



8. A Study on Qualitative Assessment of Nutritional Status of Multiple Micronutrients in Young Women, it's Social Implications in Future and Its Probable Relationship with Women Empowerment

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Abstract

The present paper is based on a research study for qualitative assessment of multiple micronutrients in young adult females, studying in college and its possible social implications, especially on MMR, NMR, IMR, U5MR, and early onset of Non-Communicable Diseases (NCDs), and its correlation with women empowerment. The study was carried out on the young female population in Bhopal. The sample under study will be bearing children in the next ten years, once or more. Therefore, their nutritional status was of utmost importance for bringing down IMR/NMR/MMR, etc. These women were supposed to have been provided with various supplements as adolescents under various health Programs. Thus, the major objective of the study was to find out the status of Multiple Micro Nutrient Deficiencies (MMND), to assess qualitative levels of listed vitamins and minerals in young adult females (age 18-25 years), and to see the correlation of MMND with women's empowerment if any. For this purpose earlier studies done in the concerned area have been reviewed. The methodology included a Qualitative assessment of multiple micronutrient levels, done with a non-invasive, electromagnetic device. Results so far show the deficiencies to the level of medium to severe deficiencies in 50-75% of the sample population. This shall help in analyzing the sudden surge of NCDs and the slow decline of MMR, NMR, and IMR despite all efforts. It is also indicative that even in the future if these young women survive with low MMND then they will be prone to low economic productivity therefore lower income, prone to diseases, and lower cognizance, also progeny will be born with MMNDs, and health implications of MMND and malnutrition will be creating a hurdle in their (progeny) empowerment as well.

Keywords-MND, young adult females, social implications, women empowerment.

Introduction

The purpose of the study was to see if there are present multiple micro nutrient deficiencies in young adult females (18-25), persisting or if they have overcome malnutrition during adolescence with the help of various health-related programs run by the governments for adolescent girls. Most of these young females will become mothers in the coming ten years. If they turn out to be deficient in multiple nutrients, then they will pass this on to the next generation and they, young women, will become further deficient and will face the consequences in the form of repeated infections and NCDs. There will be more chances of adverse outcomes of pregnancy/ pregnancies. Children born to them will be more prone to LBW, preterm, infections, higher IMR, stunting, wasting, and later early onset NCDs and/ or obesity. The possibility of their children suffering from malnutrition, in long term, will be higher. MMND will affect their working capacity which will be a big hurdle in their economic empowerment. But if these young women have overcome the majority of deficiencies of malnutrition, then future generations will be safe from the consequences of malnutrition in mothers. Then we have to look elsewhere for the causes of adverse outcomes of pregnancy, NMR, IMR, and MMR. It has been proven repeatedly in various studies that in India-

1. >50% population is anemic.
2. Vitamin A deficiency is > 55%
3. Recent studies indicate a deficiency of Vitamin D in more than 50% population.
4. Deficiencies of Zinc, Iodine, and Calcium are well-proven.
5. 65-70% pediatric and adolescent population (both male and female) is anemic.
6. 40% pediatric population is malnourished.
7. 25 % percent of under-five children are stunted(NFHS 4, 2015-16 and NFHS5, 2019-21)

Micronutrients- also known as vitamins and minerals are essential components of a high-quality diet and have a profound impact on health while they are only required in minute quantities. Micronutrients are the essential building blocks of a healthy brain, organs, blood, bone, and muscles and good immunity. Consuming a diverse range of nutrient-dense foods on a day-to-day basis prevents multiple nutrient deficiencies. Multiple micronutrient deficiencies are often referred to as hidden hunger because they develop gradually over time. Their devastating impact is not seen until Irreversible damage has occurred. While a child may go to sleep each night with a full belly,



m micronutrient deficiency means that his or her body is still hungry for good nutrition, this is also termed as Hidden Hunger. Millions of children suffer from muscle wasting, stunted growth, cognitive delays, weekend immunity, and diseases as a result of micronutrient deficiencies. For pregnant women, the lack of essential vitamins and minerals can be catastrophic increasing the risk of low birth weight, birth defects, stillbirth, and even death (UNICEF).

This study will help to think differently if there is only iron deficiency anemia or if there are other micronutrient deficiencies too in young people who are supposedly healthy. The overall inclusion of multiple factors will enable us to see the problem from a larger perspective. In the study, we have included multiple nutrients besides those which have already been proven to be deficient. Most of these micronutrients are essential for general growth, well-being, better immunity, cognizance powers, and deficiency may cause alteration of epigenetics.

If there is only iron deficiency, predominantly, then providing IFA as public health resolves the problem of anemia and related problems and consequences, which does not seem to have worked very well, so far. After so many years of the IFA program, we still have >50 % population suffering from anemia. If there co-exist multiple deficiencies then we will need further studies at a larger level, which will help us to diagnose the problem at a larger level and make policy changes accordingly. The presence of MND is indicative of a tendency towards alteration in metabolism and NCDs.

Multiple studies on “micronutrient deficiencies and gender, social and economic cost” clearly indicate that micronutrient deficiencies are responsible for not only physical and physiological problems but causes a huge socioeconomic burden. Low productivity leads to more disease burden, cost of treatment, loss of workdays, and loss of human resources. This is more so with females across all socioeconomic groups, by devaluing their work, poor mothers, single mothers, etc. In affluent countries, social bias towards women, their lower position, and lower education status make them prone to micronutrient deficiencies, and their progeny is born with deficiencies to live on food deficient in nutrients, exposing them to infection, therefore to higher morbidity and mortality and if survive till adulthood, they are prone to NCDs.

This study is a pioneer as there have been multiple studies on different nutrient statuses individually or 3-6 nutrients together, mainly by invasive methods (blood levels). This will be a noninvasive method applied to find levels of multiple (nine) micronutrients in every subject. This may prove to



be the basis for further elaborate invasive/noninvasive studies to understand how to combat malnutrition. The study may indicate other metabolic problems.

The presence of multiple micronutrient deficiencies in women has a long-term impact on themselves as well as society and in turn on the national economy. MMND also hampers efforts of women's empowerment in the long term. Physically it makes them prone to diseases and disorders, Pregnancy and lactation further deprive women of nutrients and decline their overall health, making them prone to pregnancy-related mortality. This physical and mental insult, in the long term, reduces the physical and mental capacities and capabilities of a malnourished woman and affects their earning capabilities. Which may prove to be a major factor adversely affecting women's empowerment.

Review of Literature

While searching for studies on multiple micronutrient deficiencies in Indian young females, it was realized that there were very few studies available on this topic (multiple micronutrient deficiencies and women empowerment). Many such studies, relating to malnutrition relating women's empowerment, were found internationally. Most of the Studies in India are on individual nutrients and their effects on various diseases and disorders, e.g. iron, Iodine, Vitamin D, B12, Zinc, etc. separately.

Micronutrients are essential to sustain life and for optimal physiological function. There exists widespread Global Micronutrient Deficiencies (MND), especially among adolescent and pregnant women, with their children under five being at the highest risk of MMND & malnutrition and the consequences.

West KP(2012) in her work mentioned that In the world, more than two billion people are suffering from MND worldwide. NFHS 2019-21 states that Post COVID-19 the number has increased by 300 million more suffering from MMND and MN.

Ward Elizabeth (2014) in a review mentioned that Iron, Iodine, Vit. B12, Vitamin A, and Zinc deficiencies are most widespread. All MNDs together contribute to poor growth, intellectual impairment, and perinatal & neonatal complications and also increase the risk of morbidity and mortality. Addressing Iron deficiency is the most common MND, worldwide. It leads to microcytic anemia, decreased capacity for work, and impaired immunity and endocrine function. Iodine deficiency is the cause of poor growth, goiter, mental retardation, and reduced cognitive functions.



(though we have not included these two, for their widespread existence and effects are well documented). The deficiency of Zinc may cause decreased immunity, usually leading to one or other infections especially diarrhea and respiratory infections, which incidentally are major contributors to infant and under-five mortality. Folic acid (FA) supplements in early pregnancy help prevent Neural tube defects. FA is essential for DNA synthesis and repair. It's deficiency may cause megaloblastic anemia and may cause neural tube defects in fetus. Vitamin A is necessary for cell integrity and vision. Deficiency may cause blindness, decreased immunity, and cell differentiation. The long-term consequences of MND are not only seen at the individual levels but also have deleterious impacts on economic development and human capital at the country level. The biggest concern shall be that MND may persist over the generations, and the intergenerational consequences of MND, which we have just begun to understand. Identification and prevention of MND are very critical and shall be on the priority list of every Govt. Especially in middle- and lower-income countries.

Ward Elizabeth (2014) also mentioned that MMND leads to alteration of metabolism, and this altered metabolism may lead to metabolic disorders. It has been proven that a deficiency of Folic Acid and vitamin B12 may alter DNA and RNA replication and function, it also causes megaloblastic anemia. Any deficiency is primarily caused by low intake, insufficient availability, or chronic disorder, with or without impaired absorption and assimilation due to any cause, be it an infection of others. In infants, and children MMND may be an extension of MMND from fetal life itself. This may extend to adolescent and adult life.

Love AH (1986) in his study stated that if malnutrition remains for a longer period, it may lead to metabolic alterations. This gives a wide variety of metabolic responses, depending on the circumstances, from reactions to pure deprivation of nutrients, to the added stress of injury and sepsis. Differences in responses are varied in adults and children. Weight loss is well documented, with changes in carbohydrates, proteins, fats, the macronutrients. In this study, only a few micronutrients are included.¹ Many micronutrients are responsible for energy production cycles, enzyme and hormone productions, and their activity cycle. Therefore, low or non-availability of multiple micronutrients may cause reduced energy production, decreased immunity, hormonal alterations, or alteration of the function of organs, hormones and enzymes. This will result in further non-availability

of nutrients, leading to stress, infection, etc. The intestinal tract shares the response to malnutrition. Changes in mucosal function determine the ability to absorb nutrients.

The clinical circumstances in which malnutrition may arise vary enormously and influence signs, symptoms, and metabolic responses. Primary protein-calorie malnutrition is common due to environmental forces and food habits in many countries. Secondary malnutrition is usually present in cachexia due to chronic illnesses like malignancy and other disorders. Metabolic insult in the form of sepsis or injury may add catabolic process, further aggravating malnutrition, and its response. Responses may differ in children than in adults as they are in the process of growth as well.

WHO(2004) in a report on world nutrition situation referred MMND as hidden hunger.

It also opines that when placed in a situation of undernutrition the body undergoes a series of changes, which may be divided into three stages-

- A. Depletion of reserves
- B. Metabolic adaptation
- C. Deterioration and death.

The rate and extent of these stages depend on the amount and duration of nutrient deprivation.

Weight loss is the first one to appear. This is the most common parameter for long. In my experience, well-fed people with MMNDs are prone to obesity.

Baily RL(2015)in epidemiology of malnutrition states that, it has been shown in various studies that deficiency or absence of any or many micronutrients may alter metabolism. It can also alter intestinal function, especially digestion and absorption. MMND may also cause impairment of the gut barrier and may allow bacteria and toxins an easily excess into the blood. A deficiency of Micronutrients may add up to further deficiencies, because of altered metabolism. The human body is excellent at adopting alternative pathways of metabolism. So, it will keep functioning. These alternative pathways will produce alternative metabolites which act as radicals or toxins. Another aspect of MMND is, that in a state of deficiency, metabolic actions dependent on one or more of them, are not possible or are altered. Macronutrients are present in the body, hidden hunger prompts the body to store unutilized nutrients as fat. This may be the cause of obesity in people who eat less or are well-fed but with MMNDs.

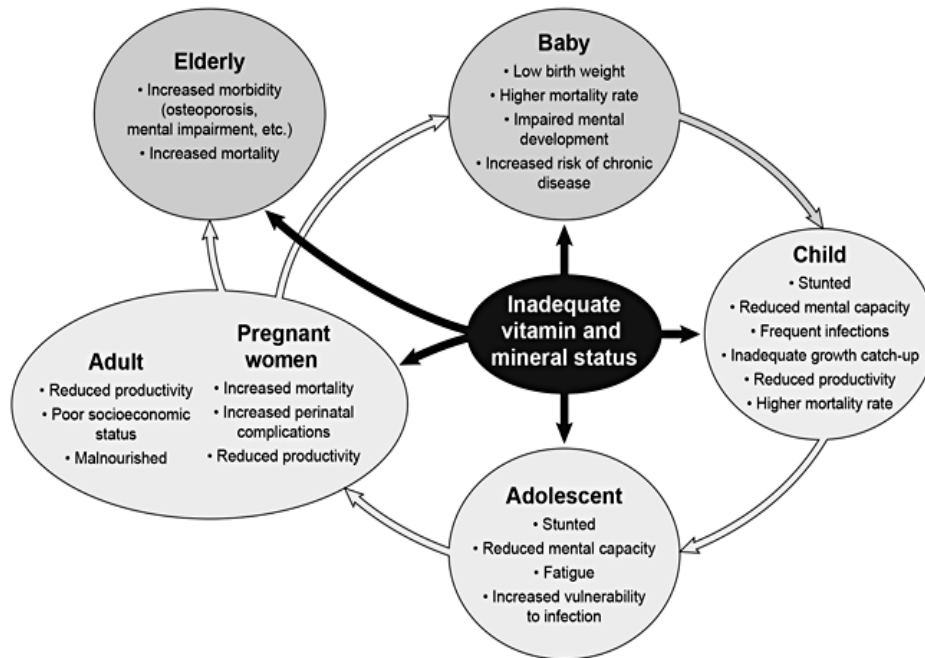


Fig1: The conceptual framework for the cycle of micronutrient inadequacies across the life span (adapted from ACC/SCN) (Epidemiology of MND in 2015)

Katona and Katona (2008) in their study mentioned that Undernutrition is the most common cause of MMND worldwide. West KP(2012) in global health report states that the different deficiencies on different sex has different effects. It has been found to have –

- a. Multiple Micronutrient deficiencies affect global health outcomes.
- b. MMND incurs substantial economic costs.
- c. Health and nutrition outcomes are affected by the sex of the person.
- d. Sex being affected by micronutrient deficiency is culture-specific.
- e. The social and economic costs of micronutrient deficiencies with particular reference to women, female adolescents, and children are likely to be considered but not well quantified as yet.

Given the potential impact on reducing infant and child mortality, maternal mortality, and enhancing neuro micronutrient deficiencies are so important to public health outcomes, particularly in the developing world, a series of goals have been established and significant donor funds have been directed toward them.

A recent report highlights the magnitude of the problem of micronutrient deficiencies and attempts



to demonstrate the economic and health costs of vitamin and mineral deficiencies through a series of country-specific reports. It also demonstrates the cost-effectiveness of known micronutrient interventions and the need for greater funding. Women comprise the majority of the world's poor. In poor households, women play a critical role in ameliorating the effects of poverty, especially for infants and young children. Therefore, it seems appropriate that reduction in micronutrient deficiencies, especially when they have an impact on infant and childhood morbidity and mortality, maternal morbidity and mortality, general development, growth, and economic and social well-being, needs to be aggressively tackled, not only to reflect legal human rights of women and children to adequate nutrition including micronutrients but for actual impact.

Darnton Hill (2005) in his review article states that Micronutrient deficiencies are so important to public health outcomes, particularly in developing countries, that a series of global goals have been established and significant amounts of donor and national funds have been directed at them. Women comprise the majority of the world's poor in our house households, women play a critical role in ameliorating the effects of poverty, especially for infants and young children this means the reduction of micronutrient deficiency is given that they have an impact on infants and child mortality, maternal morbidity and mortality and development, growth and economic and social wellbeing. MND needs to be aggressively tackled not least to reflect the legal human rights of women and children to adequate nutrition including micronutrients.

Darmon N et al (2002), in his study mentioned that long-term nutritional deficiency also leads to various NCDs including cancers, as deficiency of nutrients leads to poor healing, altered Metabolic Pathways, and therefore the extra load of altered metabolites (commonly known as toxins, radicals, oxidants, etc.). A few of the micronutrients are necessary for RNA and DNA formation for various functions and cell division. Long-term deficiencies may cause alteration in DNA and RNA, leading to immature and/or malignant cells or altered proteins which may cause autoimmune reactions and disorders.

Viteri and Gonzalez (2002), observes that in developing countries, intake of expensive animal-derived foods is often not accessible to the poor and this substantially reduces the intake of vitamins and minerals. Darmon N (2002), mentioned that in industrialized countries the poor diet in low socioeconomic groups affects micronutrient intake more through low intake of fruits and vegetables.

Kara L et al (2015) and Halimatou A (2017) in their review study state that Women's empowerment is considered crucial for improving nutrition outcomes. Since women are often primary caregivers, they can influence their children's nutrition indirectly through their own nutritional status as well as directly through childcare practices. Several studies (using direct and indirect measures of female empowerment) have demonstrated the important associations between women's empowerment dimensions and their own nutrition as well as that of their children.

Wiji A's et al (2014), carried out study in Andhra Pradesh, India, found that measures of maternal autonomy (such as financial autonomy, participation in decision-making within the household, acceptance of domestic violence, and freedom of movement) were associated with positive infant feeding and growth outcomes. A recent study in India found that maternal autonomy (measured based on variables that indicate a woman's freedom and ability to think, speak, decide, and act independently) was positively associated with a child's nutritional status, albeit only for children under three years of age.

Goal and Objectives of National Policy for Women Empowerment- GOI (2001)

1.11 The goal of this Policy is to bring about the advancement, development, and empowerment of women. The Policy will be widely disseminated to encourage the active participation of all stakeholders in achieving its goals. Specifically, the objectives of this Policy include-

- (i) Creating an environment through positive economic and social policies for the full development of women to enable them to realize their full potential.
- (ii) The de-jure and de-facto enjoyment of all human rights and fundamental freedom by women on an equal basis with men in all spheres – political, economic, social, cultural, and civil
- (iii) Equal access to participation and decision making of women in the social, political, and economic life of the nation
- (iv) Equal access for women to health care, quality education at all levels, career and vocational guidance, employment, equal remuneration, occupational health and safety, social security and public office etc.
- (v) Strengthening legal systems aimed at the elimination of all forms of discrimination against women
- (vi) Changing societal attitudes and community practices by active participation and involvement of both men and women.
- (vii) Mainstreaming a gender perspective in the development process.



- (viii) Elimination of discrimination and all forms of violence against women and the girl child; and
- (ix) Building and strengthening partnerships with civil society, particularly women's organizations.

A holistic approach to women's health which includes both nutrition and health services will be adopted and special attention will be given to the needs of women and girls at all stages of the life cycle. The reduction of infant mortality and maternal mortality, which are sensitive indicators of human development, is a priority concern. This policy reiterates the national demographic goals for Infant Mortality Rate (IMR), and Maternal Mortality Rate (MMR) set out in the National Population Policy 2000. Women should have access to comprehensive, affordable, and quality health care. Measures will be adopted that take into account the reproductive rights of women to enable them to exercise informed choices, their vulnerability to sexual and health problems together with endemic, infectious, and communicable diseases such as malaria, TB, and water-borne diseases as well as hypertension and cardio-pulmonary diseases. The social, developmental, and health consequences of HIV/AIDS and other sexually transmitted diseases will be tackled from a gender perspective. In view of the high risk of malnutrition and disease that women face at all the three critical stages viz., infancy and childhood, adolescent and reproductive phase, focussed attention would be paid to meeting the nutritional needs of women at all stages of the life cycle. This is also important in view of the critical link between the health of adolescent girls, and pregnant and lactating women with the health of infants and young children. Special efforts will be made to tackle the problem of macro and micronutrient deficiencies especially amongst pregnant and lactating women as it leads to various diseases and disabilities.

Intra-household discrimination in nutritional matters vis-à-vis girls and women will be sought to be ended through appropriate strategies. Widespread use of nutrition education would be made to address the issues of intra-household imbalances in nutrition and the special needs of pregnant and lactating women. Women's participation will also be ensured in the planning, superintendence, and delivery of the system.

Women play a significant role in the agricultural sector in developing countries. Evidence from developing countries indicates that women supply, 43 percent of the agricultural labor force, but in Sub-Saharan Africa, this contribution is nearly 50 percent. They also constitute a significant proportion of the wage workers in the agri-food supply chain. In addition to their roles in agriculture,

women have a vital role in household products and are usually the primary caregivers within the household.

This policy came into existence in 2001 after that one draft came in 2016 but was not declared officially. Other work on women's empowerment has the least focus on complete or wholesome nutrition.

A woman's role, responsibilities, and activities in household production and, particularly, in agricultural production are time-consuming and physically demanding, requiring significant energy and physical capacity. This implies that women's ability to effectively undertake these agricultural and household production activities is greatly influenced by their physical capability and their health status stating that improving women's health status can effectively enhance their performance in their socioeconomic responsibilities, including increasing agricultural production by becoming more efficient and skilled laborers.

A woman's health status is influenced by her access to and control over resources that affect food availability and her ability to be responsible for her healthcare needs. Therefore, the empowerment of women to have more decision rights over the dimensions of their lives that affect their health and capability in performing income-generating and caregiver responsibilities has been receiving significant attention in recent years (FAO, 2015 and Amugsi, et al , 2016).

Berti C, et al (2014) in a review mentioned that Empowering women is a complex concept given the socio-cultural dimensions embedded in gender relations and politics. This complexity also confounds the development of a good definition for the concept of women's empowerment. The two main elements that are widely accepted in the definition of empowerment are "process" and "agency". Empowerment is considered to be a process, a transition in an individual's decision-making capability from where she is denied choices to a position where she can choose for herself. The second element is the agency, which states that an individual must play a role in this process of change. The concept of agency is the "ability to define one's goals and act upon them". These two key elements are expressed in the following definition for women's empowerment that is adopted in the study: "women's ability to make decisions and affect important outcomes for themselves and their families as well as have control over their lives and over their resources" .

Methodology



Sant Hirda Ram Girls College Bhopal was selected for nutritional analysis of the young female population in Bhopal. Permission was taken from the college's Authorities for the study. Written Consent of students, after informing the procedure and why the study has been undertaken, from those who were ready to participate in Nutrition Analysis, was taken. Data Was collected in the month of April 2018

Investigative methods for Nutritional Analysis (NA) were non-invasive. Study- This is a cohort Nutritional Analysis, inclusive of various nutrients listed of students (females) of age group 18-25 (date of birth 1st January 1992 to 31st December 2001). The area under evaluation was College from Bhopal MP. Age group selected- College students, females, 18-25 years of age (1st January 1992 to 31st December 2000). Number of Subjects- Expected Number was 50, total turnout was 64 students. Presumption- This group was chosen, as most of them belong to similar socio-economic, cultural, and educational backgrounds. Therefore, their knowledge and eating habits must be similar, at par with each other, before coming to college and in the college, whether hosteller, day scholars, or paying guests. Most of them were hostellers, therefore consuming similar kind of food. Sample under the study were either adolescents or young adults; their food consumption must be enough, so also digestion, absorption, and assimilation.

Results Expected- Better nutritional levels of the majority of subjects. The majority must be involved in some or other extra physical activity, exercise, or sports. Those involved in some exercise will show better levels of nutrition. There are several parameters based on which, the prevalence of undernutrition among The studied populations can be based. Instruments used- A format was developed to include various listed nutrients.

Instruments used : Instruments included Electromagnetic nutritional analysis instrument and scale. An electromagnetic gazette was used for micronutrient level detection. This machine is based on principles of acupressure and the fact that each molecule has its electromagnetic field. Various nutrients have various electro-magnetic waves which get concentrated at certain points in the body. These points can be utilized to find the number of particular nutrients in a body. This gives body levels of nutrients rather than blood levels; Blood levels may be misleading at times. The gazette gives a qualitative analysis.

Nutrients verified were Vitamins A, B 12, C, D and folic acid Minerals Mg, Ca, Se, Cr, Zn, Height was taken with measuring tape. The age range was 18 years to 25 years. Nutritional analysis was done by the researchers themselves. Therefore, there was no need for verification. All the willing subjects were included with or without acute or chronic disease, known or unknown. One subject was not considered for being 16 years of age.

Procedure- Permission from the Directors of the college was obtained for the study. Visited college.

Before consent, the whole procedure was explained to groups of students. Went ahead with the procedure only for the students who gave consent. Students' consent was obtained beforehand. Daily measurements and nutritional analysis were done for as many students as possible, almost every working day. Basic questions like family income and exercise on a daily basis were included to find the economic class of the subjects. The exercise was included in the question, to understand their knowledge regarding the importance of exercise. Here we are presuming that youth are in general healthy, except for Iron Deficiency Anaemia (IDA) (which might be present in around 50% female population), they have a better capacity for food consumption, better digestion, absorption, and assimilation of nutrients due to favourable age factor. Therefore, other deficiencies shall be low.

Micronutrients include- Vitamins- A, B12, Folic Acid (FA), & D

Minerals- Zn, Mg, Cr, Se, Ca.

Delimitation- Area- Bhopal. As the study to be done was decided for urban college. Only women subjects were included. Age- 18-25 years.

Exclusion- Absence of one or, more limbs. As it may interfere with the results.

Results-

A total of 64 subjects consented and underwent nutritional analysis for Vitamin A, D, B12, Folic acid and minerals Zn, Mn, Ca, Se, and Cr, and weight and height.

The average height was 159 cm. The average weight was 55.8 kg. Out of sixty-four only 22 (32.81%) were involved in some kind of exercise. As far as ailments are concerned there were only a few who had any problems, which they know of as of now. The problems were Hypothyroid (2), migraine (1), slipped disc (1), PCOS 5 i.e. 7.9%, one had heart problems (not specified) and one had sudden weight loss problems.

Blood pressure was within the normal range for systolic and diastolic both, for all of them. The categories in which maximum girls fell were good, medium, and severe levels of deficiencies. Not a single subject had levels of any vitamin or mineral in the High-level zone. Medium levels mean that these girls are in a medium deficiency zone and are prone to getting into a severe deficiency zone at any time. Deficiencies are indicative of being more prone to infections and other problems.

Vitamin and mineral status was as follows-

Table 1- Vitamin and mineral status

Micronutrient status							
SN	MN	Normal	Percent	Medium	Percent	Low	Percent
1	A	16	25	36	56.25	12	18.75
2	D	13	20.3	35	54.68	16	25
3	B12	11	17.18	34	53.12	19	29.68
4	FA	14	21.87	37	57.81	13	20.3
5	Mg	29	45.31	31	48.43	4	6.25
6	Zn	19	29.68	36	56.25	9	14.06
7	Ca	14	21.8	41	64	9	14.06
8	Se	15	23.43	37	57.81	12	18.75
9	Cr	10	15.62	35	54.68	19	29.68

Table 1 one shows the basic status of micronutrient levels in the participants. On average 25% of subjects were in the normal range of nutrient levels, and 53-56 % had moderate deficiencies. 6-29 % (19.5 average) of the subjects were in a severe deficiency zone.

If we consider the deficiency part, medium to severe, then almost 75% of subjects showed a deficiency state for nine essential nutrients. These deficiencies are present in various combinations in different subjects. 30.15 % (19) of subjects had not a single element in the normal zone. Their nutrient levels were in medium to severe deficiency levels. That indicates that they were medium to severely deficient in various nutrients.

Only one subject had all nutrients in the normal zone, and this subject has been suffering from PCOS and a hypothyroid state. 38.09% (24) of subjects had no nutrient in the severe deficiency zone which means either they were in no deficiency or moderate deficiency state. 42 participants (65.62%) had one or more normal-level nutrients, and 22 participants (34.37%) had no nutrients in the normal zone.

DISCUSSION-

This is a qualitative study to see the status of nine vitamins and minerals in young adult female subjects and their economic status. Results are indicative of a deficiency state of multiple nutrients (nine as listed) present at the same time. The problem may be way bigger than it seems to be. Almost 75% of young adult females were showing moderate to severe levels of deficiencies. This is especially of concern as most of them will be bearing a child shortly. It has been well proven that maternal MMND may affect fetal growth and cause fetal MMND, leading to Neonatal and infant MMND and consequences of high LBW, MMR, NMR IMR, U5MR repeated infections of childhood and stunting. The study indicates that. 55.625% (36n) had a medium deficiency and 18.75 % (12n) were in a severe deficiency state of Vitamin A. A Total of around 75% of the subjects were facing deficiency of vitamin A. Vitamin A deficiency mainly leads to poor immunity and repeated infections, alteration in mucosal cell walls and skin, and long-term consequences. Repeated infections will lead to further depletion of nutrients from the body.

Folic Acid-57.81% (37n) in the medium deficiency zone and 20% (13n) in the severe deficiency zone. 77% with folic acid deficiency. FA is well known for deficiency-causing fetal neuronal deformities. Therefore, given during pregnancies. FA is an active micronutrient in cell division so long-term deficiency may cause carcinomatous changes in cells. Anaemia is a major concern still.

Vitamin D 54.68% (35n) showed medium levels and 25% (16n) were with very low levels i.e. severe deficiency. A total of 79% in the medium to severe deficiency range for Vitamin D. Vitamin D along with Calcium and Folic Acid deficiency can cause multiple health and developmental problems to mother and fetus both. Vitamin D is associated with bone growth and bone mass and density maintenance as well as calcium metabolism. Deficiency may be predictive of osteoporosis shortly with multiple pregnancies. Altered Calcium levels may interfere with muscle function as Calcium is necessary for muscle contraction.

Vitamin B12- 53.12 % (34n) with medium deficiency, 29.68% (19n) had severe deficiency. 83% were deficient in Vitamin B12. B12 deficiency not only causes anemia but also it is also important in protein manufacturing and DNA/ RNA duplication. Long-term deficiency may cause cell division/ function alteration and lead to malignancies. In vegetarians and vegans, B12 deficiency is a major factor.

Magnesium 48.3 % (31n) had a medium deficiency and only 6.25% (04n) showed severe deficiency. 53.95% are suffering from a deficiency of Magnesium. As discussed in the review Mg is the second most important cation in the body which influences almost every metabolic reaction in the body. Deficiency poses a major threat.

Zn 56.25% (36n) had a medium deficiency, 14% (9n) had severe deficiency levels. 70% show a deficiency of Zinc. **Zinc** deficiency impairs immune function and is associated with an increased risk of gastrointestinal infections. It is also a contributing factor in child deaths due to diarrhea. Zinc deficiency is especially common in lower-income countries due to the low dietary intake of zinc-rich foods and inadequate absorption.

Calcium 64 % (41n) in the medium zone and 14 % (09n) showed severe deficiency levels. 78% of young females are suffering from medium to severe calcium deficiency. Selenium 57.8% (37n) were in the medium deficiency range and 18.75 % (12n) were severely deficient. 76% showing Selenium deficiency. These persons may suffer from impaired immunity. Since it acts as an antioxidant deficiency may alter multiple metabolic reactions.

Chromium was 54.68% (35n) in the medium deficiency zone and the rest 29.68% (19n) showed severe deficiency. 84 % are in a deficient state for Chromium. Such levels of deficiency can be indicative of future NIDDM in these girls, as well as hypertension and altered metabolism, leading to metabolic syndrome and obesity.

The above results are just a small representation of the status of basic vitamins and a few essential minerals in young females, aged 18-25 years. Almost every micronutrient is showing deficiency status, either moderate or severe, to the range of 75%. Though the combination results vary, on the average scale this is an alarming situation. Simply because these are the females who were supposed to be receiving IFA during adolescence, and still their hemoglobin has not been improving (NFHS5). This could well be the reason that deficiency of not only Fe but B12, FA, Cr, Zn, and multiple vitamins necessary for the creation of hemoglobin, along with protein, is the reason for nonresponding anemia, not to forget genetic blood dyscrasias, despite all the public health efforts.

Moderate to severe multiple nutritional deficiencies are present in young adult females, quite possibly they are present in young adult males and in general the adult population as well. The presence of nutritional deficiencies may lead to metabolic disorders in the long term, e.g. long-standing deficiency of folic acid, vitamin B12, Cr, and Mg may alter DNA and RNA structurally, which may cause



malignancy in the future. Iron deficiency causes a decrease in cognitive function and reduced immunity. Zn deficiency causes problems in cell devising and reduced immunity. Vitamin D is crucial for bone mineral layout, deficiency will cause osteoporosis. Low Calcium may cause alteration in muscle function. Multiple B complex, vitamin Cr, and Zn are crucial for energy production, deficiency of vitamins and minerals in the ATPase cycle will cause low energy levels and decreased productivity. Cr and Se deficiency may be the reason why India is facing a sudden increase in all Non-Communicable Diseases. Just to mention a few. The presence of multi-nutritional deficiency will result in many of the above-mentioned problems of adulthood in near future, besides affecting the future generation. This can go on in generations. The MMND women are less productive economically, due to physical mental and disease status. The presence of MND hampers the absorption of nutrients from the gut. It may damage the mucosal barrier of the gut and cause its own consequences. MND may also lead to obesity. This study is on a very small sample of young adult females. But the trend it is indicating is of the presence of multi-micronutrient deficiencies, moderate to severe in almost 75% of the population.

Recommendations

Multiple micronutrient deficiencies may not seem to be a threat in the immediate scenario. But in the long term, it's damaging not only to the metabolism of the person, repeated infection but also a big threat to national economic health. Quite possibly MND will have already caused major metabolic alterations and damages during fetal life. A few studies are available in a few countries on young adult females. There is a need for large cross-sectional studies, across India, for females and males both. Then only the epidemiology of MND in India can be understood, to make effective policies to overcome Nutritional Hunger and Hidden Hunger. Major cross-sectional Studies are also needed for the association of malnutrition with NCDs, and correlation with agricultural MN deficiencies. We need to think further that supplementation, fortifications, and extra food may not be sufficient for overcoming MMND. Major policy reviews and alterations are required right from research to policymaking and implementation.

Working on MND epidemiology from the Indian perspective and other factors is necessary for making effective strategies for women's empowerment. In this Agriculture department should actively participate as nutrients from cereals and pulses are reducing fast (as studies are indicative of this fact), to stop this factor Agriculture shall be playing upfront. A simultaneous review of the Public

Distribution System is also required as to why food grain at such cheaper rates, and distant reach is not reaching to women. Education system to review why such an educated young generation is having such low levels of MNDs.

Nutrition is the most powerful adaptable environmental exposure to target to reduce the burden of diseases and death across the lifespan. and have a direct effect on individuals and indirect effects on societies and Nations, especially economic burdens. The relevance of this study is that it is done on young adult females. There are almost nil studies in this group, though studies on this age group of pregnant women are available, but very few are from India. Where half the population is anemic, children are stunted, and multiple deficiencies singularly are prevalent which is causing low cognizance capacities and low work capacity, has a great impact on the country's economy. Keeping this fact in mind there is a dire need for large-scale study across ages, sex, cultures, and economic levels to find out the status of multiple micronutrients (besides those already proven) and policy changes accordingly.

Declaration: - Researchers have done this study independently in their own interest. There was no other interest associated with the study.

Abbreviations-

1	B12- Vitamin B12	13	MND- Micro-Nutrient Deficiency
2	Cr- Chromium	14	MMND- Multiple Micronutrient Deficiency
3	DNA- Deoxyribonucleic Acid	15	NCD- non-communicable diseases
4	FA- Folic acid	16	NMR- Neonatal Mortality Rate
5	IFA- Iron Folic Acid	17	NNMB- National Nutrition Monitoring Board
6	IDA- Iron Deficiency Anemia	18	RNA_ Ribonucleic Acid
7	IMR- Infant Mortality Rate	19	Se-Selenium
8	LBW- Low Birth Weight	20	SSA- Sub Saharan Africa
9	MGD- Millennium Developmental Goals	21	Vit A- Vitamin A
10	Mg- Magnesium	22	WE- Women Empowerment
11	Mn- Manganese	23	Zn-Zinc
12	MMR- Maternal Mortality Ratio		



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