ORIGINAL RESEARCH PAPER

VOLUME-6 | ISSUE-6 | JUNE-2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

"CIRCULATING MACRO-MICRONUTRIENT CONCENTRATIONS AND PHYSICAL ASSESSMENT IN ADOLESCENT GIRLS: IN RURAL KOKAN, MAHARASHTRA"

Clinical Research

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ABSTRACT

Objective: - To assess anthropometric & dietary profile among adolescent girls with respect to circulating levels of macro-micronutrients.
Method: - Study was cross sectional community based, carried out on 80 adolescent rural girls of age group 10 to 16 years.
Results: The prevalence of lowBMI was 77.5% .Body composition wise fatpercentile increases as BMI increases. Out of 80 girls 18(22.5%)girls were anemic, 22(27.50%)girls had low globulin, 62(77.50%)with low calcium. Deficiency was Vitamin-B1 in29(36.25%), vitamin-A in26(34.21%) & 54(67.5%) zinc. Vitamin-D was normal in allgirls &only 5(6.57%) were deficient in Vitamin-C. Hypothyroidism was5%.
Conclusion: Majority of girl's have poor dietary habits leading to deficiencies of macro-micro nutrients. Hence, we should aim at making interventions to improve health status of adolescent girls, who are potential mothers, by providing them with health education, dietary advice.

KEYWORDS:

Adolescent Girls, Macro-Micronutrient, Body Composition, Recommended Dietary Allowance (RDA).

Introduction:-
Adolescent girls are the best human resources. Adolescent girls form a crucial group of the population, which constitute, the vital "bridge" between the present generation and the next generation. Health of an adolescent girl is important for health of her baby .But these girls have been neglected by the society especially in rural India. In a country like India, adolescent girls face serious health problems due to socioeconomic, environmental conditions, nutrition and gender discrimination and anemic status.[1] In general adolescent girls are the worst sufferers of the ravages of various forms of malnutrition because of their increased nutritional needs and low social power. The nutritional status of adolescent girls, the future mothers, contributes significantly to the nutritional status of the community.[2]

Moreover, due to faulty dietary habits, ignorance, and in a country like India, with a multitude of social customs and beliefs cited against women, the prevalence of malnutrition amongst girls remains quite high. The rates of low birth weight, pre-maturity, neonatal and infant mortality among children born to undernourished adolescent girls is high. Later on these undernourished girls becomes anemic and produce low birth weight babies. A hypothesis proposed in 1990 by the British epidemiologist David Barker (b. 1939) that intrauterine growth retardation, low birth weight, and premature birth have a causal relationship to the origins of hypertension, coronary heart disease, and non-insulin-dependent diabetes, in middle age.[3] If the risk of many common diseases of adulthood in our communities is largely determined before birth, then a critical question to be addressed is the extent to which these risks may be minimized. Since poor fetal growth is most commonly diagnosed in late gestation or even after birth, and there are not yet any effective intrauterine treatments for the baby who is growing poorly, only way to combat this epidemic of low birth weight and developing NCD in future life is to focus on the health of an adolescent girls. Though adolescent period (preconception) represents both a risk for adverse programming but also provides a window for opportunity of intervention in cases of adverse fetal programming.[4]

Methodology:-
The BKLWRMC-INDIA Study is a cross sectional descriptive community based study, of adolescent girls, aged 10 to 16 years, aimed at estimating anthropometry, body composition and levels of macro & micronutrients. Baseline data of 80 adolescent girls (10-16 years) from rural villages were collected. Detail proforma filling for socio-epidemiological data, clinical examination, and anthropometry, body composition by Tanita bio impedance machine, menstrual history, psychological examination & dietary examination was done. Blood was tested for hemo-gram, serum ferritin, Vitamin A,C, B1, B2,B6, B12, C, D, Zn, Calcium, random blood sugar, protein, Albumin, Globulin, CRP, TSH & ESR.

Objective
- To assess physical status of adolescent girls by anthropometry and body composition
- To assess levels of micro, macro nutrients

Ethical consideration:
Permission for the study was obtained from the school authorities prior to commencement.

Result:
Table I, There were 62(77.5%) low BMI girls. Average of fat percentage, bone mass, weight & height revealed increasing trend if BMI increases. Muscle mass percentage & total body water percentage showed decreasing trend if BMI increases.

Table II, Out of 80 girls 18(22.5%) girls were anemic, 62(77.50%) with low calcium. A deficiency of vitamin-B1 was seen in 29(36.25%), vitamin-A was in 26(34.21%) & 54(67.5%) girls having zinc. Vitamin-D is normal in all girls & only 5(6.57%) girls deficient in Vitamin-C.

Table III, Hypothyroidism was discovered in 5% girls and low globulin in 27.50% girls. Those girls with low hemoglobin had low serum ferritin levels and low MCV,MCHC,PCV,MCH.

Table IV, According to ICMR RDA standards, in present study 100% girls have LRDA for total energy & calcium in all age groups. More than ½ , i.e. 66.66%, 72% & 86.66% LRDA values for iron for age ranges of 10-12, 13-15 & 16-18 years respectively. While 40%, 96% & 100% proteins & 53.33%, 22% & 20% fat values were at a LRDA in previously mentioned age groups respectively.

Discussion:

Ratnagiri is a coastal district of Maharashtra state, situated in the western coast of India. It has north-south length of about 180 km and average east-west extension of about 64 km. Sahyadri hills surround it in the east. Ratnagiri district is backward area with hilly and inaccessible terrain. This area is part of western coastal strip and has access with outside world only by a single highway and few difficult passes through Sahyadri ghat. The Land being less fertile, rampant poverty is order of the day even today. The inputs hardly match the output. Konkan region in Maharashtra has villages located at far off distances in between hills and valleys and health care remains largely inaccessible. This region has inadequate government facilities, illiteracy, poverty, poor health awareness, misconceptions due to blind faith and inaccessibility with scare transportation services. That's why I have studied the adolescent girls in rural kokan region.

P.M. Siva, A. Sobha et.al. Showed the prevalence of anemia was 21% in central Kerala[5], Aguayo VM, Paintal K et.al. In India the prevalence of anemia among adolescent girls were 56% and these amounts to an average 64 million girls at any point in time.[6] In our group revealed was 22.5%, it is less compared to other studies. Though RDA for iron is less but most of the girls receive iron tablets through government programs. A low regular consumption of iron rich foods like whole grain, cereals, pulses, nuts & foods of animal origin in this coastal region makes 22.55 girls anemic.

Dr.Iqbal Singh Ahuja et.al. 20% of adolescent girls in the age group of 14 -17 suffer from calcium deficiency in both urban & rural India.[7] In the same age group in konkan it was found in 98.16% (< 8.8mg/dl) which is much more. The dietary intake of calcium (mg/day) revealed 98.75% girls has deficient RDA .There is very less consumption dairy products, crab muscles, gingelly, drum stick leaves etc.

Ritu G et.al. Vitamin-D deficiency prevails in epidemic proportions all over the Indian subcontinent, with a prevalence of 70%–100% in the general population.[8] But in our study group Vitamin-D deficiency was 0% because of wide sun exposure & easily accessible marine fishes in kokan alone ought to suffice for vitamin-D sufficiency. Manjula Hettiarachchi et. al. study of prevalence and severity of micronutrient deficiency in Sri Lanka, Zinc deficiency(<9.95µmol/L) of adolescent girls was found in 58.3%.[9] In our group it was 67.5% (<794 µg/l), comparatively more because of a low dietary intake of meats, poultry, eggs & dairy products.

Goyle A et.al. Vitamin-A level in Jaipur, India indicated that about 49.1% of the subjects had low levels of serum vitamin-A.[10] In our group it was 34.21% ,comparatively less because of easily accessible tropical food (Mango) but overall inadequate dietary intake was serious cause. It is a fat soluble vitamin, and therefore, needs to be consumed with fat in order to have optimal absorption. As per the body composition results fat percentile is very less in those girls who are deficient in Vitamin-A as it is not getting stored due to lack of fat stores. Low globulin levels were found in 27.50% girls. This may be co-related to low immunity in them. Snehal Samarth, Saunitra Inamdar et.al in central India attributed 7.69% adolescents was hypothyroi dism, higher than in our group (5%).[11] In body composition, as BMI increased fat percentile increased. This increase in fat was due to high consumption of empty calories, less nutritious food consumption.

Fruits & vegetables are not consumed by girls due to poverty and unavailability in rural areas. There is lack of knowledge about nutrition & daily RDA. There is excess consumption of empty calories in the form of wafers, kukure, Maggie as they were easily available even in remote villages and very cheap. No vitamins, minerals, are consumed. Milk products are not consumed at all so low calcium, Rarely eat sprouts, Skip breakfast, Lack of fiber causing poor absorption, use of open pan cooking method, Lack of fat so no storage of fat soluble Vitamins and long gaps between meals. There are the common dietary habits observed which has serious effects on adolescent girl's health and it will also affect the health of future generation as she is a potential mother. Only way to combat this is to provide proper health education and teach her good dietary habits, which will lead to healthy adolescent and healthy future India.

Statistical Analysis:-

Table I: Body composition in relation to BMI

TANITA PARAMETER/ BMI CLASSIFICATION	LOW BMI (MEAN ± SD)	NORMAL BMI (MEAN ± SD)	OBESE (MEAN ± SD)
N (%)	62 (77.5%)	17 (21.25%)	1 (1.25%)
HEIGHT IN CM	148.67 ± 7.39	150.05 ± 4.76	148
WEIGHT IN KG	34.54 ± 5.42	44.82 ± 5.35	60.6
TOTAL BODY WATER PERCENTAGE	60.22 ± 3.73	51.98 ± 3.36	37.6
FAT PERCENTAGE	18.72 ± 9.54	29.63 ± 3.62	48.7
MUSCLE MASS PERCENTAGE (PMM)	77.95 ± 5.07	67.5 ± 4.96	48.3
BONE MASS	1.47 ± 0.36	2.16 ± 1.11	1.8

Table II: Nutrient Assay

PATHOLOGY TESTS/ BMI group (Normal Range)	LOW RANGE N(%)	NORMAL RANGE N (%)	HIGH RANGE N(%)
HB (11.5-16 gm%)	**18 (22.5)**	62 (77.50)	0
PROTEIN (6.4-8.3 gm/dl)	3 (3.75)	76 (95.00)	1(1.25)
ALBUMIN (3.5-5.2 gm/dl)	0	75 (93.75)	5 (6.25)
GLOBLULIN (2.8-3.6 gm/dl)	**22 (27.50)**	56 (70.00)	2 (2.50)
CALCIUM (8.8-10.5mg/dl)	**62 (77.50)**	18 (22.50)	0
CRP (Upto 6.0 mg/Lit)	0	77 (96.25)	3 (3.75)
B1 (3.9-300 ng/ml)	**29 (36.25)**	51 (63.75)	0
B2 (0.313-20 ng/ml)	0	20 (25.00)	60 (75.00)
B6 (3.9-300 ng/ml)	1 (1.25)	43 (53.75)	36 (45.00)
B12 (211-911 pg/ml)	0	80 (100.00)	0
VIT A (1.05 - 3.32 µmol/L)	**26 (34.21)**	47 (58.75)	3 (3.95)
VIT C (0.6 -2.0 mg/dl)	5 (6.57)	50 (62.50)	21 (27.6)
VIT D (8.2_ 37.4mg/ml)	0	80 (100.00)	0
FERRITIN (10-200ng/ml)	2 (2.5)	76 (95.00)	2 (2.5)
Zinc(794-1026 µg/l)	**54 (67.5)**	22 (27.50)	4 (5)

Table III: Indirect Nutrient Markers

PATHOLOGY TESTS/ BMI group (Normal range)	LOW RANGE N (%)	NORMAL RANGE N(%)	HIGH RANGE N(%)
PLATELET COUNT (1.5-4.5/cumm)	0	59 (73.75)	21 (26.25)
ESR (0-20mm/hr)	0	73 (91.25)	7 (8.75)
RBSL (70-130mg/dl)	6 (7.5)	72 (90.00)	2 (2.5)
A/G RATIO (1.0-2.1)	0	73 (91.25)	7 (8.75)
TSH (0.270-4.02µIU/ml)	0	76 (95.00)	**4(5.00)**
RBC (3.5-5.5millions/cumm)	0	76 (95.00)	4 (5.00)
RDW-CV (10-14%)	0	41 (51.25)	39 (48.75)
PCV (37-47%)	**22 (27.5)**	58 (72.50)	0
MCV (78-98fL)	**13 (16.25)**	65 (81.25)	2 (2.5)
MCH (27-32pg)	**41 (51.25)**	35 (43.75)	4 (5.00)

MCHC (32-36%)	**43 (53.75)**	37 (46.25)	0
WBC (4000-11000/cumm)	0	65 (81.25)	15 (18.75)
NEUTROPHILS N (40-75%)	2 (2.5)	70 (87.50)	8 (10.00)
LYMPHOCYTES L (20-45%)	8 (10.00)	69 (86.25)	3 (3.75)
EOSINOPHILS E (1-6%)	5 (6.25)	71 (88.75)	4 (5.00)
MONOCYTES (2-10%)	**30 (37.5)**	50 (62.50)	0

Table IV: Dietary profile of respondents in relation with RDA

Years	10-12th (n=15)			13-15th (50)			16-18th (15)			Total **N RDA	Total ***L RDA
	*Range	NRDA (%)	LRDA (%)	Range	NRDA (%)	LRDA (%)	Range	NRDA (%)	LRDA (%)		
Energy (kcal)	2010	1 (6.66)	14 (93.33)	2060	1 (2.04)	49 (98.00)	2060	0 (0.00)	15 (100.00)	2 (2.50)	78 (97.50)
Protein (gm)	40.4	9 (60.00)	6 (40.00)	65	2 (4.00)	48 (96.00)	63	0 (0.0 0)	15 (100)	11 (13.75)	69 (86.25)
Fat (gm)	35	7 (46.66)	8 (53.33)	22	39 (78)	11 (22.00)	22	12 (80.00)	3(20.00)	58 (72.50)	22 (27.5)
Calcium (mg)	800	0 (0.00)	15 (100)	600	1 (2.04)	49 (98.00)	500	0 (0.00)	15 (100)	1 (1.25)	79 (98.75)
Iron (mg)	27	5 (33.33)	10 (66.66)	28	14 (28.00)	36 (72.00)	30	2 (13.33)	13 (86.66)	21 (26.25)	59 (73.75)

Abbreviation: *source-RDA 2010, ICMR, NIN;[12] ** NRDA-Normal range of recommended dietary allowances; * LRDA – Lower range of recommended dietary allowances.**

Interpretation & Conclusion:

It is very important to focus on health of an adolescent girl in rural areas as she is the mother of future generation. Her physical and biochemical health needs assessed regularly and treated accordingly. This will prepare her for safe motherhood.

Acknowledgement:

We thank the staff of the Community Medicine Unit for conducting the interviews, making measurements and data collected; we are particularly grateful to ANM-GNM nurses, MSW, Dietitians, Psychologist, department of biochemistry, department of pathology & department of pediatrics in BKLWRMC for initiatively participate in research.

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