Open Access Original Research Article

VITAMIN B_{12} LEVELS IN GENERAL ADULT POPULATION OF SINDH.

Mashal Siddiqui[1], Majid Ali Hingoro[2], Shomail Saeed Siddiqui[3], Jawad Mumtaz Sodhar[4], Palwasha Abbasi[5], Arooba Bhutto[6], Mehwish Kashif[7], Kashif Rasheed Shaikh[8].

ABSTRACT

INTRODUCTION: Micronutrients such as vitamins are essential for body to function and perform vital physiological functions. **OBJECTIVE:** To determine the frequency of vitamin B12 levels in general adult population of Sindh. **STUDY DESIGN:** Cross sectional study **PLACE AND DURATION:** Department of Pharmacology, Suleman Roshan Medical College, Tando Adam from January 2021 to September 2021. **METHODOLOGY:** A sample of 1027 normal healthy adults of both genders was selected and entered in study protocol according to the inclusion criteria. 2 ml blood was centrifuged, sera collected and vitamin B12 was measured by ELISA method. Measured vitamin B12 was categorized as sufficiency (≥300 pg/mL), marginal deficiency (200 - 299 pg/mL) and deficiency (<200 pg/mL). Vitamin B12 was tabulated as mean +/- SD and analyzed by Student t-test using SPSS (ver. 19.0) ($P \leq 0.05$). **RESULTS:** Of 1027 participants, 513 (49.9%) were male and 514 (50.01%) were female (P=0.9). Vitamin B12 sufficiency was found in 14.1% subjects compared to 85.9% deficiency. Sufficiency, marginal deficiency and deficiency were found in 14.1%, 15.4% and 70.39% respectively. Mean vitamin B12 in female was 201.3±19.1 pg/ml, 209.6±17.3 pg/ml in male subjects (P=0.0001). Vitamin B12 in total study sample was found as 206.80±83.42 pg/ml. **CONCLUSION:** The present study reports 85.9% of vitamin B12 deficiency. Sufficiency, marginal deficiency and deficiency were found in 14.1%, 15.4% and 70.39% respectively.

KEY WORDS: Vitamin B12, Sufficiency, Deficiency, Adults, Sindh

1. Senior Medical Officer, Department of Surgery, Bahria Town Hospital, Karachi, Sindh, Pakistan
2. Associate Professor, Department of Pharmacology, Mohi-ud-Din Islamic Medical College, Mirpur AJK, Pakistan
3. Associate Professor, Department of Pathology, Indus Medical College Tando Muhammad Khan, Sindh, Pakistan
4. Associate Professor Department of Pharmacology, Indus Medical College Tando Muhammad Khan, Sindh, Pakistan
5. Associate Professor Department of Pharmacology, Suleman Roshan Medical College,Tando Adam, Sindh, Pakistan
6. Women Medical Officer, Civil Hospital,Ghulam Muhammad Mahar Medical College, Sukkur, Sindh, Pakistan
7. Lecturer Department of Management Sciences, Isra University, Hyderabad, Sindh, Pakistan
8. Professor Department of Pharmacology, Suleman Roshan Medical College,Tando Adam, Sindh, Pakistan

Corresponding author: Dr Kashif Rasheed Shaikh -------- MBBS, M. Phil
Professor Department of Pharmacology, Suleman Roshan Medical College,
Tando Adam, Sindh, Pakistan**.** Email: mailboxKxm@gmail.com Cell: 0333 710 33 24

How to cite this article: Siddiqui M[1], Hingoro MA[2], Siddiqui SS [3], Sodhar JM[4], Abbasi P[5], Bhutto A[6], Kashif M[7], Shaikh KR[8] **VITAMIN B_{12} LEVELS IN GENERAL ADULT POPULATION OF SINDH.** *JPUMHS; 2021:11:04,46-50.* http://doi.org/10.46536/jpumhs/2021/11.04.335

Received NOV 4 2021, Accepted On 15 DEC 2021, Published On 31 December 2021

INTRODUCTION

Micronutrients such as vitamins are essential for body to function and perform vital physiological functions. Vitamin B12 is one of the micronutrient vitamins. Vitamin B12 is a water soluble vitamin of animal origin. Vitamin B12 manifests a wide range of disorders affecting nearly every organ and system of human body.[1,2] Role of Vitamin B12 is increasingly recognized in the epigenetic effects, aging, glycemic control, cell division, neuronal functioning, and cognitive function of brain in recent times. Early detection of Vitamin B12 deficiency along with appropriate public health measures may halt various disease processes and may have potential to positively impact associated health conditions. Poor health

awareness, prevalent malnutrition, with inadequate mass-screening at the community-level could potentially contribute to higher prevalence of vitamin B12 deficiency that remains unnoticed in the communities.[1,2] Occurrence of vitamin B12 deficiency varies according to dietary habits, geography, religious, social and cultural practices. Food fortification with vitamin B12 is never observed in the country except for iodine as salt. Countrymen are at high risk of vitamin B12 deficiencies, most probably the rural populations. The rural community is even more vulnerable to vitamin deficiencies due to poor food quality – called the malnutrition. Vitamin B12 deficiency is cause of poor physical, mental and cognitive development. Vitamin B12 is an essential micronutrient for certain biochemical reactions in body. Liver stores vitamin B12, and estimate shows approximating 2000-5000 µg, sufficient for 3 – 5 years. Daily vitamin B12 body requirement approximates 2.5 – 3 µg and daily gut absorption is about 5 µg in well-nourished persons.[3,4] Animal origin of Vitamin B12 is a risk for strict vegetarians in any community. People of poor countries are often consuming vegetables and they are prone to vitamin B12 deficiency.[4] Major causes of vitamin B12 deficiency are the; dietary deficiency, intrinsic factor deficiency, malabsorption syndrome, parasitic infestations, autoimmune and genetic disease. Growing children and pregnant mothers have increased daily vitamins requirement. Pancreatic disease also may cause vitamin B12 deficiency. *Diphyllobothrium latum*, a parasitic agent, is a notorious cause of vitamin B12 deficiency. Vitamin B12 is required for nuclear maturation and cell division in rapidly proliferating cells like the hematopoietic tissue and skin epithelia. Vitamin B12 is a co – enzyme in two forms – the methylcobalamin and S – adenylyl Cobalamin required for nucleotide synthesis.[5,6] Search of medical literature shows few studies have been conducted hence there is need to estimate the vitamin B12 levels in general adult population of country for nutritional status and deficiencies and risk of future disease. The present study is valuable insight of vitamin B12 deficiency in the country.

SUBJECTS AND METHODS

A cross–sectional study was conducted at the Department of Pharmacology, Suleman Roshan Medical College, Tando Adam from January to September 2021. Study ethics was fulfilled and permission was taken in writing before conducting the research. Aim of study was to study and estimate the vitamin B12 levels in health adult population from different cities of Sindh. An online system was generate and shared among the authors. Each author collected the patient data and shared online with the Principal author. A sample of 1027 normal healthy adults of both genders was selected and entered in study protocol according to the inclusion criteria. Sample size was calculated by the "Sampling for proportions" using Rao`s system. Volunteer adults, healthy without any major disease, age 40 – 60 years, and both genders were included. Those taking multivitamin – multimineral pills were strictly excluded. Pregnant and breast feeding ladies were excluded too. Any person taking anti – epileptic drugs, proton pump inhibitors, and taking liver diet were also excluded. Diagnosed cases of ischemic heart disease, chronic liver disease, chronic inflammatory disease, pulmonary tuberculosis, chronic kidney disease and diabetes mellitus were not included. Volunteer's healthy adult subjects were negotiated about the aim and purpose of study. It was informed the blood collected will be used laboratory investigations and data will never be publicized. Expenses of laboratory investigations were paid by the authors. Participants were informed of writing the consent form and study inclusion was on volunteer basis. Participant's data was handled as confidential keeping in custody of principal author. Blood samples were collected under standard conditions after aseptic conditions. 2 ml blood was centrifuged, sera collected and stored at – 20 ^{0}C till biochemical analysis of vitamin B_{12} detection. Vitamin B12 was measured by ELISA method using commercial assay kit. Measured vitamin B12 was categorized as; Category – 1. Sufficiency (≥300 pg/mL), category – 2. Borderline Deficiency (200 - 299 pg/mL) and category – 3. Deficiency (<200 pg/mL).[7] Vitamin B12 was tabulated as mean +/- SD and analyzed by Student t-test. Chi square testing calculated the categorical variables (frequency and %) using SPSS (version 19.0) ($P \leq 0.05$).

RESULTS

Age of male and female participants was 50.3±10.5 and 49.9±11.7 years respectively (P=0.71). Of 1027 participants, 513 (49.9%) were male and 514 (50.01%) were female (P=0.9). Vitamin B12 sufficiency was found in 14.1% subjects compared to 85.9% deficiency. Sufficiency, marginal deficiency and deficiency were found in 14.1%, 15.4% and 70.39% respectively. Mean vitamin B12 in female was 201.3±19.1 pg/ml, 209.6±17.3

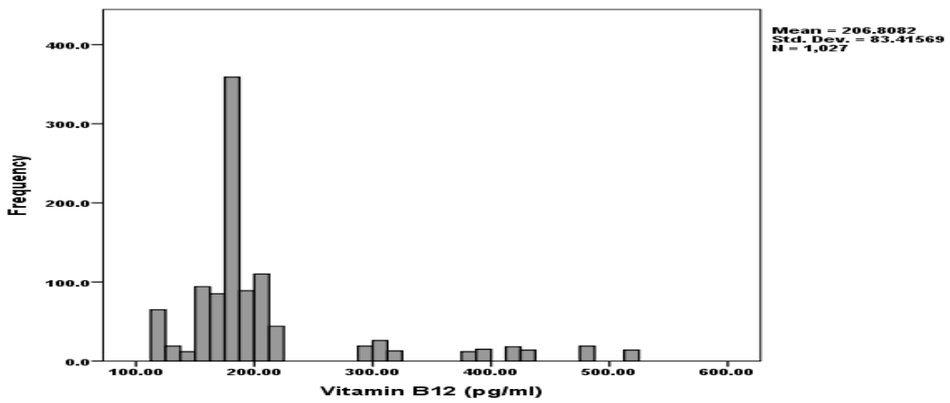
pg/ml in male subjects (P=0.0001). Vitamin B12 in total study sample was found as 206.80±83.42 pg/ml.

Table – 1. Mean +/- SD of vitamin B12 in study population (n=1027)

Vitamin B12	Mean	SD	95% CI Mean		P
			LB	UB	
≥300 pg/mL	391.76	73.19	379.75	403.77	0.0001
200 - 299 pg/mL	212.38	14.44	210.12	214.64	
<200 pg/mL	168.49	20.67	166.98	170.00	
Total	206.80	83.42	201.70	211.92	

Table – 2. Frequency of Vitamin B12 categories in study population (n=1027)

Vitamin B_{12} categories	No.	%	P
Sufficiency (≥300 pg/mL)	145	14.1	0.0001
Marginal Deficiency (200 - 299 pg/mL)	159	15.4	
Deficiency (<200 pg/mL)	723	70.39	
Total	1027	100	



Graph – 1. Bar graph showing vitamin B12 distribution

DISCUSSION

The present is the first cross sectional study conducted to measure the vitamin B12 deficiency in adult health population of Sindh. In present study, the vitamin B12 sufficiency was found in 14.1% subjects only compared to 85.9% deficiency. Sufficiency, marginal deficiency and deficiency were found in 14.1%, 15.4% and 70.39% respectively (P=0.0001). The observations are similar to previous studies from Pakistan.[8,9] Vitamin B12 in total sample was found as 206.80±83.42 pg/ml that is termed as marginal deficiency. Vitamin B12 sufficiency was found in 14.1% subjects compared to 85.9% deficiency. Sufficiency, marginal deficiency and deficiency were found in 14.1%, 15.4% and 70.39% respectively. Mean vitamin B12 in female was 201.3±19.1 pg/ml, 209.6±17.3 pg/ml in male subjects (P=0.0001). Findings of present study are highly consistent to previous studies.[10,11] Of 1027 participants, 513 (49.9%) were male and 514 (50.01%) were female (P=0.9). Age of male and female participants was 50.3±10.5 and 49.9±11.7 years respectively (P=0.71). Old age population of present study is consistent with previous studies.[12,13] In present study, 145 (14.1%) participants proved vitamin B12 sufficiency, whilst that 85.9% proved marginal deficiency or deficiency. The findings are consistent with previous studies.[12,13] Vitamin B12 deficiency of 85.9% is in keeping with previous studies.[14,15] Our findigns of vitamin B12 deficiency are consistent with previous studies.[16-20] A previous study[21] study found 85% vitamin B12 deficiency in vegans and 78.5% in non – vegans. The findigns are highly concordant with observations of present study. Frequency of 85.9% vitamin B12 deficiency is also consistent with other previous studies.[13, 20-23] Previous study[20] reported 76% prevalence of vitamin B12 deficiency. The findings of present study show the depth of vitamin B12 deficiency. The problem may even be severe deficiency of this vitamin B12 deficiency but studies are lacking over large scale at national level. Present study has limitation of small sample that may not be representative of population. Hence findigns of present study may not be generalizable to other settings and geographical areas but erupting health issues caused by vitamin deficiencies may be

overcome by supplementing the populace. Our study is a contribution to national medical literature.

CONCLUSION

In present study, 85.9% of participants show vitamin B12 deficiency. Sufficiency, marginal deficiency and deficiency were found in 14.1%, 15.4% and 70.39% respectively. Further studies on large scale from different areas of Sindh are recommended for precise vitamin B12 deficiency in the indigenous population. Vitamin supplements may prevent complicated health problems in those suffering from vitamin deficiencies.

ETHICS APPROVAL: The ERC gave ethical review approval

CONSENT TO PARTICIPATE: written and verbal consent was taken from subjects and next of kin

FUNDING: The work was not financially supported by any organization. The entire expense was taken by the authors

ACKNOWLEDGEMENTS: We would like to thank the all contributors and staff and other persons for providing useful information.

AUTHORS' CONTRIBUTIONS: All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated in the work to take public responsibility of this manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST: No competing interest declared.

REFERENCES

1. Jatoi S, Hafeez A, Riaz SU, Ali A, Ghauri MI, Zehra M. Low Vitamin B12 Levels: An Underestimated Cause Of Minimal Cognitive Impairment And Dementia. Cureus 2020; 12(2): e6976.
2. Singla R, Garg A, Surana V, Aggarwal S, Gupta G, Singla S. Vitamin B12 deficiency is endemic in Indian population: A perspective from North India. Indian J Endocrinol Metab 2019; 23:211-4.
3. Al-Musharaf S, McTernan PG, Hussain SD, Aleisa KA, Alnaami AM, Wani K, et al. Prevalence and Indicators of Vitamin B12 Insufficiency among Young Women of Childbearing Age. Int J Environ Res Public Health 2021; 18: 1.
4. Ata F, Bint I Bilal A, Javed S, Chaudhry HS, Sharma R, Malik RF, et al. Optic neuropathy as a presenting feature of vitamin B-12 deficiency: A systematic review of literature and a case report. Ann Med Surg 2020; 60:316-22.
5. Sundarakumar JS, Shahul Hameed SK, SANSCOG Study Team, Ravindranath V. Burden of Vitamin D, Vitamin B12 and Folic Acid Deficiencies in an Aging, Rural Indian Community. Front Public Health 2021; 9:707036.
6. Aniqa J, Mushtaq S, Hasan R. Vitamin B12 deficiency: prevalence and evaluation of a reversible co-morbidity in hypothyroid patients. Pak J Nuclear Med 2016; 6:23-9.
7. Nizamani GS, Memon IA, Memon A, Khoharo HK. Vitamin B12 Deficiency with Megaloblastic Anemia: An Experience at Tertiary Care Hospital of Sindh. J Liaquat Uni Med Health Sci 2014; 13 (01): 13-7.
8. Siddiqui B, Rabindranath D, Faridi SH, Khan A, Haiyat S, Eswaran R. Megaloblastic anemia: A common but often neglected cause of pyrexia of unknown origin. J Transl Int Med 2015; 3(2): 64–7.
9. Hasan N, Makki MU, Abid I, Butt MRA. Association of vitamin B12 deficiency with intake of oral metformin in diabetic patients. J Ayub Med Coll Abbottabad 2019; 31(1):72–5.
10. Khan A, Shafiq I, Hassan Shah M. Prevalence of Vitamin B12 Deficiency in Patients with Type II Diabetes Mellitus on Metformin: A Study from Khyber Pakhtunkhwa. Cureus 2017; 9(8):e1577.
11. Rauf A, Khan M, Arshad A. Frequency of Vitamin B12 Deficiency in patients with Type 2 Diabetes Mellitus Taking Metformin. Pak J Med Health Sci 2015; 9 (4): 1316-8
12. Ahmed S, Bogiatzi C, Hackam DG, Spence JD. Vitamin B $_{12}$ deficiency and hyperhomocysteinaemia in outpatients with stroke or transient ischemic attack: a cohort study at an academic medical centre. BMJ Open 2019; 9 (1):e026564.
13. Yasmeen T, Ali J, Khan K, Siddiqui N. Frequency and causes of anemia in Lymphoma patients. Pak J Med Sci 2019; 35(1):61-65.
14. Tesega WW, Genet S, Natesan G, Tarekegan G, Girma F, Chalchisa D, et al. Assessment of Serum Vitamin B12 and Folate Levels and Macrocytosis in Patients with Type 2 Diabetes Mellitus on Metformin Attending Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia: A Cross-Sectional Study. Diab Metab Syn Obesity: Targets Ther 2021:14 2011–18.
15. Devi A, Rush E, Harper M, Venn B. Vitamin B12 Status of Various Ethnic Groups Living in New Zealand: An Analysis of the Adult Nutrition Survey 2008/2009. Nutrients 2018; 10(2):181.

16. Jabeen A, Mushtaq S, Raza H, Memon MA. Vitamin B_{12} deficiency: prevalence and evaluation of a reversible co-morbidity in hypothyroid patients. Pak J Nucl Med 2016;6(1):25-31
17. Sukumar N. Prevalence of vitamin B_{12} insufficiency during pregnancy and its effect on offspring birth weight: a systematic review and meta-analysis. Am J Clin Nutr 2016; 103:1232–51.
18. Al Saeed RR, Baraja MA. Vitamin B12 deficiency in patients with type 2 diabetes mellitus using metformin and the associated factors in Saudi Arabia. Saudi Med J 2021; 42 (2):161-165.
19. Owhin SO, Adaja TM, Fasipe OJ, Ak hideno PE, Kalejaiye OO, Kehinde M O.Prevalence of vitamin B12 deficiency among metformin-treated type 2 diabetic patients in a tertiary institution, South-South Nigeria. SAGE Open Med 2019; **7**: 2050312119853433.
20. Obeid R, Heil SG, Verhoeven MMA, van den Heuvel EGHM, de Groot LCPGM and Eussen SJPM .Vitamin B12 Intake From Animal Foods, Biomarkers, and Health Aspects. Front. Nutr 2019; 6:93.
21. Iqtidar N, Chaudary MN. Misdiagnosed vitamin B_{12} deficiency: a challenge to be confronted by use of modern screening markers. J Pak Med Assoc 2012; 62 (11):1223-8.
22. Soofi S, Khan GN, Sadiq K, Ariff S, Habib A, Kureishy S, et al. Prevalence and possible factors associated with anaemia, and vitamin B_{12} and folate deficiencies in women of reproductive age in Pakistan: analysis of national-level secondary survey data. BMJ Open 2017; 7:e018007.
23. Miyan Z, Waris N; MIBD. Association of vitamin B_{12} deficiency in people with type 2 diabetes on metformin and without metformin: a multicenter study, Karachi, Pakistan. BMJ Open Diab Res Care 2020; 8(1):e001151.