maternal and fetal tissue synthesis and a small increase in energy utilization [33].

Our results showed dietary intake of vitamin B_6 was very inadequate in ≥90% of the subjects. Deficiency of this vitamin rarely occurs. The FAO/WHO (1974) [34] has not recommended additional requirements for pregnant women. But the IOM (1990) has on assumption that the vitamin not stored to any great extent, and there is an increased need in the latter half of pregnancy. Thus, the IOM recommended that the RDA should be elevated by 46 % to ensure sufficiency throughout pregnancy.

Mean intake of folic acid was very low intake and very inadequate for pregnancy requirements [35]. A very similar result was obtained by another [17]. The intake of folic acid was 100% adequate for subjects who took fefol supplements whereas 100% inadequate among those who did not use supplements.

Folic acid is needed to maintain maternal stores and to meet the needs of supplementation. A study conducted on folate bioavailability and health documented that insufficient folate status might attribute to risk of developing various medical conditions throughout the individual's life. Such as certain congenital malformation and poor pregnancy outcomes to cardiovascular disease, some malignancies, and neurological dysfunction of the elderly [36].

Calcium mean intake was slightly higher than 50% RDA (57.71% RDA). This might attribute to the high cost of calcium rich dietary sources, e.g., milk and milk products. In addition to this is groundnuts and arugula that contain 75 mg and 165 mg Ca per 100 gram, respectively. Low intakes of calcium have also been documented in Sudan many parts of Africa[37,38] and other developing countries in Asia, the Caribbean and Central/South America[40]. Higher intakes were found in another study but still less than recommended allowances [17]. However one study reported variations in calcium intake among countries, with very low intake in India 250 mg/day ± 49 to high intakes in Caucasian women in Canada 1256 ±577 mg/day. During the third trimester of pregnancy, 200 mg/day is considered the average increment rate. [39].

In our study iron intake was less than 50% RDA. Similar studies reported median dietary intakes of iron were below the recommended levels and suggested fortified foods as important sources of iron, folate, and vitamin C [40,41].

Regarding zinc, intake was also less than 50% RDA. Other studies reported similarly low intakes of zinc [18,40,42]. Micronutrients deficiencies thgim exist due to malabsorption or losses associated with disease or inadequate intakes detimiL .knowledge about adequate prenatal nutrition or dietary taboos associated with pregnancy with potential adverse consequences for both mothers and newborns [43].

Fetal supply substrate is a primary regulator of prenatal growth. Maternal nutrition influences the availability of nutrients for transfer to the fetus [44].

Apart from the dietary intake, nutrition is highly dependent on economic status, social and cultural environment, and maternal dietary habits [3,5,45,46].

There was an overall pattern of positive correlations between dietary intake and socioeconomic factors. Results showed a positive relationship between income and fathers' education and 12 nutrients (80%). Mothers' education also correlated positively with 11 nutrients (73.3%).

Family size correlated negatively with all nutrients except for vitamin C. The correlation was significant for vitamin A (r=-0.23, P=0.04), vitamin B2 (r=-0.29, P=0.01), folate (r=-0.22, P=0.05) but the correlation with calcium was not significant (r=-0.21, P=0.06).

Our findings were supported by other studies [17, 47]. They found that economic aspects and education levels a have a significant influence on the adequacy of the diet consumed. Ensuring proper food and improving the social and economic conditions will reduce the risk of anemia during pregnancy and its prenatal consequences.

Vitamin A intake positively and significantly correlated with age, family size, and mothers' education. Our findings show that iron and zinc both positively related to mothers and fathers education but, negatively correlated with family members, age, and fathers occupation. Iron-deficiency anemia (IDA) and vitamin A deficiency (VAD) share the same socio-economic risk factors and may occur simultaneously [48].

Martin et al., showed a positive impact from the social marketing campaign of eggs and dark green leafy vegetables on food consumption; an increase in the consumption of eggs and plant sources of vitamin A, and associated improvement in vitamin A status [43].

Pregnancy increases metabolic demand for high-quality nutrients. Careful food selection, make it possible to obtain most of the recommended levels of nutrients [3].

5. Conclusions

Dietary intake of vitamins A, B1, B6, folate, calcium, phosphorus, iron and zinc were significantly lower than RDA whereas potassium was significantly higher than RDA. Thiamine (B1), magnesium and zinc intakes were >85% RDA. Vitamins A, B6, folate, phosphorus and iron were below 50 % RDA. Pregnant mothers are at risk of multiple micronutrients deficiencies.

6. Acknowledgements

This work funded by a scholarship from the German DAAD Research Fund. This fund provided the real support that enabled the author to step over financial difficulties and finalize this research. This manuscript done for academic purposes

Licensed Under Creative Commons Attribution CC BY

References

[1] Ladipo, O.A. Nutrition in pregnancy :mineral and vitamin supplements12,3,Am J Clin Nutr:, 72(1):S280-S290(2000)
[2] Gittelsohn, J., Thapa, M., Landman, L.T. : Cultural factors, caloric intake and micronutrient sufficiency in rural Nepali household. Soc Sci Med,1739:44-49 (1997)
[3] Kontic-Vucinic O, Sulovic N, Radunovic N. Micronutrients in women's reproductive health: I. Vitamins. Int J Fertil Womens Med. May-Jun, 51(3):106-15. (Medline) (2006)
[4] Passmore R and Eastwood MA. Part VI Diet and Physiological Status in: Human Nutrition and Dietetics 8th ed. ELBS & Churchill, UK. Pages:575-87 (1986)
[5] Whitney, E.N., Cataldo, C.B., Rofles, S.R. .:Understanding Normal and Clinical Nutrition 6th edition-Wadsworth Group. Thompson Learning , Inc. US(2002.
[6] Sandra L, Huffman .L, Zehner ER, Harvey P, Martin L, Piwoz E, Ndure, KS, Combest C, Mwadime R, Quinn V. Prevalence and Causes of Maternal Malnutrition in Africa, Chapter 1 in Essential Health Sector Actions to Improve Maternal Nutrition in Africa. Publication of the Regional Centre for Quality of Health Care at Makerere University in Uganda and LINKAGES. The Academy for Educational Development. Washington, DC 2001 pages 2-18. Available on Website: www.linkagesproject.org (accessed 25 May 2007).
[7] Katz, J., Khatry, S.K., West, K.P. : Night blindness is prevalent during pregnancy and lactation in rural Nepal . Nutr, 7:212-225(1995)
[8] Christian, P., West, K.P., Khartry, S.K.,: Night blindness of pregnancy in rural Nepal: nutritional and health risks .Int J Epidemiol, 23(7)231-237 (1998)
[9] West, K., Katz, J., Khatry, S. , Sommer, A.: Double blind ,cluster randomised trial of low dose supplementation with vitamin A or β carotene on mortality related to pregnancy in Nepal. BMJ .Feb ,27. 575–570 :(7183) 318 (1999)
[10] Ramakrishnan, U., Manjrekar, R., Rivera, J., Gonzalez-Cossio, T., Martorell, R.: Micronutrients and pregnancy outcome: a review of the literature. Nutr Res, 103: 19-59 (1999)
[11] Shrama, D.C., Kiran, R., Ramnath, V., Khuahlani, K., Singh, P.P. : Iron deficiency anemia in vegetarian mothers and their newborns. Inc. J. Clin. Biochem, 9:100-102 (1999)
[12] Williams, M.D., Wheby, M.S. : Anemia in pregnancy . Med Clin North Am645–631 :76 (1992)
[13] Rush, D. :Nutrition and maternal mortality in the developing world. Am J Clin Nutr , 72 (Suppl.): S212–S40 (2000)
[14] Jameson S.: Zinc and pregnancy . In Nriagu, J.O.: Zinc in the Environment, Part II : Health Effects. Edited by John Wiley New York 1980.
[15] Dura-Trave T, Puig-Abuli M, Monreal I , Villa-Eluzaga I: Relation between maternal plasmatic zinc levels and uterine contractibility Gynecol Obstet Invest 17:247-251 (1984)
[16] Simmer K, Thompson RPH : Maternal zinc and intrauterine growth retardation. Clin Sci 68:395-399 (1985)
[17] AlKhalifa FA. Nutritional assessment of pregnant Sudanese women. MSc Thesis, University of Khartoum, 2000.
[18] Nyuar Kot B, Khalil Akh, and Crawford MA. Dietary intake of Sudanese women: A comparative assessment of nutrient intake of displaced and non-displaced women. Nutr Health . 21[2]:131-144, PMID 23275454 (2012)
[19] Erhardt J. Nutrisurvey for Windows, Dietary Analysis Package. Copyright ©. Only for non commercial use, University of Indonesia, SEAMEO-TROPMED, 2004. Available from website: www.nutrisurvey.de. (2004)
[20] Abdelmuti OMS. Biochemical and nutritional Evaluation of famine food of the Sudan. A Thesis submitted in partial fulfillment of the requirement for the A Thesis submitted in partial fulfillment of the requirement for the Degree of Philosophy in Faculty of Agriculture, University of Khartoum (1991)
[21] Ahmed AEN. Evaluation of the Major and Minor Nutrients in some Sudanese food items A Thesis submitted in partial fulfillment of the requirement for Master Degree in Science and Education, Faculty of Education, University of Khartoum (1998)
[22] Ahmed B.I. : Famine food in eastern regions of the Sudan. A Thesis submitted in partial fulfillment of the requirement for the Degree of Masters in Sciences (MSc) in Faculty of Agriculture, University of Khartoum (1995)
[23] Dirrar HA. The Indigenous Fermented Food of the Sudan. A study in Africa food and Nutrition, CAB International, Cambridge University Press UK (1993)
[24] Food and Agriculture Organization (FAO). Food composition Table for use in Africa, FAO Rome, 1968.
[25] FAO : Food composition Table for use in East Africa, Food and Agriculture Organization Rome (1972)
[26] FAO/WHO/UNU[a]: Energy in human nutrition, Report of a Joint FAO/WHO/UNU Expert Consultation. FAO Food and Nutrition Technical Paper Series, No. 1. Rome, (2004) Internet: http://www.Fao.org/docrep/007/y5740e/5740eOF.htm, (accessed 14 December 2007.
[27] FAO/WHO/UNU[b]. Energy requirements during pregnancy, Report of a Joint FAO/WHO/UNU Expert Consultation. FAO Food and Nutrition Technical Paper Series, No. 1. Rome, 2004 Internet: http://www.Fao.org/docrep/007/y5686e/y5686e00.htm (accessed December 2007.
[28] Allen, L.H.: The Nutrition CRSP: What is marginal malnutrition, and does it affect human function? Nutr Rev ,51(9):255–67 (1993)
[29] Underwood, B.A. : IVACG Statement : Safe Doses of vitamin A during pregnancy and lactation. International Vitamin A Consultative Group (IVACG) The ILSI Research Foundations, Washington DC,USA (1998)
[30] Wallingford, J.C., Underwood, B.A.: Vitamin A deficiency in pregnancy, lactation ,and the nursing child .In : Bauernfeind JC ,ed .Vitamin A deficiency and its control .New York :Academic Press ; pp.52–101 (1986)
[31] Drife, J. and MacNab, G. : Mineral and vitamin supplements. Clin Obstet Gynaecol .67–13:253 (1986)
[32] Heller, S., Salkeld, R.M., Korner, W.F. : Vitamin B1 status in pregnancy. Am J Clin Nutr ,4:1221-27(1974)

Licensed Under Creative Commons Attribution CC BY

[33] FAO/WHO : Requirements of vitamin A, thiamin, riboflavin, and niacin. Report of a joint FAO/WHO Expert Group .Rome :FAO (1985)
[34] FAO/WHO . Handbook on Human Nutritional Requirements: FAO Food and Nutrition Series No. 4, FAO Nutritional Studies, No. 28 - WHO Monograph Series No. 61, 1974. Food and Agriculure Organization, Rome (1974)
[35] IOM (Institute of Medicine) : Nutrition during pregnancy .Washington, DC :National Academy Press (1990)
[36] Molloy, A.M.: Folate bioavailabilty and health. Int J Vitam Nutr Res. Jan , 72(1): 46-52(2002)
[37] Prentice, A.M. : Presentation made at ICDDRB. Meeting on Prevention of Low Birthweight. Dhaka, Bangladesh. Aug. (1999)
[38] Thacher, T.J., Fischer,. P.R., Pettifor, J.M., Lawson, J.O., Isichei, C.O., Reading, J.C., Chan, G.M. : A comparison of calcium, vitamin D or both for nutritional rickets in Nigerian children. NEJM, 341(8):563–8((1999)
[39] Mahmoud, F.A. : Calcium intake during pregnancy. Review prepared for the 12th Postgraduate Course in Reproductive Medicine and Biology- Geneva Foundation for Medical Education and Research, Postgraduate Training Course in Reproductive Health/Chronic Disease. Edited by Aldo Campana, August 13, 2003, Geneva. Available from : Web www.gfmer.ch (2003)
[40] Lee SE, Talegawkar SA, Merialdi M, Caulfield LE . Dietary intakes of women during pregnancy in low- and middle-income countries. Public Health Nutr. Aug,16(8):1340-53. doi: 10.1017/S1368980012004417. Epub Oct 9(2012)
[41] Siega-Riz, A.M., Bodnar, L.M., Savitz, D.A.: What are pregnant women eating ? Nutrient and food group differences by race. Am J Obstet Gynaecol . 1:105-195 (2002)
[42] Hambidge, K.M., Krebs, N.F., Jacobs, M.A., Favier, A., Guyette, L., Ikle, D.N.: Zinc nutritional status during pregnancy :a longitudinal study .Am J Clin Nutr, 429:37-42 (1983)
[43] Pitkin, R.M.: Calcium metabolism in pregnancy and the perinatal period: a review. Am J Obstet Gynecol, 1985. 99: 109-151 (1985)
[44] Kind, K.L., Moore, V.M., Davies, M.J.: Diet around conception and during pregnancy--effects on fetal and neonatal outcomes. Reprot Biomed Online May,12(5):532-41.[Abstract]. PubMed (2006)
[45] Sukkar, M.Y., Mahmoud, N.A., El Munshid H. : Concise Human Physiology-2nd edition. (1996)
[46] Whitney, E.N., Cataldo, C.B., Rofles, S.R. : Understanding Normal and Clinical Nutrition, 5th edition - West Wadsworth ITP, An International Thompson Publishing Company-London– UK (1998).
[47] Marin, G.H., Fazio, P. , Rubbo, S. , Baistrocchi, A., Sager, G., Gelemur, A. : Prevalence of anaemia in pregnancy and analysis of the underlying factors. Aten Primaria Feb 28- 2002, 29(3): 158-63.
[48] Rosales, F.J., Jang, J.T., Oinero, D.J., Erikson, K.M., Beard, J.L., Ross, A.C.: Iron Deficiency Alters the Distribution of Vitamin A Between Plasma and Liver, and Retinol and Retinyl Esters in Young Rats [Abstract] :Report of the INACG Symposium-12 March 1999 International Nutritional Anaemia Consultative Group. International Convention centre Durban. South Africa. ISBN 1-57881-074-4, USA (2000)

Licensed Under Creative Commons Attribution CC BY