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Contemporary perspectives on vitamin D provision in children and adolescents obesity: a literature review and clinical case description

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Introduction. Vitamin D deficiency is currently considered a global epidemic. Recent data highlight its pivotal role in the of metabolic disorders, including obesity in children and adolescents.

The aim of the study. To review current literature on the problem of vitamin D provision in children and adolescents with to present a clinical case of a child with obesity, vitamin D deficiency, and accompanying metabolic disorders.

Materials and methods: The study included literary review using content analysis, systemic and comparative analysis well as biblio-semantic methods to explore current data on the problem of vitamin D provision in children and adol obesity. Sources included PubMed-NCBI, Medline, CochraneLibrary, EMBASE, ResearchGate databases using keyword children, adolescents, insulin resistance, obesity, vitamin D deficiency, VDR (Vitamin D Receptor) gene polymorp adipocytes. 66 English-language articles were analyzed, highlighting the role of vitamin D in human metabolic p association with obesity, mechanisms of its deficiency impact including the inhibitory effect of leptin and interleukir peculiarities of vitamin D biological action through nuclear VDR-mediated control of target genes. The prevalence deficiency in obese children in various countries was determined.

Results. Obesity can induce altered protein binding and accelerated metabolic clearance of 25(OH)D, leading to redu 25(OH)D in the blood serum. It was identified that lower serum vitamin D levels and VDR gene polymorphism are asso predisposition to obesity in children and its severe consequences, this link apparently can help to identify VDR features an increased risk of developing obesity, potentially leading to new therapeutic strategies for this metabolic condition.

increase public awareness about the psychosocial and clinical consequences of vitamin D deficiency and VDR gene poly obese children. Children with excessive weight and obesity are often diagnosed with hypovitaminosis, including vitamin Many studies around the world have found that vitamin D deficiency in obese children is at a critical stage and requires diagnostic and treatment strategies.

The clinical case described involves a patient who had obesity in association with vitamin D deficiency, and characteristic changes typical of this pathology. Biochemical indices included vitamin D deficiency, dyslipidemia, insulin resist resistance, and hypothyroidism. Bioimpedance analysis revealed the presence of excessive body fat and its abnorma distribution in the child.

Conclusions. Currently vitamin D deficiency is considered a global epidemic, causing concern among physicians and re various specialties. Recent data underscore its leading role in the onset of metabolic disorders, including obesity in adolescents. The literature review confirmed the significant impact of vitamin D on the primary biochemical and metabol in the human body, its crucial role in the emergence of obesity and various complications in children and adolescents. T of overweight or obesity in these patients requires a number of laboratory indeces, including serum vitamin D, leptin hormones levels, protein, carbohydrate and lipid metabolism parameters, to be estimated. The use of bioimpedance ultrasound examination of the thyroid gland is advisable.

References

1. Akter R, Afrose A, Sharmin S, Rezwan R, Rahman MR, Neelotpol S. A comprehensive look into the association of vitamin D levels and vitamin D polymorphism with obesity in children. Biomed Pharmacother. 2022;153:113285. https://doi.org/10.1016/j.biopha.2022.113285
2. Alaklabi AM, Alsharairi NA. Current evidence on vitamin D deficiency and metabolic syndrome in obese children: What does the evidence from sauc Children (Basel). 2018;5(1):11. https://doi.org/10.3390/children5010011
3. Alathari BE, Sabta AA, Kalpana CA, Vimaleswaran KS. Vitamin D pathway-related gene polymorphisms and their association with metabolic disea review. J Diabetes Metab Disord. 2020;19(2):1701-1729. https://doi.org/10.1007/s40200-020-00561-w
4. Al-Eisa AA, Haider MZ. Vitamin D receptor gene TaqI and Apal polymorphisms and steroid responsiveness in childhood idiopathic nephrotic syndrom Renovasc Dis. 2016;9:187-192. https://doi.org/10.2147/IJNRD.S111538
5. Antonucci R, Locci C, Clemente MG, Chicconi E, Antonucci L. Vitamin D deficiency in childhood: old lessons and current challenges. J Pediatr En 2018;31(3):247-260. https://doi.org/10.1515/jpem-2017-0391
6. Bennour I, Haroun N, Sicard F, Mounien L, Landrier JF. Vitamin D and obesity/adiposity-A brief overview of recent studies. Nutrients. 20 https://doi.org/10.3390/nu14102049
7. Bover J, Egido J, Fernández-Giráldez E, Praga M, Solozábal-Campos C, Torregrosa JV et al. Vitamin D, vitamin D receptor and the importance of patients with chronic kidney disease. 2015;35(1):28-41.
8. Chen H, Lin RJ, Schiltz RL, Chakravarti D, Nash A, Nagy L et al. Nuclear receptor coactivator ACTR is a novel histone acetyltransferase and for activation complex with P/CAF and CBP/p300. 1997;90(3):569-580. https://doi.org/10.1016/S0092-8674(00)80516-4
9. Colak R, Anil M, Yasar F, Rahmi Bakiler A, Pirgon O, Helvaci M, Dündar B. Metabolic disturbances and cardiovascular risk factors in obese childre deficiency. Arch Pediatr. 2020;27(3):140-145. https://doi.org/10.1016/j.arcped.2019.12.005
10. Corica D, Zusi C, Olivieri F, Marigliano M, Piona C, Fornari E et al. Vitamin D affects insulin sensitivity and β-cell function in obese non-diabeti Endocrinol. 2019;181(4):439-450. https://doi.org/10.1530/EJE-19-0369
11. Cunha KA, Magalhães EI, Loureiro LM, Sant'Ana LF, Ribeiro AQ, Novaes JF. Ingestão de cálcio, níveis séricos de vitamina D e obesidade associação? [Calcium intake, serum vitamin D and obesity in children: is there an association?]. Rev Paul Pediatr. 2015 https://doi.org/10.1016/j.rpped.2015.03.001
12. Darwish H, DeLuca HF. Vitamin D-regulated gene expression. Crit Rev Eukaryot Gene Expr. 1993;3(2):89-116.
13. Delvin EE, Lambert M, Levy E, O'Loughlin J, Mark S, Gray-Donald K, Paradis G. Vitamin D status is modestly associated with glycemia and in metabolism in French-Canadian children and adolescents. J Nutr. 2010;140(5):987-991. https://doi.org/10.3945/jn.109.112250
14. Ding C, Parameswaran V, Blizzard L, Burgess J, Jones G. Not a simple fat-soluble vitamin: Changes in serum 25-(OH)D levels are predicted b adipocytokines in older adults. J Intern Med. 2010;268(5):501-510. https://doi.org/10.1111/j.1365-2796.2010.02267.x
15. Durá-Travé T, Gallinas-Victoriano F, Chueca-Guindulain MJ, Berrade-Zubiri S. Prevalence of hypovitaminosis D and associated factors in obese S Nutr Diabetes. 2017;7(3):e248. https://doi.org/10.1038/nutd.2016.50
16. Earthman CP, Beckman LM, Masodkar K, Sibley SD. The link between obesity and low circulating 25-hydroxyvitamin D concentrations: con implications. Int J Obes (Lond). 2012;36(3):387-396. https://doi.org/10.1038/ijo.2011.119
17. Ebihara K, Masuhiro Y, Kitamoto T, Suzawa M, Uematsu Y, Yoshizawa T et al. Intron retention generates a novel isoform of the murine vitamin D re in a dominant negative way on the vitamin D signaling pathway. Mol Cell Biol. 1996;16(7):3393-3400. https://doi.org/10.1128/MCB.16.7.3393
18. Ekbom K, Marcus C. Vitamin D deficiency is associated with prediabetes in obese Swedish children. Acta Paediatr. 2016;105 https://doi.org/10.1111/apa.13363
19. Faghfouri AH, Faghfuri E, Maleki V, Payahoo L, Balmoral A, Khaje Bishak Y. A comprehensive insight into the potential roles of VDR gene polymorp A systematic review. Arch Physiol Biochem. 2022;128(6):1645-1657. https://doi.org/10.1080/13813455.2020.1788097
20. Fiamenghi VI, Mello ED. Vitamin D deficiency in children and adolescents with obesity: A meta-analysis. J Pediatr (Rio J). 2021 https://doi.org/10.1016/j.jped.2020.08.006
21. Florez H, Martinez R, Chacra W, Strickman-Stein N, Levis S. Outdoor exercise reduces the risk of hypovitaminosis D in the obese. J Steroid Bio 2007;103(3-5):679-681. https://doi.org/10.1016/j.jsbmb.2006.12.032

22. Freedman LP. Increasing the complexity of coactivation in nuclear receptor signaling. 1999;97(1):5-8. https://doi.org/10.1016/S0092-8674(00)80708-
23. Gün E, Uzun H, Bolu S, Arslanoğlu İ, Kocabay K. Serum 25-hydroxyvitamin D is associated with insulin resistance independently of obesity in chil Prim Care Diabetes. 2020;14(6):741-746. https://doi.org/10.1016/j.pcd.2020.06.006
24. Gustafson B, Hammarstedt A, Hedjazifar S, Smith U. Restricted adipogenesis in hypertrophic obesity: The role of WISP2, WNT, and BI 2013;62(9):2997-3004. https://doi.org/10.2337/db13-0473
25. Halline AG, Davidson NO, Skarosi SF, Sitrin MD, Tietze C, Alpers DH, Brasitus TA. Effects of 1,25-dihydroxyvitamin D3 on proliferation and different cells. Endocrinology. 1994;134(4):1710-1717. https://doi.org/10.1210/endo.134.4.8137734
26. Haussler MR, Whitfield GK, Haussler CA, Hsieh JC, Thompson PD, Selznick SH et al. Thenuclearvitamin D receptor: Biological and molecular regul revealed. J Bone Miner Res. 1998;13(3):325-349. https://doi.org/10.1359/jbmr.1998.13.3.325
27. Heaney RP, Horst RL, Cullen DM, Armas LA. Vitamin D3 distribution and status in the body. J Am Coll Nutr. 2009 https://doi.org/10.1080/07315724.2009.10719779
28. Hossain HT, Islam QT, Khandaker MAK, Ahasan HN. Study of Serum Vitamin D Level in Different Socio-Demographic Population – A Pilot Stu 2017;19(1):22-29. https://doi.org/10.3329/jom.v19i1.34836
29. Hultin H, Edfeldt K, Sundbom M, Hellman P. Left-shifted relation between calcium and parathyroid hormone in obesity. J Clin Endocrinol Metab. 2(3981. https://doi.org/10.1210/jc.2009-2822
30. Islam MZ, Bhuiyan NH, Akhtaruzzaman M, Allardt CL, Fogelholm M. Vitamin D deficiency in Bangladesh: A review of prevalence, causes and recon mitigation. Asia Pac J Clin Nutr. 2022;31(2):167-180.
31. Kaddam IM, Al-Shaikh AM, Abaalkhail BA, Asseri KS, Al-Saleh YM, Al-Qarni AA et al. Prevalence of vitamin D deficiency and its associated factors of Saudi Arabia. Saudi Med J. 2017;38(4):381-390. https://doi.org/10.15537/smj.2017.4.18753
32. Kamale V, Sharma P, Yewale Y, Thamke R. Role of vitamin D in health and diseases in children. New Indian J Pediatr. 2022;4(4):211-230.
33. Kato S. The function of vitamin D receptor in vitamin D action. J Biochem. 2000;127(5):717-722. https://doi.org/10.1093/oxfordjournals.jbchem.a0226
34. Kim SY. The pleiomorphic actions of vitamin D and its importance for children. Ann Pediatr Endocrinol Metab. 20 https://doi.org/10.6065/apem.2013.18.2.45
35. Li J, Byrne ME, Chang E, Jiang Y, Donkin SS, Buhman KK, Burgess JR, Teegarden D. 1alpha,25-Dihydroxyvitamin D hydroxylase in adipocytes. J S Mol Biol. 2008;112(1-3):122-126. https://doi.org/10.1016/j.jsbmb.2008.09.006
36. Liu X, Xian Y, Min M, Dai Q, Jiang Y, Fang D. Association of 25-hydroxyvitamin D status with obesity as well as blood glucose and lipid concentra and adolescents in China. Clin Chim Acta. 2016;455:64-67. https://doi.org/10.1016/j.cca.2016.01.023
37. Luong KV, Nguyen LT. Beneficial role of vitamin D3 in the prevention of certain respiratory diseases. Ther Adv Respir Dis. 201 https://doi.org/10.1177/1753465813503029
38. Mawer EB, Backhouse J, Holman CA, Lumb GA, Stanbury SW. The distribution and storage of vitamin D and its metabolites in human tis 1972;43(3):413-431. https://doi.org/10.1042/cs0430413
39. McCarty MF, Thomas CA. PTH excess may promote weight gain by impeding catecholamine-induced lipolysis-implications for the impact of calcium alcohol on body weight. Med Hypotheses. 2003;61(5-6):535-542. https://doi.org/10.1016/S0306-9877(03)00227-5
40. Motlaghzadeh Y, Sayarifard F, Allahverdi B, Rabbani A, Setoodeh A, Sayarifard A, Abbasi F et al. Assessment of vitamin D status and response t obese and non-obese Iranian children. J Trop Pediatr. 2016;62(4):269-275. https://doi.org/10.1093/tropej/fmv091
41. Mueller E. Understanding the variegation of fat: novel regulators of adipocyte differentiation and fat tissue biology. Biochim Biophys Acta. 2014;1 https://doi.org/10.1016/j.bbadis.2013.05.031
42. Murni IK, Sulistyoningrum DC, Oktaria V. Association of vitamin D deficiency with cardiovascular disease risk in children: Implications for the Asia Asia Pac J Clin Nutr. 2016;25(Suppl 1):S8-S19.
43. Nagpal S, Na S, Rathnachalam R. Noncalcemic actions of vitamin D receptorligands. Endocr Rev. 2005;26(5):662-687. https://doi.org/10.1210/er.20
44. Peterson CA, Belenchia AM. Vitamin D deficiency & childhood obesity: a tale of two epidemics. Mo Med. 2014;111(1):49-53.
45. Plesner JL, Dahl M, Fonvig CE, Nielsen TRH, Kloppenborg JT, Pedersen O et al. Obesity is associated with vitamin D deficiency in Danis adolescents. J Pediatr Endocrinol Metab. 2018;31(1):53-61. https://doi.org/10.1515/jpem-2017-0246
46. Rachez C, Lemon BD, Suldan Z, Bromleigh V, Gamble M, Näär AM et al. Ligand-dependent transcription activation by nuclear receptors req complex. Nature. 1999;398(6730):824-828. https://doi.org/10.1038/19783
47. Rahman S, Islam MT, Alam DS. Obesity and overweight in Bangladeshi children and adolescents: a scoping review. BMC Public Heal https://doi.org/10.1186/1471-2458-14-70
48. Romacho T, Elsen M, Röhrborn D, Eckel J. Adipose tissue and its role in organ crosstalk. Acta Physiol (Oxf). 2014; https://doi.org/10.1111/apha.12246
49. Roth CL, Elfers C, Kratz M, Hoofnagle AN. Vitamin d deficiency in obese children and its relationship to insulin resistance and adipo 2011;2011:495101. https://doi.org/10.1155/2011/495101
50. Ruiz-Ojeda FJ, Anguita-Ruiz A, Leis R, Aguilera CM. Genetic Factors and Molecular Mechanisms of Vitamin D and Obesity Relationship. A 2018;73(2):89-99. https://doi.org/10.1159/000490669
51. Saad M, El-Askary A. Vitamin D receptor gene polymorphism among Egyptian obese children. Asian J Clin Nutrition. https://doi.org/10.3923/ajcn.2017.24.29
52. Shapses SA, Lee EJ, Sukumar D, Durazo-Arvizu R, Schneider SH. The effect of obesity on the relationship between serum parathyroid ho hydroxyvitamin D in women. J Clin Endocrinol Metab. 2013;98(5):E886-890. https://doi.org/10.1210/jc.2012-3369
53. Shen F, Wang Y, Sun H, Zhang D, Yu F, Yu S et al. Vitamin D receptor gene polymorphisms are associated with triceps skin fold thickness and body but not with body mass index or waist circumference in Han Chinese. Lipids Health Dis. 2019;18(1):97. https://doi.org/10.1186/s12944-019-1027-2
54. Siddiqee MH, Bhattacharjee B, Siddiqi UR, Rahman MM. High burden of hypovitaminosis D among the children and adolescents in South Asia: A sy and meta-analysis. J Health Popul Nutr. 2022;41(1):10. https://doi.org/10.1186/s41043-022-00287-w
55. Targher G, Bertolini L, Scala L, Cigolini M, Zenari L, Falezza G, Arcaro G. Associations between serum 25-hydroxyvitamin D3 concentrations and l patients with non-alcoholic fatty liver disease. Nutr Metab Cardiovasc Dis. 2007;17(7):517-524. https://doi.org/10.1016/j.numecd.2006.04.002
56. Turer CB, Lin H, Flores G. Prevalence of vitamin D deficiency among overweight and obese US children. Pediatrics. 2013;1 https://doi.org/10.1542/peds.2012-1711

57. Umar M, Sastry KS, Chouchane AI. Role of vitamin D beyond the skeletal function: A review of the molecular and clinical studies. Int J Mol Sci. 2 https://doi.org/10.3390/ijms19061618
58. Valdivielso JM, Fernandez E. Vitamin D receptor polymorphisms and diseases. Clin Chim Acta. 2006;371(1-2):1-12. https://doi.org/10.1016/j.cca.200
59. Villalba-Heredia L, Comeras-Chueca C, González-Agüero A, Domingo-Del-Val D, Calmarza P, Vicente-Rodríguez G et al. 25-hydroxy cardiorespiratory fitness in prepubertal overweight and obese children. Nutrients. 2021;13(5):1597. https://doi.org/10.3390/nu13051597
60. Vimaleswaran KS, Berry DJ, Lu C, Tikkanen E, Pilz S, Hiraki LT et al. Causal relationship between obesity and vitamin D status: bi-directi randomization analysis of multiple cohorts. PLoS Med. 2013;10(2):e1001383.
61. Wamberg L, Kampmann U, Stødkilde-Jørgensen H, Rejnmark L, Pedersen SB, Richelsen B. Effects of vitamin D supplementation on body fa inflammation, and metabolic risk factors in obese adults with low vitamin D levels – results from a randomized trial. Eur J Intern Med. 2013 https://doi.org/10.1016/j.ejim.2013.03.005
62. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measu in 128•9 million children, adolescents, and adults. Lancet. 2017;390(10113):2627-2642. https://doi.org/10.1016/S0140-6736(17)32129-3
63. Wortsman J, Matsuoka LY, Chen TC, Lu Z, Holick MF. Decreased bioavailability of vitamin D in obesity. Am J Clin Nutr. 2000 https://doi.org/10.1093/ajcn/72.3.690
64. Yahyaoui S, Jmal L, Sammoud A, Abdenebi M, Jmal A, Boukthir S. Vitamin D deficiency is associated with metabolic syndrome in Tunisian childr Tunis Med. 2019;97(12):1353-1356.
65. Zakharova I, Klimov L, Kuryaninova V, Nikitina I, Malyavskaya S, Dolbnya S et al. Vitamin D insufficiency in overweight and obese children and ad Endocrinol (Lausanne). 2019;10:103. https://doi.org/10.3389/fendo.2019.00103
66. Zehnder D, Bland R, Williams MC, McNinch RW, Howie AJ, Stewart PM et al. Extrarenal expression of 25-hydroxyvitamin d(3)-1 alpha-hydr Endocrinol Metab. 2001;86(2):888-894. https://doi.org/10.1210/jc.86.2.888

clinical cases description, Literature review, Lviv clinical bulletin #3(43)-4(44) 2023 adipocytes, adolescents, children, insulin resistance, obesity, VDR gene polymorphism, vitam лептин

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