.*

Keywords: phosphatidylethanol, cut-off value, alcohol dependence.

Alcohol dependence is globally prevalent disorder [3,10]. Objective measures for efficiently detecting alcohol-induced disorders are critically needed in clinical practice [1,6]. Alcohol metabolites can serve as reliable markers of alcohol abuse to complement self-report [9]. Phosphatidylethanol (PEth) has been gaining popularity as a direct biochemical marker to identify chronic alcohol intoxication [11]. PEth is a group of abnormal phospholipids which are formed in cell membranes by a transphosphatidylation reaction from phosphatidylcholine only in the presence of ethanol [8]. Recent findings suggest that PEth is superior to the indirect biomarkers such as gamma-glutamyl-transpeptidase (GGT), carbohydrate deficient transferrin (CDT), and mean corpuscular volume (MCV) which are confounded by sex, age, non-alcohol comorbidities [2,5].

There is some evidence that gender-related differences in alcohol metabolism, body composition and drinking pattern may affect both the formation and elimination of PEth [13]. Evidence also suggests that women may exhibit higher biomarker concentrations than men at comparable levels of alcohol intake [10]. However, findings are not entirely consistent, and standardized gender-specific cut-offs remain lacking. Recognition of these differences is essential to avoid misclassification and to improve the accuracy of alcohol use assessment.

PEth has been validated to identify harmful drinking in a variety of settings including forensic pathology, treatment programs and prenatal screening [2,7]. However, evaluation of PEth as a marker for alcohol abuse in hospitalized settings is lacking and sparse data are available regarding alcohol-dependent patients. At the present time, there is no consensus regarding the gender-specific cut-off value for PEth concentration in blood to be used for detecting alcohol dependence [6].

The aim of this study was to establish the gender-specific cut-off value of PEth concentration in the blood for detecting alcohol dependence.

Materials and methods

The study involved 127 alcohol-dependent men and 25 alcohol-dependent women undergoing inpatient treatment at the Grodno regional clinical center. The control group consisted of 136 moderately drinking (no more than one standard drink per day) men and 36 moderately drinking women. The study was approved by the clinic's Ethics Committee, and written informed consent was obtained from all participants. Venous blood was samples upon patient admission, prior to the initiation of any medical or detoxification procedures. Whole blood samples collected in Vacutainer were kept at room temperature in sampling room and during transport. The concentration of PEth (homologue 16:0/18:1) in the blood was determined by high-performance liquid chromatography - tandem mass spectrometry (HPLC - MS) [12]. Statistical data analysis (descriptive statistics, correlation analysis, dispersion analysis, logistic regression) was performed using Statistica, version 10.0 (StatSoft Inc., Tulsa, OK, USA). The Shapiro-Wilk criterion was used to test statistical hypotheses about the type of distribution. Differences between independent groups were analyzed using one-way ANOVA followed by assessment using the Shapiro-Wilk test. Receiver Operating Characteristic (ROC) analysis was performed to assess diagnostic accuracy (sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV)), as well as to determine the optimal threshold concentration of PEth. To assess the prognostic value, the area under the ROC curve (AUC) was determined. The diagnostic accuracy of the marker increases as this indicator approaches unity. The 95% confidence interval of the AUC was calculated according to DeLong. The Youden index was used to determine the threshold level.

Results

The mean value of the PEth concentration in the blood of alcohol-dependent men and women was significantly higher than in the blood of moderate drinkers. The mean value of the PEth concentration in the blood of alcohol-dependent men was significantly higher than in the blood of alcohol-dependent women (Table 1).

Table 1: Values of PEth concentration in the blood, ng/ml.

Gender	Control	Alcohol dependence
males	105 ± 23,9	2336 ± 148*
females	50.7 ± 7,69†	1887 ± 192*†

* – p< 0,05 in comparison to control
† – p< 0,05 in comparison to males

Binary logistic regression analysis was conducted to model the relationship between PEth concentration (ng/ml) and group status (0 = control, 1 = alcohol dependence). The resulting model was of the form:

$$\textbf{logit}(P) = \beta_0 + \beta_1 \times \textbf{PEth},$$

where *P* is the probability of belonging to the alcohol-dependent group, β_0 is the intercept, and β_1 is the regression coefficient for PEth concentration (Table 2).

Table 2: Results of binary logistic regression estimating the probability of alcohol dependence based on PEth concentration in the blood.

males	Coefficient (β)	St. Error	Z-value	P-value
	-4,81	1,18	-4,08	0,000
PEth	0,008	0,002	4,02	0,000
females	Coefficient (β)	St. Error	Z	P
	-6,47	1,57	-4,11	0,000
PEth	0,009	0,002	3,64	0,000

(ROC) analysis identified a cut-off value of 495 ng/ml for men and 385 ng/ml for women, above which the likelihood of alcohol dependence was high. At this cut-off value, the model demonstrated strong performance with sensitivity of 99% and 100%, specificity of 96% and 98%, PPV of 98% and 96%, and NPV of 98% and 100% for men and women respectively. The area under the ROC curve (AUC) was 0.99 for men and women, indicating a very good predictive value of the model (Table 3).

Table 3: Results of ROC analysis.

Parameters	Males	Females
AUC [95% ДИ]	0,997 [0,994-1,0]	0.998 [0,99-1,0]
p	>0,336 [0,021–0,912]	>0,05 [0,013–0,5]
cut-off value, ng/ml	495 [115–858]	385 [234–704]
Sensitivity %	99	100
Specificity %	96,2	97,7
PPV %	98	85,7
NPV %	98,1	100

Discussion

The results indicate the high efficiency of PEth as a biochemical marker of alcohol dependence, which is consistent with the results of previous studies [2,5]. Most studies report that there is no clear evidence for gender differences regarding formation or elimination of PEth [13]. However, women have a higher specific gravity of fat, in which alcohol is insoluble, and, accordingly, a lower specific gravity of water [4]. Therefore, the dose of alcohol that must be drunk to achieve a detectable level of PEth in the blood is lower in women than in men. We did not see a gender differences in diagnostic performance of PEth, which is in agreement with other studies that found no sex differences in PEth sensitivity [5].

The differences we found between the concentration of PEth in the blood of moderately drinking men and women, as well as in alcohol-dependent men and women, are most likely due to the higher level of alcohol consumption in men [4]. The gender differences in the cut-off values of PEth for discrimination between moderate alcohol consumption and alcohol dependence, found in the present study, are explained by the higher level of PEth in the blood of men. These finding does support routine implementation of gender-specific PEth cut-offs.

In conclusion, the results of this inpatient treatment study highlighted the clinical value of alcohol biomarkers as objective measures of chronic alcohol abuse. These findings demonstrate a good clinical efficiency of PEth for detecting alcohol dependence. It was found that the PEth content in the blood of alcohol-dependent men is higher than in alcohol-dependent women. It was also shown that the cut-off values of PEth for discrimination between moderate alcohol consumption and alcohol dependence is higher in men than in women. Gender differences in the cut-off values of PEth should be taken into account when using this biochemical marker in the detection of alcohol dependence. Although PEth 16:0/18:1 seems very promising as a biomarker for alcohol dependence, further research is necessary focusing on the determination of sex-specific cut-off value and identification of confounding factors.

References

1. Andresen-Streichert H., Müller A., Glahn A., Skopp G., Sterneck M. Alcohol biomarkers in clinical and forensic contexts. Dtsch Arztebl Int. 2018;115: 309–315.
2. Aradottir S., Asanovska G., Gjerss S., Hansson P., Alling C. Phosphatidylethanol concentrations in blood are correlated to reported alcohol intake in alcohol-dependent patients. Alcohol Alcohol. 2006;41(4):431-7.
3. Babor T.F., Casswell S., Graham K., Huckle T., Livingston M., Rehm J., Room R., Rossow I., Sornpaisarn B. Alcohol: No Ordinary Commodity-a summary of the third edition. Addiction. 2022;117(12):3024–3036.
4. Erol A, Karpyak VM. Sex and gender-related differences in alcohol use and its consequences: contemporary knowledge and future research considerations. Drug Alcohol Depend. 2015;156:1–13.
5. Hartmann S., Aradottir S., Graf M., Wiesbeck G., Lesch O., Ramskogler K., Wolfersdorf M., Alling C., Wurst F.M. Phosphatidylethanol as a sensitive and specific biomarker: comparison with gamma-glutamyl transpeptidase, mean corpuscular volume and carbohydrate-deficient transferrin. Addict Biol. 2007;12(1):81-4.
6. Helander A. Biological markers in alcoholism. Journal Neural Transm Suppl. 2003;66:15–32.
7. Helander A., Hermansson U., Beck O. Dose-Response Characteristics of the Alcohol Biomarker Phosphatidylethanol (PEth)-A Study of Outpatients in Treatment for Reduced Drinking. Alcohol Alcohol. 2019;54(6):567-573.
8. Hill-Kapturczak N, et al. Differences in the synthesis and elimination of Phosphatidylethanol 16:0/18:1 and 16:0/18:2 after acute doses of alcohol. Alcohol Clin Exp Res. 2018;42(5):851–60.
9. Liangpunsakul S., Lai X., Ross R.A. Novel serum biomarkers for detection of excessive alcohol use. Alcohol Clin Exp Res. 2015;39:556–565.
10. Moskalewicz J., Razvodovsky Y.E., Wieczorek P. East-West disparities in alcohol-related harm. Alcoholism and Drug Addiction. 2016;29:209–222.
11. Razvodovsky Y.E. Phosphatidylethanol as a marker of alcohol abuse. International Archive Substance
12. Abuse Rehabilitation. 2022; 4(1):1-5.
13. Schuriberco A.V., Razvodovsky Y.E. Method of estimation of phosphatidylethanol concentration in blood. Academic Journal of Western Siberia. 2022; 18 (4): 36-42.

14. Wurst F.M., Thon N., Aradottir S., Hartmann S., Wiesbeck G.A., Lesch O., Skala K., Wolfersdorf M., Weinmann W., Alling C. Phosphatidylethanol: normalization during detoxification, gender aspects and correlation with other biomarkers and self-reports. Addict Biol. 2010;15(1):88-95.