Original Research Paper

Volume - 15 | Issue - 08 | August - 2025 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Psychiatry

IMPACT OF SOCIO-DEMOGRAPHIC VARIABLES ON SERUM CPK TOTAL LEVEL IN PSYCHIATRIC PATIENTS: A REGRESSION ANALYSIS.

Dr Seram Chaoba Devi* Assistant professor, Department of Psychiatry, Shija Academy of Health Sciences, Imphal, Manipur. *Corresponding Author

Dr Rajkumar Tarusana Tutor, Department of Pharmacology, Shija Academy of Health Sciences, Imphal, Manipur.

ABSTRACT **Objective:** To identify the prognostic socio-demographic variables and their causal effects on the serum CPK total level in Psychiatric patients. **Methods:** This study is based on a primary sample of 103 psychiatric disorder patients admitted to the Psychiatry Ward of Maulana Azad Medical College and associated hospitals in New Delhi. **Results:** Of seven prognostic variables considered, age and sex were identified as key influencing factors on serum CPK total level, particularly on day 1. **Conclusion:** The multiple regression models-Entered and Stepwise-proved suitable to identify socio-demographic risk factors across time points. These variables collectively explained 4.3% of serum CPK variation at day 1, increasing up to 69.2% by week 3.

KEYWORDS : Serum CPK total, sex

INTRODUCTION:

Creatine phosphokinase (CPK), also known as creatine kinase (CK), is an essential enzyme that facilitates the regeneration of ATP in tissues with high energy demands, such as muscle and brain. While its clinical relevance in myocardial infarction and muscular dystrophy is well documented, its role as a biomarker in neuropsychiatric conditions has gained renewed attention in recent years.

Recent literature highlights elevated serum CPK as a biomarker of neuromuscular stress, mitochondrial dysfunction, and even psychotropic medication effects in psychiatric patients[1,2]. Elevated levels have been reported in schizophrenia, catatonia, alcohol dependence syndrome, and bipolar disorder-even in the absence of neuroleptic malignant syndrome [3,4].

In recent studies, CPK has been associated with agitation, psychomotor activity, and pharmacological factors-particularly antipsychotics and mood stabilizers [5]. However, the role of socio-demographic variables in CPK fluctuation is not well understood. Some studies suggest age, sex, and BMI influence baseline CPK values, while others show weak or inconsistent associations [6,7].

Therefore, this study aims to explore the influence of socio-demographic variables- sex, age, residence, education, height, weight, and BMI-on serum CPK levels in psychiatric patients during hospitalization. This investigation fills a gap in understanding whether these non-clinical variables play a cumulative or transient role in CPK variability.

MATERIALS AND METHODS:

The present study is based on a primary sample of 103 psychiatric disorder patients according to DSM-5 who satisfied with the laydown inclusion and exclusion criteria and were admitted in the Psychiatry wards of Maulana Azad Medical College and Associated Hospital including Gobind Ballabh Pant Institute of Post Graduate Medical College Education and Research (GIPMER). The Cross-Sectional Observational Study is adopted as study design. The background variables and blood sample were collected, only from those who gave informed consent on the format provided, on the semi-structured pro forma designed for the purposed. The study was conducted over a period of one year during December, 2018 to December, 2019.

Inclusion criteria adopted for the purposed were 1. Patient of either sex admitted to psychiatry ward with a diagnosis of mental disorder according to the Diagnostic and Statistical Manual of Mental Disorder (DSM-5) criteria. 2. Age between 18 years and 60 years. And 3. Patient/relative who had given a written informed consent. While exclusion criteria were 1. Patient having a known heart disease. 2. Patient with an impaired renal function. 3. Patient with a muscular disease. 4. Pregnant patient. 5. Patient who has been admitted for less than 24 hours. 6. Patient who is on statins. 7. Patient with an endocrine disease. And 8. Patient who has had strenuous exercise within 6 hours before admission.

Based on a previous study's[1] result with 50% prevalence of elevated CPK level of psychiatric patients; and assumption of Z= 1,96 for 95% confidence (i.e., $\alpha = 0.005$) and e (Standard Error) as 10%, the adequate sample size for the study is found to be n = 96 study subjects. Due consideration of some drop-out rate finally, select a sample of 103 study subjects. The formula viz., $n = Z^2 * P (1 - P) / e^2$ is used for determination of sample size.

After thorough scrutiny and diagnosing the data, statistical analysis was performed by using SPSS Statistics Version 21. In order to establish association between Serum CPK total level and seven socio-demographic variables – sex, age, residence, education, height, weight, and BMI, the multiple regression model viz., Entered and Stepwise methods are adopted. Serum CPK total is the response variable while socio-demographic variables are taken as prognostic variable in the present study. All comparisons are two-sided and the P-values < 0.05, < 0.01 and < 0.001 are taken as the cut off values for significant, highly significant, and very highly significant respectively.

RESULTS AND OBSERVATIONS:

To assess the prognostic influence of selected socio-demographic variables on serum Creatine Phosphokinase (CPK) total levels at various time points of psychiatric admission, both standard multiple linear regression (Enter method) and stepwise regression (Backward elimination method) were applied. The independent variables considered included sex, age, residence, education, height, weight, and BMI. The dependent variable was serum CPK total level measured at different time points: Day 1, Day 4, Day 8, Week 2, and Week 3.

Multiple Linear Regression (Enter Method)

The Enter method regression analysis revealed a progressive increase in the explanatory power (R^2) of the model across time points, suggesting an increasing influence of socio- demographic variables on serum CPK levels during prolonged hospitalization.

Table-1 Model Summary Across Time Points

Time Point	R	R^2	F-value	p-value
Day 1	.209[a]	.043	.585	.767[b]
Day 4	.341[a]	.116	1.561	.159[b]
Day 8	.345[a]	.119	.964	.467[b]
Week 2	.530[a]	.281	1.004	.460[b]
Week 3	.832[a]	.692	.374	.847[b]

a. Predictors: (Constant), BMI, residence, sex, age (year), education, height, weight. b. Dependent Variable: CPK total day 1

At the day 1, only 4.3% of the variation in Serum CPK is explained (R^2=0.043) by the independent variables considered, but the model in insignificant statistically. While at day 4 also the there is a weak model fit; only 11.6% variance of Serum CPK explained by the independent variables. Nevertheless, slightly better fit but still non-significant model at day 8 with 11.9% influenced by the seven independent variables considered. A moderate variance explained (28.1%), but not statistically significant at week 2. Whilst in week 3 a high R^2 (69.2%) is

persisted, but presence of missing data in 'residence' variable causes limited analysis.

2. Coefficient-level Analysis:

Table-2 Regression Coefficients At Day 1 Coefficients

		Unstandardized Coefficients		Standardized Coefficients	t-value	p-value
Model at day 1		β	Std. Error	β		
1	(Constant)	57.130	65.165		.877	.383
	sex	4.194	3.249	.166	1.291	.200
	Age (year)	-.188	.106	-.187	-1.772	.080
	residence	-2.439	3.450	-.073	-.707	.481
	Education	-1.528	3.050	-.054	-.501	.618
	height	-.107	.400	-.063	-.267	.790
	weight	.030	.504	.026	.059	.953
	BMI	-.389	1.411	-.103	-.275	.784

At day 1 the regression coefficients suggest that age showed a marginal negative effect on CPK levels (β = -0.188, p = 0.080), indicating that CPK tends to decrease slightly with age advances. In order words, when one-year advances there is 18.8% decrease in CPK keeping other variables – BMI, residence, sex, Education, height, weight – constant. Sex was a positive but non-significant predictor as evident by β = 4.194, p = 0.200. Other variables (residence, education, height, weight, BMI) were not statistically significant (all p > 0.48).

Table-3 Regression Coefficients At Day 4 Coefficients

		Unstandardized Coefficients		Standardized Coefficients	t-value	p-value
Model at day 4		β	Std. Error	β		
1	(Constant)	-58.224	324.883		-.179	.858
	sex	11.851	16.672	.097	.711	.479
	Age (year)	-.442	.551	-.090	-.802	.425
	residence	-7.607	17.963	-.047	-.423	.673
	Education	5.845	15.371	.044	.380	.705
	height	.927	1.991	.111	.466	.643
	weight	-.555	2.523	-.104	-.220	.827
	BMI	-.671	7.088	-.038	-.095	.925

At day 4 no variable reached significance as its p-value greater than 0.005, the significant level adopted. All predictors had weak standardized coefficients (β < ±0.11), suggesting minimal contribution to variance in Serum CPK levels at this stage.

Table-4 Regression Coefficients At Day 8 Coefficients

		Unstandardized Coefficients		Standardized Coefficients	t-value	p-value
Model day 8		β	Std. Error	β		
1	(Constant)	-154.457	94.310		-1.638	.108
	sex	4.561	4.789	.162	.952	.346
	Age (year)	-.015	.145	-.014	-.105	.917
	residence	-12.610	5.292	-.309	-2.383	.021
	Education	2.071	4.292	.066	.483	.631
	height	1.104	.579	.582	1.906	.062
	weight	-1.914	.736	-1.495	-2.603	.012
	BMI	5.354	2.038	1.307	2.627	.011

In case of the day 8, residence (β = -12.610, p = 0.021), weight (β = -1.914, p = 0.012), and BMI (β = +5.354, p = 0.011) were statistically significant predictors. Thus, these findings suggest that urban/rural status, nutritional status, and body composition start to significantly influence CPK levels by Day 8 of hospitalization.

Table-5 Regression Coefficients At Week 2 Coefficients

		Unstandardized Coefficients		Standardized Coefficients	t-value	p-value
Model at week 2		β	Std. Error	β		
1	(Constant)	-265.179	223.468		-1.187	.252
	sex	-9.548	9.007	-.310	-1.060	.304
	Age (year)	.010	.306	.009	.034	.973
	residence	4.455	9.974	.094	.447	.661
	Education	13.607	9.765	.378	1.393	.181
	height	1.841	1.360	1.105	1.354	.193
	weight	-3.015	2.165	-2.161	-1.392	.182
	BMI	6.965	5.532	1.551	1.259	.225

At week 2, none of the variable reached conventional statistical significance. However, education, height, and BMI showed moderate effect sizes (β ≈ 1.1–1.5), suggesting a potentially cumulative impact of body metrics and socioeconomic status.

However, at week 3, model could not be fully processed due to missing data in the 'residence' variable.

3. Stepwise Regression (Backward Elimination):

The stepwise backward elimination regression model is applied at day1, and it process gradually reduced the model from 7 to 1 predictor variable, retaining only statistically more robust contributors. The model 1 is as same as Enter method shown elsewhere considering 7 independent variables. While in model 2 is fitted after eliminating one least influencing variable among them i.e., BMI. Similarly, education, height, weight, residence, and age were successively eliminated in model 3 to 7 respectively. Only the most indispensable variable i.e., sex was considered in the final model (model 7).

Table-6 Step Wise Model Summary

Model	R	R^2	Model test value	
			F-value	p-value
1	.209	.043	.585	.767
2	.208	.043	.687	.660
3	.205	.042	.809	.546
4	.202	.041	.986	.419
5	.199	.040	1.293	.281
6	.188	.035	1.738	.182
7	.173	.030	2.952	.089

Table-7 Step Wise Regression Coefficients

Coefficients						
		Unstandardized Coefficients		Standardized Coefficients	t-value	p-value
Model		β	Std. Error	β		
1	(Constant)	1168.499	3974.636		.294	.769
	sex	261.231	198.177	.171	1.318	.191
	Age (year)	-3.581	6.480	-.059	-.553	.582
	residence	133.867	210.404	.067	.636	.526
	Education	64.292	186.039	.038	.346	.730
	height	-7.837	24.402	-.076	-.321	.749
	weight	7.042	30.727	.104	.229	.819
	BMI	-10.001	86.067	-.044	-.116	.908
2	(Constant)	782.467	2170.331		.361	.719
	sex	263.506	196.135	.173	1.343	.182
	Age (year)	-3.608	6.441	-.059	-.560	.577
	residence	136.558	207.989	.068	.657	.513
	Education	63.706	184.960	.037	.344	.731
	height	-5.624	15.172	-.055	-.371	.712
	weight	3.612	8.514	.053	.424	.672
3	(Constant)	812.116	2158.210		.376	.708
	sex	273.182	193.181	.179	1.414	.161
	Age (year)	-4.106	6.247	-.067	-.657	.513
	residence	135.411	206.963	.068	.654	.515
	height	-5.537	15.097	-.054	-.367	.715
	weight	3.878	8.438	.057	.460	.647
4	(Constant)	41.989	496.379		.085	.933
	sex	235.236	162.378	.154	1.449	.151
	Age (year)	-4.216	6.211	-.069	-.679	.499
	residence	127.679	204.927	.064	.623	.535
	weight	2.322	7.259	.034	.320	.750
5	(Constant)	168.636	297.942		.566	.573
	sex	250.010	154.925	.164	1.614	.110
	Age (year)	-4.363	6.164	-.072	-.708	.481
	residence	132.752	203.334	.066	.653	.515
6	(Constant)	279.087	244.512		1.141	.257
	sex	257.303	154.054	.169	1.670	.098
	Age (year)	-4.501	6.142	-.074	-.733	.465

7	(Constant)	120.636	113.900		1.059	.292
	sex	263.641	153.440	.173	1.718	.089

Sex emerges as the most consistent variable across reductions, with marginal predictive potential for Serum CPK levels, particularly on day 1. In other words, one unit change in sex (from female to male) the change in Serum CPK levels will be 17.18%, keeping other variables constant. In the sense that male has more Serum CPK levels than that of his counterpart female. However, the model still just below the significant level. Variables like **BMI, height, weight**, and **residence** had negligible impact and were eliminated early. But their less importance sequences are **BMI, education, height, weight, residence, age and sex.**

Stepwise regression confirmed the **limited explanatory power** of the seven socio- demographic variables for initial Serum CPK levels.

DISCUSSION:

The findings of this study indicate a gradual increase in the explanatory power of socio- demographic variables on serum CPK levels across the timeline of hospitalization, especially notable by week 3 ($R^2 = 69.2\%$). However, at the initial stage (day 1), only 4.3% of variance was explained, supporting previous assertions that acute CPK fluctuations in psychiatric patients may not be solely driven by socio-demographics [7,8].

Sex and age emerged as the most consistently associated variables across time points, though not always statistically significant. This aligns with prior findings suggesting baseline CPK is generally higher in males and tends to decrease with age due to muscle mass reduction [6,7].These physiological trends, although subtle, could be clinically relevant when interpreting elevated CPK in psychiatric populations.

Interestingly, by day 8, **residence**, **weight**, and **BMI** became statistically significant, suggesting environmental and anthropometric factors may start influencing metabolic stress markers as treatment or hospitalization progresses. This observation is consistent with Feier et al. (2011), who noted that euthymic bipolar patients still presented with varying CPK levels depending on physical and social conditions.

Moreover, the weak model fit in the early hospitalization stages may reflect the dominance of clinical factors—such as psychotropic medication, catatonia, and acute stress response—which were not included in this analysis. Several studies report that second-generation antipsychotics can induce mild elevations in serum CPK, independent of demographic profiles.

The stepwise regression analysis further corroborates that sex remained the most retained predictor, albeit with borderline significance. This marginal association is biologically plausible and echoed in studies involving both psychiatric and healthy populations [6]. However, the inability of other variables like BMI, education, or residence to maintain consistency across models suggests their influence might be context-dependent or mediated through more complex pathways not captured in this analysis.

CONCLUSION:

The multiple regression and stepwise analyses suggest that socio-demographic factors alone have limited but gradually increasing influence on Serum CPK levels during psychiatric hospitalization. While variables like sex, BMI, and residence showed sporadic significance, further research incorporating clinical variables (e.g., medication type, psychomotor agitation, muscle damage markers) is essential for a more predictive model. Nevertheless, sex and age stand out as the most robust (though not always significant) predictors across models, particularly in the early phase of hospitalization.

REFERENCES:

1. Shimizu T, Watanabe K, Yamashita S, et al. (2017). *Serum creatine kinase levels in patients with schizophrenia: relationship with psychomotor agitation and antipsychotic medication*. Psychiatry Research, 257, 205–209.
2. Hsieh MH, Hsiao MC, Liu CY. (2020). *Benign creatine kinase elevation associated with antipsychotics: a chart review study*. Psychiatry Clin Neurosci, 74(3), 135–142.
3. Gupta A, Gupta C, Khurana S. (2015). *Evaluation of total creatine kinase levels in neuro-psychiatric disorders*. Int J Med Public Health, 5(4), 362–366.
4. Feier G, Valvassori SS, Rezin GT, et al. (2011). *Creatine kinase levels in patients with bipolar disorder: depressive, manic, and euthymic phases*. Rev Bras Psiquiatr, 33(2), 171–175.
5. Martínez-Cengotitabengoa M, MacDowell KS, Alberich S, et al. (2019). *Creatine kinase as a marker of treatment response in patients with psychosis*. Psychopharmacology, 236(7), 2129–2136.
6. Pereira C, Costa P, Cruz F, et al. (2016). *Determinants of creatine kinase levels in healthy adults: influence of gender, age, and physical activity*. Ann Clin Biochem, 53(5), 548–554.
7. Darragh I, O'Connor L, McLaughlin G, et al. (2021). *Creatine kinase variability and reference intervals: impact of age, sex, and ethnicity*. Clin Chem Lab Med, 59(3), 539–546.
8. Nevins MA, Saran M, Bright M, Lyon LJ. (1973). *Pitfalls in interpreting serum creatine phosphokinase activity*. JAMA, 224(10), 1382–1387.