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**Health and Population:
Perspectives and Issues**



आरोग्यम् सुखसम्पदा

राष्ट्रीय स्वास्थ्य एवं परिवार कल्याण संस्थान
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The National Institute of Health and Family Welfare

बाबा गंगनाथ मार्ग, मुनीरका, नई दिल्ली—110067

Baba Gangnath Marg, Munirka, New Delhi –110067

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An Investigation on the Prevalence of Anaemia among Rural Adolescent Students of West Bengal, India

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Abstract

Anaemia among adolescents causes impaired cognitive performance, motor coordination, behaviour and motor development, academic achievement, and language development as well as impaired growth, developmental delay, decreased physical activity, and increased morbidity from infectious diseases. The present study was undertaken to investigate anaemia prevalence among the adolescent students in West Bengal. This study included 253 subjects of which 128 were boys and 125 were girls in the age group of 12-15 years, selected from different districts of West Bengal state in India. Anthropometric measures and physiological parameters were measured from the subjects by using standard techniques. The prevalence of anaemia was very high among the subjects and more than the global prevalence. There was a significant difference in mean hemoglobin content among different FIG groups. FIG I had the lowest mean hemoglobin content while FIG III had the highest mean hemoglobin content. There was an increasing trend in anaemia prevalence with decreasing monthly family income. The Odd ratio became higher in the FIG I group than in the FIG II and FIG III groups of both sexes. Improving overall nutritional status and access to resources of their family will have the greatest impact on reducing anaemia. Iron supplementation programmes can reduced the anaemia prevalence. Awareness about A diet plan with the low-cost iron-rich foods may be another solution to the problem among the rural population. Health nutrition education by school teachers, changes in the Mid-day Meal menu, and the development of the kitchen garden on school campuses will have the greatest impact on reducing anaemia prevalence.

Key words: Adolescent, anaemia, monthly family income, prevalence

Introduction

The rural population in India faces considerable disparity as compared to the urban population in terms of medical facilities, educational facilities, health facilities, and economic pursuits¹. In developing countries like India, poverty and scarcity of food are greater, awareness of diseases nonexistent and it appears that the diseases, viz., anemia, hypertension, diabetes, obesity, depression, and undernutrition may be equally prevailing in poor people^{2,3,4}. Anemia continues to be a major public health problem worldwide; particularly most affected are children and women in both developed and developing countries and it is an indicator of malnutrition and poor health for human health as well as for the socio-economic development of a population^{5,6}. More

individuals have been suffering from iron-deficiency anemia at any given moment than any other health problem worldwide⁷. Globally, anemia prevalence was 29.9 per cent in women of reproductive age (15-49 years), 29.6 per cent in non-pregnant women of reproductive age, and 36.5 per cent in pregnant women in 2019⁸. Globally, anemia prevalence was 39.8 per cent in children aged 6-59 months in 2021, which is equivalent to 269 million children⁸. The prevalence of anaemia in children under five was 60.2% in 2021, which was the highest in the African Region⁸. Anemia is one of the most common public health problems in India, which is much more prevalent in the rural population than the urban⁹. Nutritional anemia is a critical public health problem in India that affects almost poor women, adolescent girls, and children⁹. National Family Health Survey (NFHS) studied the prevalence of anemia among pregnant women in India and reported that 50 percent of pregnant women were anaemic in India, India had the highest prevalence of anaemia in pregnancy among South Asian countries¹⁰. Smaller-scale studies on micronutrient deficiency conducted in India revealed that the prevalence of anemia was high among adolescent¹¹⁻¹⁴.

Haematological parameter like haemoglobin (Hb) is generally known to be affected by socioeconomic conditions, especially via nutrition, as the nutritional status largely depends upon the socioeconomic condition and cultural norms^{15,16}. In India, the rural population is mostly subjected to low bio-availability of iron because of the cereal-based diet and chronic blood loss from hookworm infestations which results in anemia^{17,18}.

Anaemia is associated with decreased muscular strength, lowered physical activity, weakness, fall injury, and mental capacity, increased morbidity from infectious diseases, increased frailty risk, maternal, perinatal and neonatal mortality, inadequate storage iron of the new-born, premature delivery, low birth weight, impaired cognitive performance, and motor development among children^{19,20}. There is convincing evidence that iron deficiency and anaemia among young children and adolescents was a matter of serious concern because it impaired cognitive performance, behavioural and motor development, co-ordination, language development, and scholastic achievement which resulted in a lower Intelligence Quotient (IQ) and behavioural abnormalities, as well as impaired growth, developmental delay, decreased physical activity, and increased morbidity from infectious diseases^{21,22}. Anaemia in childbearing females has been associated with the higher risk of maternal morbidity and mortality, perinatal and neonatal mortality, preeclampsia, inadequate iron stores for the new-born, preterm birth, and low birth weight^{20,23}.

The adolescent population is experiencing a tremendous amount of changes in physical development, although development is continuous, the rate at which this development occurs may vary in individual case²⁴. Physical changes in the body are taking place in adolescent girls, along with rapid sexual development^{25,26}. Adolescents need more nutrients and energy due to the increased height and weight and their heightened physical growth also depend upon socioeconomic status^{27,28}. It is also a time when the physiological needs for energy and nutrients are increased and the consumption of a diet with proper nutrition is important²⁹. Several investigators have demonstrated an association between physical development in the adolescent period with nutritional and socioeconomic status²⁹⁻³¹. Several recent studies have been carried out in different states in India on the nutritional status of adolescent³²⁻³⁵. However, studies on anemia among the rural adolescent population in relation to the economic status of the family in

West Bengal state are scanty^{36,37}. Taking the above issues into consideration, the present study was therefore undertaken to investigate the prevalence of anemia among adolescent boys and girls in West Bengal state and to examine the possible association of the prevalence of anemia among adolescents with the economic status of the family.

Methodology

Selection of Site and Subjects: This cross-sectional descriptive study was conducted on 253 subjects of which 128 were boys and 125 were girls in the age range of 12-15 years, selected from different schools of Howrah, East, and West Midnapore districts of West Bengal state, India. Ethical approval and prior permission were obtained from the institutional Ethics Committee before the commencement of the study and the study was performed in accordance with the ethical standards of the committee and with the Helsinki Declaration.

Sampling Design: Two-stage sampling method was utilized. In the first stage, the cluster sampling method was used to identify 5 clusters (schools) in each district e.g., Midnapore (East and West), and Howrah of West Bengal, India. In the second stage, a systematic random sampling method was used to identify 20 students (boy-10; Girl-10) per cluster. All the students (Standard VII to Standard X) in the cluster were listed and the number of students was divided by the required number of students to get the sampling interval. The first student was selected randomly by using the lottery method and then subsequent students were identified by adding the sampling interval to the random number. The selected students were approached during field visits and the protocol of the study was explained verbally in the local language (Bengali) and they were selected as participants. It was reported that apparently healthy students who were not suffering from any acute illness and were self-satisfied with their normal day-to-day work schedule at the time of measurements were enrolled as participants in the study. Informed consent was obtained from the school, local Panchayat, and the parents.

Age Estimation: Assessment of age most essential for conducting growth studies. The accurate age of the adolescent students was recorded from the school registration books.

Socioeconomic Status: The socioeconomic status of the parents of the students was evaluated by a modified Kuppuswami scale³⁸. From the response of the subjects, the total monthly income of the family was noted. The socioeconomic status of the parents was determined by the scores suggested in this scale. The score obtained by each person in education, occupation, and income was added to get the final score, and accordingly, the parents were categorized. Five different categories from the lower to upper have been suggested in this scale. Monthly family income was recorded in rupees (Rs.). The current exchange rate is US \$1 = 82.3275 INR (Approximate). The subjects were further classified into the following three family income groups (FIG) according to their monthly family income (MFI):

FIG I: Rs. \leq 5,000

FIG II: Rs. 5,001–9,999

FIG III: Rs. \geq 10,000

Measurement of anthropometric dimensions: Height and weight of the participants were measured using standard methodology. Height was measured by using an anthropometer

(Hindustan Minerals) and weight was measured by using a portable weighing machine (Libra). From measuring the height and weight of the participants, the body mass index (BMI) was computed using the following standard equation: $BMI = \text{Weight (kg)} / \text{Height}^2 \text{ (m)}$

Determination of Hemoglobin Concentration

The hemoglobin (Hb) status was measured with a finger prick sample of capillary blood and analyzed immediately using a hemoglobinometer. Both boys and girls were classified as mildly, moderately, or severely anemic based on their hemoglobin status following international reference³⁹. Anemia was defined as Hb of <12g/dl. Mild anemia was defined as Hb of 10 –11.9 g/dl. Moderate anemia was defined as a Hb of 7-9.9 g/dl and severe anemia as a Hb of < 7 g/dl.

Determination of Blood Pressure

Blood pressure was measured by auscultatory method, with the help of a sphygmomanometer (mercury type) and a stethoscope⁴⁰. Resting systolic and diastolic blood pressures of the subject were measured after taking a rest in a sitting position for at least 15 min prior to measurement and again at least 10 min after the first reading. The mean values of three measures were used in analyses. The mean arterial pressure (MAP) was calculated from the formula, $MAP = DBP + \frac{1}{3} (SBP - DBP)$.

Determination of Breathing Rate and Pulse rate: The breathing Rate and Pulse rate of the subjects were determined by standard technique⁴¹⁻⁴³.

Statistical analysis: The sample size was determined by the standard formula $(n = z^2 pq/d^2)$ ⁴⁴. The minimum estimated sample size was 210 $[(1.96^2 \times 0.837 \times 0.163)/0.05^2]$. The calculation was based on 83.7 per cent prevalence (p) of anaemia among rural Bengali students⁴⁵ with desired precision (d) of 5%. Where, $q = p-1$ and $z = 1.96$. Data were presented by sex. Age, anthropometric measures, and hemoglobin content were described by their means and standard deviations. To test the significance of the difference of different parameters, the student t-test was performed. A Chi-square analysis was done to determine the differences in the prevalence of anemia among the sexes and different family income groups. One-way analyses (Scheffe's procedure) were carried out to test differences in mean hemoglobin content across the three economic categories. The odd ratio (OR) was calculated to determine the change in the prevalence of anemia with respect to family income groups. Statistical significance was set at $p < 0.05$.

Findings

The socioeconomic status of the parents was evaluated by the modified Kuppaswami's scales as already mentioned. From the results of the present study, it was noted that the majority of the parents belonged to the lower socioeconomic category (64.82%). 25.69% of the parents belonged to the lower middle socioeconomic category. Only a notable percentage of the parents belong to the upper middle category (9.49%).

The physical and physiological characteristics of the students have been shown in Table 1 according to sex. The mean ages were 13.48 ± 1.11 years and 13.42 ± 1.12 years for boys and girls respectively. No significant difference in mean age was obtained between the sexes. The hemoglobin content was significantly higher ($p < 0.05$) in boys compared to girls. However, no significant difference was obtained in other physical and physiological characteristics between the sexes.

Table 1
Physical and Physiological Characteristics of the Subjects

Parameters	Boy (n=128) (Mean±SD)	Girl (n=125) (Mean±SD)
Age (years)	13.48±1.11	13.42±1.12
Height (cm)	145.38±7.93	143.96±6.27
Weight (Kg)	36.71±6.06	35.44±6.05
BMI (Kg/m ²)	17.32±2.26	17.06±2.42
Hemoglobin (g/dl)	10.23±2.24	9.59±2.14*
Breathing rate (breaths/min)	19.33±1.84	19.70±2.18
Pulse rate (beats/min)	77.83±5.71	78.79±6.78
Systolic blood pressure (mm Hg)	106.77±11.70	104.07±12.70
Diastolic blood pressure (mm Hg)	71.14±8.53	70.21±8.96
Mean blood pressure (mm Hg)	83.02±9.11	81.50±9.31

With respect to Boy * $p < 0.05$

The prevalence of anaemia was studied among the study population based on WHO-prescribed hemoglobin cutoff values as mentioned earlier³⁹ and it was found that the prevalence of anemia was very high among both boys and girls (boy 73.44%; girl 83.2%). Again the subjects were divided into three anemia groups viz. mild anaemia, moderate anaemia, and severe anaemia based on WHO-prescribed hemoglobin cutoff value. Among the study population, about 39.06 per cent of boys and 36 per cent of girls belonged to a mild anemia group and about 25.78 per cent of boys and 29.6 per cent of girls belonged to a moderate anemia group respectively. The occurrence of severe anemia cases among the study population was 8.59 per cent in boys and 17.6 per cent in girls respectively. The results also indicated that the prevalence of severe anemia cases was significantly higher ($p < 0.05$) in girls than the boys.

Table 2
Frequency (f) and Percentage (%) of Males and Females Having Different Categories of Anaemia

Anaemia classification	Frequency (f)		Percentage (%)	
	Male	Female	Male	Female
Severe (Hb. < 7 g/dl)	11	22	8.59	17.6
Moderate (Hb. 7-9.9 g/dl)	33	37	25.78	29.6
Mild (Hb. 10 –11.9 g/dl)	50	45	39.06	36.0
All categories (Hb. <12g/dl)	94	104	73.44	83.2

The subjects were further classified into three family income groups (FIG), viz., FIG I: Rs. $\leq 5,000$; FIG II: Rs. 5,001–9,999 and FIG III: Rs. $\geq 10,000$ according to their monthly family income (MFI). From the results, it was noted that 32.03 per cent of boys and 36 per cent of girls belonged to the FIG I group and 38.28 per cent of the boys and 38.4 per cent of the girls belonged

to the FIG II group, while 29.69 per cent of the boys and 25.6 per cent of the girls belonged to the FIG III group respectively.

The hemoglobin content of the subjects of different FIG groups was also studied and table 3 presents the mean values of hemoglobin by FIG categories. From the results, it was revealed that significant differences (Boy: $F=7.905$, $p<0.001$; Girl: $F=12.032$, $p<0.001$) in hemoglobin contained were observed among the FIG categories. Subjects belonged to FIG III had significantly higher hemoglobin content (Boy: 11.25 g/dl; Girl: 10.72 g/dl) compared to the subjects belonged to FIG II ($p<0.05$) as well as FIG I ($p<0.001$) categories of both sexes. On the contrary, the subjects belonging to a low-income group (FIG I) had the lowest mean hemoglobin content (Boy: 9.35 g/dl; Girl: 8.54 g/dl) compared to other FIG groups. The mean value of hemoglobin increased steadily from the low-income group (FIG I) through FIG II to the FIG III groups.

Table 3
Hemoglobin Content among Three Family Income Groups (FIGs)

Economic Group	Boy (Mean±SD)	Girl (Mean±SD)
FIG I: Rs. ≤5,000 (n= Boy: 41; Girl: 45)	9.35±2.21	8.54±2.16
FIG II: Rs. 5,001–9,999 (n= Boy: 49; Girl: 48)	10.18±2.21	9.83±1.76
FIG III: Rs. ≥10,000 (n= Boy: 38; Girl: 34)	11.25±1.90	10.72±1.99
F	7.905 ($p<0.001$)	12.032 ($p<0.001$)

The prevalence of anaemia among the subjects of different FIG categories was studied and from the results, it was found that the higher prevalence of anemia was noted among the subjects belonging to the lower income group (FIG I) (Boy: 85.37%; Girl: 91.11%) and FIG II group (Boy: 77.55%; Girl: 85.42%) compared to higher income group (FIG III) (Boy: 55.26%; Girl: 68.75%) (Table 4). The result indicated that there were significant differences in the prevalence of anemia among the categories except between the FIG I and the FIG II groups of both sexes. The result also indicated that there was an increasing trend of anemia prevalence (Boy: $\chi^2=9.85$, $p<0.01$; Girl: $\chi^2=6.964$, $p<0.05$) with decreasing family monthly income.

The Odd ratio becomes higher in the FIG I group than in the FIG II and FIG III of both sexes. In the case of boys, it was about five times higher in FIG I group and about three times higher in the FIG II group compared to the FIG III group. Moreover, it was about two times higher in FIG I group than in the FIG II group. Similarly, in the case of girls, the Odd ratio is about five times higher in FIG I group and three times higher in the FIG II group compared to the FIG III group. Moreover, the odd ratio was about two times higher in the FIG I group than in the FIG II group.

Table 4
Relationships of FIG with Anaemia Prevalence

Economic group	Boy			Girl		
	Prevalence	Odd Ratio (95% CI)		Prevalence	Odd Ratio (95% CI)	
FIG I: Rs. ≤5,000	85.37%	4.72 (1.11 to 7.07)	1.69 (0.56 to 5.05)	91.11%	4.66 (1.31 to 16.59)	1.75 (0.48 to 6.44)

(n= Boy: 41; Girl: 45)						
FIG II: Rs. 5,001–9,999 (n= Boy: 49; Girl: 48)	77.55%	2.80 (1.61 to 13.86)	1	85.42%	2.67 (0.89 to 7.97)	1
FIG III: Rs. ≥10,000 (n= Boy: 38; Girl: 34)	55.26%	1	-	68.75%	1	-
χ^2	9.85 (p<0.01)			6.964 (p<0.05)		

Discussion

By any measure, India is now one of the poorest country in the world, with a population estimated at more than 1.42 billion and India's total fertility rate (TFR) has declined from 2.2 in 2015-16 to 2.0 in 2019-21⁴⁶. The fertility rate has declined to 1.6 in urban areas and 2.1 in rural areas which indicating the significant progress of population control measures⁴⁶. However, there have been impressive improvements in health status in the last two decades, as measured by a number of indicators, including a reduction in child mortality rate and a decline in the fertility rate, but nutritional improvements have been less⁴⁷. A large section of the population lives in India remains undernourished⁴⁸. Apart from overall impoverishment, the health status of the Indian rural population reflects the health inequities, unequal resource distribution, low purchasing power of food and unequal sharing of food in the families which makes them vulnerable in society⁴⁹. Undernutrition (underweight, wasting, stunting) and anemia are now globally recognized public health problem and these are the indicators of poor health of a population^{18,50,51}. However, there is very little information on the anemia prevalence among the adolescent school children from rural areas of the state of West Bengal. The absence of suitable epidemiological data is the reason why we have attempted to investigate the prevalence of anemia among the adolescent school children from the rural areas of West Bengal.

In the study population, the overall prevalence of anemia was 73.44 per cent in boys and 83.2 per cent in girls, which was more than the global prevalence⁵². The exact figures for the prevalence of anemia vary from study to study, but there is no doubt that anemia is a serious public health problem in India, especially among the rural population. According to the WHO classification of anemia as a problem of public health significance at community levels, the prevalence of anemia, which was >40 per cent was considered to be a severe public health problem, that which was between 20.0 to 39.9 per cent to be a moderate public health problem, that which was between 5.0 to 19.9 per cent to be a mild public health problem and that which was <4.9 per cent to be not a public health problem⁵³. The prevalence of anemia among the study population was far-greater than 40 per cent, it was considered as a severe public health problem. The dietary habits and prevalence of various intestinal parasitic infestations and other chronic illnesses were not studied in present study. Moreover, the rural population in India have taken a nutritionally deficient diet and exposed to different diseases due to the insanitary conditions of the environment and they have to wash clothes and utensils in the polluted pond and river water which may have been more susceptible to parasitic infestations and other chronic infections, thus leading to a higher prevalence of anaemia⁵⁴.

Adolescence is a transitional period of the life cycle associated with change from childhood to adulthood where a multitude of physical and psychological changes occurs⁵⁵. Children experience rapid and significant developmental change during adolescence stage of the life cycle⁵⁵. Physical development relates to the changes in the body and brain, including growth, improved both gross (large) and fine motor skills and biological maturity⁵⁵. During adolescence, the body grows faster than any other time, except the first two years of life⁵⁵. Physical growth includes significant changes in height, weight, and in the size of internal organ as well as changes in muscular systems⁵⁶. Adolescents are often physically vulnerable due to poor physical fitness, poor diet, poor health habits,⁵⁷ and high-risk behaviors, include alcohol, tobacco or illicit drugs intake⁵⁸ and sexual experimentation⁵⁹. Anemia causes permanent brain damage, lower school performance, physical and exercise intolerance, and weak immune response⁶⁰. Other report stated that anemia was a major concern in young children because it impaired cognitive functions, development of motor co-ordination and motor behavior, language achievement and scholastic achievement which resulted in a lower Intelligence Quotient (IQ) scores and behavioral disorders, as well as interruption of growth and increased morbidity from infectious diseases⁶¹.

Recent studies worldwide have established that low socioeconomic status is associated with undernutrition in different populations⁶². The present study attempted to study the possible association of monthly family income with anemia prevalence among rural adolescent student. The results of the present studies showed that there was a significant FIG difference in mean hemoglobin content among the adolescent student. It was observed that FIG I had the lowest mean hemoglobin content among both sexes while FIG III had the highest mean hemoglobin content. The results of the present study indicated that MFI (monthly family income) was associated with anemia prevalence among adolescent student. It also was observed that there was an increasing trend in anemia prevalence with decreasing monthly family income. The findings of this study also highlights the fact that the anemia prevalence was high in individuals belongs to the low FIG group. The Odd ratio became higher in the FIG I group than the FIG II and FIG III groups of both sexes. Therefore, it seems that the low family income has a significant clinical effect on the anemia prevalence. The results of the present study are in concordance with earlier studies from Asia including India⁶³⁻⁶⁵.

This study has demonstrated that anemia was highly prevalent among adolescent boys and girls in the state of West Bengal. Thus, there is a need to initiate intervention measures at this group in order to reduce the prevalence of anemia. Improving dietary diversity and their access to resources will have the greatest impact on reducing anemia. Iron supplementation programs, may be effective in reducing the prevalence of anemia. Awareness about the low cost iron rich food among the rural population may be another solution of the problem. School can be the most important strategic place to foster healthy lifestyles and valuable second front in the war against ill health and malnutrition. Unfortunately, health education in rural schools in India is either limited to some routine touching of the syllabus or nonexistent. Health-nutrition education by school teachers may be effective for reducing anemia prevalence among student. Changes in Mid-day Meal (MDM) menu and development of the kitchen garden in school campuses will have the greatest impact on reducing anemia prevalence.

Limitation

The current study has certain limitations. In the present study, the prevalence of anaemia among adolescent students were studied. However, some potential confounders, such as the physical activity of the study participants, age of the mother at first birth, mother's BMI, preceding birth interval, diarrhea episode, prevalence of various parasitic infestation, type of food consume and method of feeding, were not studied. There are limitations associated with using cross-sectional data, as in every cross sectional study, conclusions related to cause and effect cannot be drawn. A longitudinal dataset would be better suited to examine the influence of sociodemographic factors on nutritional status of adolescent. However, as far as we are aware, this is the only provincial study to define the relationship between sociodemographic factors and nutritional status of adolescent students. This study was conducted among 12 to 15 year-old children. Additional study is needed for children under 12 years of age.

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Assessment of DISHA (Delhi Initiative for Safeguarding Health of Adolescents) Clinics in Delhi and Challenges Faced

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Abstract

Rashtriya Kishor Swasthya Karyakram (RKSK) programme addresses the +A component of RMNCH+A programme. In Delhi, the facility-based approach was implemented through DISHA clinics. The basic objectives of the present study were to assess the availability of adolescent health services at DISHA clinics and to identify the challenges faced by healthcare workers in providing services. A cross-sectional study was carried out at fifteen DISHA clinics in Delhi that were randomly chosen. Data were collected using interview schedule for healthcare providers (n=30) and observation checklist for DISHA clinics. The study was approved by the Institutional Ethical Committee of NIHFV. It was found that two-thirds of the DISHA clinics lacked physical infrastructure such as dedicated space for clinic while 40 per cent of those didn't have signboards and privacy in consultation rooms. Sanitary napkins were available at only one DISHA clinic. Challenges faced by healthcare workers were high workload, lack of dedicated counsellors, no provision of sanitary napkins, no dedicated space for clinic and inadequate training of staff.

Key words: Adolescent health, DISHA clinics, RKSK, Availability, Challenges.

Introduction

The term "adolescence" was derived from the Latin word "adolescere" which means "to grow" or "to mature". As per the World Health Organization (WHO), an adolescent is a person in the age group of 10-19 years.¹ Adolescence is a phase in which transformation from childhood to adulthood takes place. Adolescence is one of life's most interesting and perhaps most complex stages, a time when young people take on new responsibilities and experiment with independence.² Though seen in all adolescents, the transition through these phases, the order and extent of each step are influenced by the environment in which they live and grow and the prevailing cultural and societal norms of that environment.³ There are 1.3 billion adolescents in the world, making up around 16 per cent of the world's population.⁴ India has the largest adolescent population in the world- 253 million, which means every fifth person in India is between 10 to 19 years.⁵

Adolescence is ideally considered as a healthy period. Nonetheless, more than 33% of the disease burden and almost 60% of premature deaths among adults can be associated with behavior or conditions that began or occurred during adolescence.⁶ India is considered a 'multi-burden' country, as adolescents face the burden of malnutrition, anemia, unawareness of sexual and reproductive health (SRH) issues, substance abuse, communicable and non-communicable

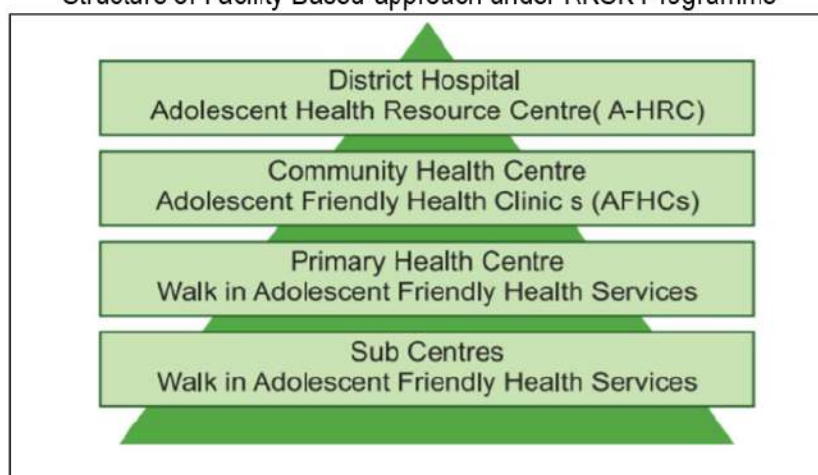
diseases, mental health concerns, and injuries and violence (including gender-based violence GBV). These contribute to increased morbidity and mortality during adolescence and later in their lives.⁷

To enable all adolescents in India to realize their full potential by making responsible decisions associated with their health and well-being, RKSK was launched. RKSK addresses the +A adolescent health component of the Reproductive, Maternal, Neonatal and Child + Adolescent Health (RMNCH+A) strategy. Under this program, six priority areas were identified which are implemented through three approaches as follows^{6,8}:

- Sexual and Reproductive Health
- Nutrition
- Non-communicable diseases
- Substance misuse
- Injuries and violence
- Mental disorders

The main 'friendly' component of AFHC mandates facility-based clinical and counselling services for adolescents to be equitable, accessible, acceptable, appropriate, effective and comprehensive. Rashtriya Kishor Swasthya Karyakram (RKSK) point out the need for strengthening Adolescent Friendly Health Clinics (AFHC) under its facility-based approach.⁶ The structure of facility based approach is shown in Figure 1.

Figure 1
Structure of Facility Based-approach under RKSK Programme⁹



Delhi has an adolescent population of nearly 35.0 Lac, almost 21 per cent of its entire population. This represents a huge opportunity that could be the critical point to transform the social and economic status of the state. As part of the strategy to address adolescents' health & development needs, Rashtriya Kishor Swasthya Karyakram (RKSK) has been adopted in Delhi. Under the facility-based component of RKSK, Delhi government had established DISHA clinic (Delhi Initiative for Safeguarding Health of Adolescents) to provide quality adolescent health services to the adolescents.¹⁰

Following initiatives under RKSK were undertaken:

- Weekly Iron & Folic Acid Supplementation Programme
- Peer Education Programme
- Adolescent Health Day
- Menstrual Hygiene Scheme¹⁰

Present Adolescent Health status in India:

- In India, 64 per cent women aged 15-24 years use sanitary napkins, 50 per cent use cloth, and 15 per cent use locally prepared napkins. Overall, 78 per cent of women in this age group use a hygienic method of menstrual protection.¹¹ In India, 7 per cent of women aged 15-19 have begun childbearing; out of which 5 per cent of women have had a live birth and 2 per cent of women are pregnant with their first child during NFHS-5¹².
- According to Global Burden of Disease 2017 (GBD), the main causes of early adolescent deaths and late adolescent deaths were unintentional injuries and self-harm respectively. In 2017, 28 per cent of deaths amongst 10–14 year-olds and 44 per cent of deaths amongst 15–19 year-olds were attributed to injuries¹³.
- The mean age of initiation for tobacco use in India is 18.9 years.¹⁴ About 7 per cent of men and 1 per cent of women aged 15 -19 years currently use tobacco products. Research shows that heavy alcohol use during adolescence is associated with a lifetime dependence on alcohol and tendency towards high-risk sexual behaviours, including multiple sex partners, unprotected intercourse and sex with high-risk partners (e.g., intravenous drug users, prostitutes).¹⁵
- According to the CNNS report, 28.4 per cent of adolescents aged 10–19 years had some degree of anaemia and about 26 per cent adolescent boys and 14 per cent of adolescent girls aged 15–19 years were moderate or severely thin respectively.¹⁶
- Most of the risk factors for NCDs are behaviorally accumulated and are due to changes in lifestyle during adolescence.¹⁷ Around 46 per cent of women aged 15-19 years and 28% of men aged 15-19 years have a waist-to-hip ratio that puts them at a substantially increased risk of metabolic complications. The prevalence of hypertension among men and women aged 15-19 years is 4.6 per cent and 3.3 per cent respectively that increases sharply with age.¹²

The major component of RKSK programme is to strengthen the Adolescent Friendly Health Clinics with availability of suitable infrastructure, commodities, drugs, equipment and trained health staff. Few studies have been conducted to assess the physical characteristics of AFHCs and showed that infrastructure lacked dedicated clinic space, constant supply of few commodities like sanitary napkins and regular trainings of healthcare staff on adolescent health.¹⁸⁻²² A study conducted by Mahalakshmy et al in 2018 concluded that factors hampering the utilization include lack of knowledge about AFHC and services provided at AFHC, laziness of the adolescents to go to the clinic, boys assumed that the clinic is only for girls, parents not aware of the other services at AFHC and parents come to get the sanitary napkins, gender difference of the health staff and adolescents, non-availability of sanitary napkins at times, fear of being teased by friends if they attend AFHC and parents perceive that adolescents need to attend clinic only when they are ill.²³ A qualitative study carried out by Human Rights Law Network (2018) in DISHA clinics found that the functioning of DISHA clinics was grossly inadequate and failing to impact adolescents and communities in Delhi and the staff who were tasked with managing and working

in DISHA clinics were both untrained and currently not capable of providing a non-judgmental environment in which adolescents' privacy and wellbeing was prioritized.²⁴

In order to enable the adolescents to fulfil their potential, substantial investments must be made in education, health, development and other areas. Investments in adolescents will have an immediate, direct and positive impact on India's health goals and on the achievement of the Sustainable Development Goals (SDGs). At the same time, it will enhance economic productivity, effective social functioning and overall population development.⁸ Studies have pointed out that implementation of the program is still fragmentary in the country and utilization of AFHC services is minimal.¹⁸⁻²⁴ There are no detailed studies conducted in the Delhi about functioning of DISHA clinics. The study assessed the availability of adolescent health services and found out the challenges faced by healthcare workers at DISHA clinics in Delhi.

Methodology

This was a mixed-methods assessment of explanatory type. Quantitative method (record review, observation checklist) was followed by qualitative method (interviews) to get the complete picture and explanation of the quantitative findings. Delhi had implemented RKSK facility-based approach through DISHA clinics. There are thirty DISHA clinics in Delhi out of which fifteen DISHA clinics were randomly chosen. All the healthcare providers working at these clinics were interviewed.

Data were collected using interview schedule for healthcare providers. Structured observations were conducted using a checklist developed adapting World Health Organization's Global standards for quality health-care services for adolescents. The checklist included criteria covering signage, waiting area, physical infrastructure, basic amenities, availability of equipment, commodities, privacy features, confidentiality procedures, IEC material on display etc.

The quantitative data was cleaned, edited, validated and analyzed using SPSS version 26 and tables were generated as per the objective of the study. Variables were summarized using frequencies (percentages). The qualitative data from the healthcare providers was aggregated into categories, which was then further merged into themes and thematic analysis was done.

Ethical clearance had been taken from Institutional Ethical Committee of National Institute of Health and Family Welfare, New Delhi before conducting the study. Written consent form was taken from all participants before inducting into the study.

Findings

Availability of services at DISHA clinics:

Findings related to availability of services at DISHA clinics including physical infrastructure and basic facilities under general facility status and availability of trained staff to provide adolescent health services, adequate equipment, drugs and commodities. Table 1 described the general facility status and it showed that only 5 (33.3%) out of fifteen DISHA clinics had separate dedicated space/room for clinic. Majority of DISHA clinics 12 (80%) had facilities to ensure privacy

in the consultation room and adequate waiting areas. All the DISHA clinics were functional on days as per program guidelines and only 9 (60%) out of 15 DISHA clinics had signboard mentioning timing and location of the clinic. All the DISHA clinics have IEC materials regarding adolescent health on display. Clean surroundings were available in 77.3% (n=11) of the facilities. Basic facilities like clean drinking water facility, functional toilet and adequate hand hygiene facilities were available in all the DISHA clinics.

Table 1
General Facility Status of DISHA Clinics (n=15)

S. No.	Facility status	Response	Frequency (n)	Percentage (%)
1	Dedicated separate space for clinic	Present	5	33.3
		Absent	10	66.7
2	Privacy ensured in consultation room	Yes	12	80
		No	3	20
3	Adequate waiting area	Yes	12	80
		No	3	20
4	Functional on days as per guidelines	Yes	15	100
		No	0	0
5	Signboard indicating timing and location	Present	9	60
		Absent	6	40
6	IEC material on display	Present	15	100
		Absent	0	0
7	Surroundings clean	Yes	11	77.3
		No	4	26.7
8	Drinking water facility	Present	15	100
		Absent	0	0
9	Functional toilet	Present	15	100
		Absent	0	0
10	Adequate hand hygiene facilities	Present	15	100
		Absent	0	0

The training was conducted for one-week duration to provide necessary knowledge and skills regarding adolescent health initiatives taken under RKSK program. Figure 2 described the availability of trained health care staff for providing adolescent health services.

Figure 2
Training Status of Healthcare Workers at DISHA Clinics



About 70% (n=21) of healthcare staff interviewed had received training, out of which only 11 (73.3%) medical officers had received training in adolescent health and 10 (66.7%) ANM/LHV were trained to provide adolescent friendly health services. No counsellors were available at any DISHA clinics under the study.

Availability of drugs and consumables, furniture, equipment and services at DISHA clinics provided as per program were shown in Table 2. Sanitary napkins were available at only one DISHA clinic. Drugs were available in all the DISHA clinics in adequate and constant supply. All the DISHA clinics offered majority of the adolescent health services and had all required equipment and furniture in adequate quantity.

Table 2
Availability of Commodities at DISHA clinics (n=15)

		Frequency (n)	Percentage (%)
A	Availability Of Drugs and Other Consumables		
	Iron folic acid/albendazole tablets	15	100
	Sanitary napkins	1	6.7
	Contraceptives	15	100
	Pregnancy testing kits	15	100
	Other medicines (paracetamol, antispasmodics, first aid etc.)	15	100
B	Availability of Equipment (Weighing scale, BMI scale, Height chart, Snellen's chart, Stethoscope etc.)	15	100
C	Availability of furniture	15	100
D	Availability of adolescent health services as per the guidelines	15	100

Majority of the equipment, drugs, furniture, services as per program guidelines were available at the clinic except sanitary napkins.

Performance of Facility (DISHA clinic):

Using WHO's Adolescent Friendly Health Services Supervisory/ Self-assessment checklist, performance of each DISHA clinic was assessed and scored based on observations, interviews and record review. Out of fifteen DISHA clinics, 10 clinics (66.6%) had scored more than fifteen points that means the facility is adequate to provide the adolescent health services. Five of the DISHA clinics scored between 10 to 14 that means these clinics required minor improvements. Table 3(a), 3(b) depicts all the standards used and scoring of each DISHA clinics included in the study.

Table 3(a)
Performance and Scoring of the DISHA Clinics

S. No.	Standards	Items	POLYCLINIC GAUTAMFURI	POLYCLINIC GHONDA	MCW YAMUNA VIHAR	SUHC NEHRU VIHAR	DGD JOHRIPUR	MCW SHAKURPUR	PUHC RANIBAGH	DGD RAGHUBIR NAGAR
1	Provision of services (Max score = 7)	Information and advice on SRH issues is provided (0/1)	1	1	1	1	1	1	1	1
		STI/ RTI treatment (0/1)	1	1	1	1	1	1	1	1
		Provision of condoms free of cost (0/1)	1	1	1	1	1	1	1	1
		Provision of IFA and albendazole (0/1)	1	1	1	1	1	1	1	1
		Provision of referral services (0/1)	1	1	1	1	1	1	1	1
		Provision of contraceptives including emergency contraceptives pills free of cost (0/1)	1	1	1	1	1	1	1	1
		Adolescent health services including outreach services (0/1)	1	1	1	1	1	1	1	1
2	Facility checks (Max score= 4)	Signboard with clinic information (0/1)	1	0	1	0	0	0	1	0
		Consultation room ensuring privacy (0/1)	0	1	0	0	1	0	0	0
		Basic facilities (0/1)	1	1	1	1	0	1	1	1
		Record of adolescent clients (0/1)	1	1	1	1	1	1	1	1
3	Capacity of service providers (Max score = 2)	Received training on AFHS (0/1)	0	0	1	1	0	1	1	1
		Have confidence in dealing with adolescents (0/1)	1	0	1	1	0	1	1	1
4	Demand creation for services (Max score = 4)	Availability of IEC material on AFHS/ ARSH (0/1)	1	1	1	1	1	1	1	1
		Provision of AFHS/ ARSH information in schools (0/1)	1	1	1	1	1	1	1	1
		Dissemination of information to community members (0/1)	1	1	1	1	1	1	1	1
		Dissemination of AFHS / ARSH information to adolescents in community (0/1)	1	1	1	1	1	1	1	1
		Total score earned out of 17	15	14	16	15	13	15	16	15
Interpretation		Major improvement needed (score 9 and below)								
		Minor improvement needed (score 10 to 14)		Yes			Yes			
		No significant problem (15 to 17)	Yes		Yes	Yes		Yes	Yes	Yes

Table 3(b)
Performance and Scoring of the DISHA Clinics

S. No.	Standards	Items	DGD JANAKPURI	POLYCLINIC SARASWATI VIHAR	POLYCLINIC ROHINI	DGD NANGLOI	DGD MANGOLPURI	DGD SHIV VIHAR	DGD MALIUPUR
1	Provision of services (Max score = 7)	Information and advice on SRH issues is provided (0/1)	1	1	1	1	1	1	1
		STI/ RTI treatment (0/1)	1	1	1	1	1	1	1
		Provision of condoms free of cost (0/1)	1	1	1	1	1	1	1
		Provision of IFA and albendazole (0/1)	1	1	1	1	1	1	1
		Provision of referral services (0/1)	1	1	1	1	1	1	1
		Provision of contraceptives including emergency contraceptives pills free of cost (0/1)	1	1	1	1	1	1	1
		Adolescent health services including outreach services (0/1)	1	1	1	1	1	1	1
2	Facility checks (Max score= 4)	Signboard with clinic information (0/1)	1	0	1	0	1	0	0
		Consultation room ensuring privacy (0/1)	1	0	0	1	0	0	0
		Basic facilities (0/1)	1	1	1	1	1	1	1
		Record of adolescent clients (0/1)	1	1	1	1	1	1	1
3	Capacity of service providers (Max score = 2)	Received training on AFHS (0/1)	1	0	1	0	1	1	0
		Have confidence in dealing with adolescents (0/1)	1	1	1	0	1	1	0
4	Demand creation for services (Max score = 4)	Availability of IEC material on AFHS/ ARSH (0/1)	1	1	1	1	1	1	1
		Provision of AFHS/ ARSH information in schools (0/1)	1	1	1	1	1	1	1
		Dissemination of information to community members (0/1)	1	1	1	1	1	1	1
		Dissemination of AFHS / ARSH information to adolescents in community (0/1)	1	1	1	1	1	1	1
		Total score earned out of 17	17	14	16	14	16	15	13
Interpretation		Major improvement needed (score 9 and below)							
		Minor improvement needed (score 10 to 14)		Yes		Yes			Yes
		No significant problem (15 to 17)	Yes		Yes		Yes	Yes	

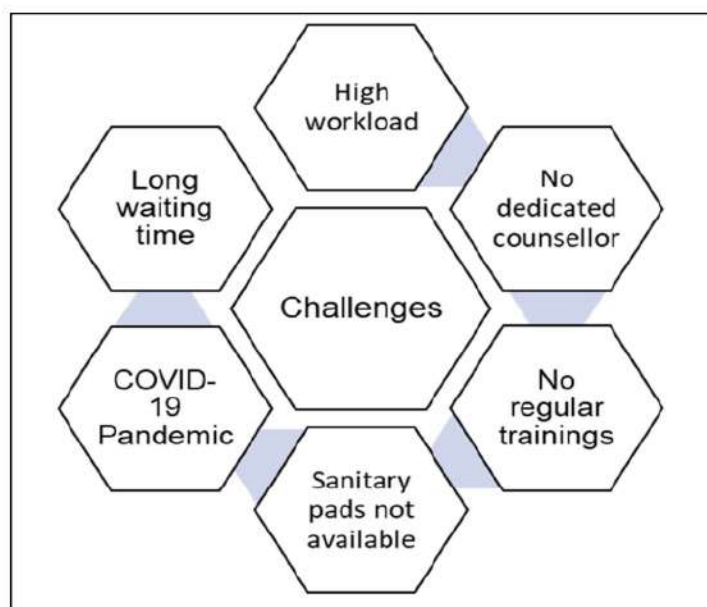
Perception of healthcare workers:

- Knowledge of key informants on AFHS
In order to determine the knowledge level of the health staff, respondents in the key informant interviews were asked whether they had heard of adolescent friendly health services. The responses revealed that all the health staff have heard of AFHS. In order to understand more of what they actually know about AFHS, they were asked to describe their knowledge about AFHS. They were able to describe what AFHS meant in a way. They were of the view that, AFHS concerns boys and girls within the ages of 10 and 19 years and need some special attention to be able to make informed choices about their health. They were able to describe their knowledge about the privacy aspect of AFHS and its importance but none of the staff knew about “Saathiya salah” mobile application.
- Willingness /readiness of health workers to provide friendly services to adolescents:
All the healthcare providers in their attempt to respond to a question asked on their readiness as well as their willingness to provide services to the adolescents, they all said yes. Some of the them included instances like sacrificing non- working hours to serve the adolescents and sometimes made some expenses to support the health issues of adolescents.
- Challenges health workers face in providing AFHS:
Healthcare providers were asked about some of the major challenges that they face as they provide services to the adolescents. Figure 3 shows the major challenges faced by healthcare providers.
- ✓ Training of health workers: Majority of the healthcare providers pointed out that the training given to them was long time ago and no refresher training given to them and majority of the staff trained had been either resigned or transferred to other places.
- ✓ Gender equity in health workers: Majority of the staff (86.7%) providing adolescent health services were female. It had been pointed that boys are not comfortable sharing their issues openly with female staff so gender equity was needed to cater to both adolescent boys and girls.
- ✓ Dedicated counsellor needed: Due to high workload at each clinic and staff lacking counselling skills to counsel adolescents, dedicated counsellors were needed.
- ✓ Constant supply of sanitary napkins: Majority of the health staff interviewed mentioned that there was no supply of sanitary napkins at their clinics despite being demanded by the adolescent girls.
- ✓ No separate space: At majority of the clinics, adolescents were treated in general OPD and counselling was done by ANM/LHV in injection room/ ANM room. No separate room was dedicated for the DISHA clinic which leads to long waiting time.
- ✓ COVID-19 Pandemic: All the healthcare staff interviewed mentioned pandemic as a challenge as majority of the clinic were converted to COVID care centers and lockdown limiting the movement of adolescents and no outreach sessions.
- ✓ Challenges adolescents face: During the interview with the service providers, they were asked that, in their opinions, what were some of the common factors that makes it difficult for adolescents to utilize the services they provide for them. Following this question, several reasons came out which included:
 - Fear of being stigmatization
 - Misconception about some services
 - Lack of privacy and confidentiality
 - Religious/cultural beliefs
 - Attitude of health workers
 - Lack of permission from parents/guardians

- Inadequate information on services available
- Unfavourable period for rendering services and time wasting at the facility.

Figure 3

Challenges Faced by Healthcare Workers at DISHA Clinics



Discussion

Availability of DISHA clinics was assessed by checking the availability of drugs, equipment, furniture, trained healthcare staff and adolescent health services. These data were then compared with the implementation guidelines for functioning of AFHCs which include the set standards for AFHCs. All the furniture, equipment, drugs and services were available at the clinic as per the program guidelines. Availability of trained healthcare staff is 70 per cent with no counsellors being available at any DISHA clinic. Sanitary napkins were available at only one DISHA clinic. A study carried out by Wadhwa et al found that 50 per cent of healthcare staff were trained (70% in current study) and sanitary napkins were not present (present in only one clinic in current study) in any of the clinics in Delhi. IEC materials were on display in all the clinics in Delhi.¹⁰ The findings of this study about Delhi are supporting the findings of current study. Another study Bali et al conducted in district hospitals and CHCs found that majority 22 (73.3%) of the adolescent friendly health clinics were having counsellors and 8 (26.7%) of clinics did not have counsellors (in current study no counsellors were present). Around 86 per cent of service providers in AFHCs under RKSK were trained as compared to 70 per cent in the current study. Majority of the resources were present in the clinics.¹¹ The difference in findings about the availability of counsellors was because this study was conducted at DHs and CHCs while the majority of DISHA clinics were at DGDs (Delhi Government Dispensaries). Bhat et al concluded that only 25 per cent of AFHCs under RKSK had sanitary napkins as compared to 6.7 per cent in current study and Snellen's chart available. Around 8 per cent of AFHCs had injection tetanus toxoid available in stock. Commodities like iron folic acid tablets, albendazole, weighing scale

and contraceptives were available in almost 50 per cent of AFHCs as compared to current study in which these commodities present in all clinics.¹²

In this study, physical infrastructure of DISHA clinic was assessed by checking for availability of dedicated space for clinic, waiting area, signboard (mentioning timings, days and location of clinic), IEC material, basic amenities and clean surroundings. It was found that only 33.3 per cent of DISHA clinics had separate dedicated room for clinic with clean surroundings (77.3%) and only 60 per cent of them had signboard mentioning the location, day and timing of the clinic. About 80 per cent of clinic had adequate waiting area and basic amenities were present in all the clinics along with IEC material on display. Studies carried out by Dayal et al and Bhat et al found that only 25 per cent of Ujala clinics/AFHCs had signboard mentioning the timings, location and day of clinic as compared to 60 per cent in the current study.^{12,13} Another study by Bali et al found that majority (70%) of the health facilities (Bhat et al 75%) had specific room for AFHS. Around 20 per cent of the adolescent clinics had wash basin with running water and sitting arrangements (33%) and in most of the facilities (90%) the services were available on daily basis with only 10 per cent facilities providing services on alternative days in a week.^{11,12} A study by Dixit et al showed that all AFHCs had signboards and basic amenities but none of the facilities had IEC material which is contradictory to current study findings.¹⁴ Another study by Wadhwa et al conducted in Delhi found that 33 per cent of clinic had dedicated space for clinic in Delhi which support the finding of current study.¹⁰

This study validates the findings of previous similar studies that major challenges faced by HCWs include training of healthcare providers, high workload, absence of dedicated counsellors, lack of consumables like sanitary napkins and lack of knowledge among adolescents and community.^{10,15} A study by Wadhwa et al presented the main factors for the decreased performance of AFHCs included were inadequate staffing, untrained service providers, inadequate equipment, frequent stock out of drugs, low priority accorded by program managers and service delivery restricted to ARSH without availability of curative services.¹⁰

Conclusion and Recommendations

The study concludes that the DISHA clinics were deficient in the required infrastructure as per the guidelines under the programme. Most of the clinics lack separate/ dedicated room for adolescent health clinic to ensure privacy to the adolescents. About less than half of the clinic did not had a signboard mentioning location, days and timings of clinic. Basic facilities like clean drinking water, functional toilet, adequate hand hygiene facilities and clean surroundings were present in majority of the clinics. Sanitary napkins were only available at one DISHA clinic. A large proportion of healthcare providers had received training for one-week duration. According to healthcare workers, the main barriers to utilization of adolescent health services by adolescents were fear of being stigmatization, lack of privacy, religious and cultural beliefs, inadequate services available and long waiting time. The major challenges faced by the healthcare workers to provide adolescent health services were high workload, absence of dedicated counsellor, lack of consumables like sanitary napkins and lack of knowledge among adolescents and community. Proper implementation, monitoring and evaluation of health programs in adolescent health is required to change the attitude of adolescents, the healthcare providers and also that of the setting where these services are addressed.

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Lessons Learnt from Malaria Elimination in Malkanagiri District, Odisha and the Way Forward

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Abstract

As per the World Malaria Report 2019, India achieved a reduction of 2.6 million malaria cases in 2018 than 2017. This sharp reduction of 28 per cent of malaria cases indicates the success in malaria elimination strategies not only in macro level but also in micro level. The present study tries to evaluate the malaria elimination strategies adopted in micro level of Odisha. A qualitative study was undertaken using tools like In-depth interviews (IDIs) and focus group discussions (FGDs) among different stakeholders of service providers and service accepters in two villages of Malakangiri district to understand the micro level strategies adopted for malaria elimination. The study reveals that the Durgam Anchalare Malaria Nirakaran (DAMaN; the English translation for the Odia words- Malaria Elimination in Inaccessible Areas) programme helps in the reduction of malaria infections in inaccessible part of scheduled areas. Use of tools like tracking, testing and treating (3T), regular and compulsory usage of long lasting insecticidal net (LLIN) and acceptance of community participatory awareness practices for behavioural change are the major reasons in reduction of malaria. However, some suggestions like arrangement of DAMaN camp three times a year, keeping sufficient stock of anti-malaria drugs and RDT kits with ASHA and timely replacement of LLINs should be taken into consideration to achieve zero prevalence of malaria while compulsory registration of inter-state migration data with active surveillance mechanism at panchayat/village level will control incidence of malaria. Besides, leadership training for ASHA, increment of monetary incentives for community level health workers and use of tribal art, music, dances, musical instruments and languages to disseminate health education. Lastly, developing social infrastructures and connectivity and recruitment of health human resources and focus on tribal research will help in malaria elimination in future.

Key words: Malaria, DAMaN, development, tribes, community participation, health education,

Introduction

Malaria is one of the aged mosquitos borne parasitic disease with significant burden in different parts of world, particularly in lower and middle income countries (LMICs) of the tropics, transmitted by female anopheles mosquitos. As per world malaria report 2019, a total of 22.8 crore malaria cases and 405 thousand related deaths occurred globally in 2018. According to world malaria report 2018, India's contribution to total malaria cases was 87 per cent in Southeast Asia having 3 per cent global malaria burden. A sum total of 8 lakh and 40 thousand confirmed

malaria cases and 194 related deaths occurred in India in 2017, as per the national vector borne disease control programme (NVBDCP). India has highest burden of vector borne diseases (VBDs) both in cases and deaths in the world whereas Odisha is situated in the eastern part of India having 4 per cent of land and 3 per cent of population, has the highest burden of malaria (40%) in India in 2017¹. Maximum part of Odisha is conducive to malaria transmission because of its high humidity, hilly forested areas with perennial streams and medium-to-high rainfall. It is observed that both the malaria transmission and burden are region specific and the Koraput-Bolangir-Kalahandi (KBK) region has experienced high risk of infection followed by northern and western districts². However, understanding the negative consequences of malaria, targets were set with various strategies to eliminate malaria both globally and regionally. According to world malaria report 2018, elimination of malaria by 2030 is one of the goals of sustainable development of goals (SDG) globally. To achieve this goal, the global technical strategy for malaria 2016-2030 was adopted by world health organisation to eliminate malaria by 2030. In response to WHO's strategic plan, malaria control interventions have been scaled up and strategies were made to eliminate malaria in India by 2030 with the start of national framework for malaria elimination (NFME) in February, 2016. Later, with a shifting focus from "control to elimination", India adopted five-year national strategic plan for malaria elimination in 2017³. Indian council of medical research (ICMR) also joined hand with Government of India through its institutions to eliminate malaria by demonstrating the best strategy⁴. Understanding the high infection rate of Plasmodium falciparum in the high malaria endemic districts, national vector borne diseases control programme (NVBDCP) adopted compressive case management programme (CCMP) to strengthen surveillance and to identify the asymptomatic/ afebrile malaria cases (malaria infection having no fever). The asymptomatic cases are silent reservoirs for malaria. To combat asymptomatic reservoirs, the Government of Odisha started its own flagship programme, one of the biggest public health interventions, *Durgama Anchalare Malaria Nirakaran* (elimination of malaria in inaccessible areas) in short DAMaN, from state's own fund in 2016 in all hard-to-reach areas of Odisha². However, DAMaN was implemented in remote and inaccessible pockets to eliminate malaria in 2017.

As per world malaria report 2019, India has made impressive progress in malaria control over the past two decades and India achieved the largest malaria cases reduction, with an amount of 26 lakh cases, in 2018 than 2017. This sharp 28 per cent reduction of malaria cases indicates the success in malaria elimination strategies both at macro and micro level but the question arise is it the same strategies adopted both at macro level and micro level or any new strategies adopted at micro level because all regions have not the same setting. To understand these questions, the study tries to evaluate the malaria elimination strategies adopted at micro level of Odisha.

Methodology

As per tribal health report, India, tribal communities constitute only 8.6 percent of national population but accounts 30 percent of all cases of malaria and 50 percent mortality associated with malaria in India. As per Census of India 2011, the percentage of scheduled tribes is 22.8% in Odisha contributing 9.17 percentages to total tribal population of India and is the third highest tribal population among states of India. A total of 62 different tribal communities where 13 belongs to particularly vulnerable tribal groups (PVTG) are residing in Odisha. The Koraput-Bolangir-Kalahandi (KBK) region has not only high malaria infection but also this region is historically

underdeveloped compare to other part of Odisha where most of the districts of this region are coming under aspirational districts list, prepared by national institution for transforming India (NITI Aayog), Government of India and the southern part of Odisha is more underdeveloped among KBK region. To improve inclusive growth and standard of living of citizens and also in the ranking of human development index, the initiative like transformation of aspirational districts has undertaken by NITI Aayog. The index is the combination of different indicators comprising of health and nutrition, education, financial inclusion and skill development, agriculture and water resources, and finally basic infrastructure. The undivided region of Koraput is comprised of four districts namely Koraput, Malakangiri, Nabarangapur and Rayagada. The malaria infection is high in Koraput-Bolangir-Kalahandi (KBK) region and most importantly, the annual parasite incidence (API) status, the number of malaria cases per 1000 population, is more than 10 among 12 districts of Odisha in the year of 2016¹. All the southern districts are coming under these 12 districts of high API. According to census of India 2011, more than 50% of population is tribes in each of the districts and the health indicators of tribal population are not good in Odisha. Besides, the total population belongs to both scheduled tribes and scheduled castes are highest in Malakangiri district among other districts. The district is situated at the bottom of the southern region of Odisha and adjacent to two neighbouring states like Andhra Pradesh and Chhattisgarh. In addition to, the district is hilly area with densely forest area, even hard-to-reach area with sparsely inhabited by indigenous tribes and also having presence of left-wing extremism.

Understanding the three important concepts like annual parasite incidence status, human development index and region, the study was conducted in Malakangiri district, which is coming under the undivided region of Koraput, part of larger KBK region is also in the list of aspirational district. In this context, the author had conducted a qualitative study in two villages (one is situated near to main road and other one comprising of only 10 households is situated in the hilly area, hard-to-reach area, with a distance of 12 kilometres from the main road) of Malakangiri district to understand malaria elimination strategies adopted in grassroots level. Tribal, basically koya and parja tribes are residing in these villages. The study was conducted in the month of 28th November 2018 to 4th December, 2018 and again telephonic interview was also undertaken during the year 2020. Both the techniques like in-depth interviews (IDIs) and focus group discussions (FGDs) were used to explore strategies undertaken at the grassroots level. IDIs and FGDs were conducted among different stakeholders of service providers like community level health workers, members of local self-government and members of community level organizations and service accepters/ beneficiaries of malaria treatment and common people of the village to know their views and perceptions regarding strategies. Besides, staffs and officials of health and line departments were also interviewed. Total 15 members were interviewed and two FGDs were organized where every discussions comprising of 6 to 10 members depending upon the availability. Community level health workers are accredited social health activists (ASHA), anganwadi workers (AWW) and auxiliary nurse midwife (ANM) and male health worker. The triple A (ASHA, AWW, ANM) are the three women working at the grass-root level to cater health care services where ASHA is from national health mission and ANM and male health worker are from health and family welfare department and AWW is from the scheme of integrated child development services (ICDS) of department of women and child development and mission shakti. Ward member and sarapanch are the lowest and the highest elected representatives of the panchayat (village assembly) respectively and are empowered by panchayats (extension to scheduled areas) act, (PESA) 1996 belong to Panchayati Raj Institutions (local self-government).

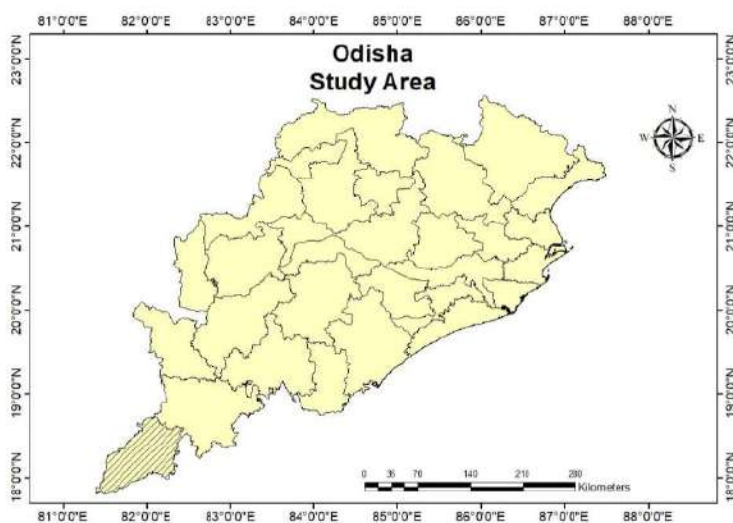
Apart from, members of non-governmental organizations (NGOs) and women self-help groups (WSHG) belong to community level organization. Besides, the public health system has their own community participatory structure at village level known as village health and sanitation committee (VHSC) (commonly known as Gaon Kalyan Samiti (GKS) in Odisha) comprising of community level health workers (ASHA, AWW) and member from local self-government (ward member) and member from community level organizations. The beneficiaries include local residents of the village which includes males, females and children of different age groups and local priests those are mastered in witchcrafts, herbal

Table 1
Thematic Guide for Qualitative Study undertaken in Malkangiri District of Odisha

Stakeholders [Nos.]	Domains of Inquiry Sub-Themes
In-depth Interviews with health workers, community members (VHSC, PRI, CO), beneficiaries and officials [15] & Focus group discussions (FGDs) with health workers, community members, beneficiaries and officials [two with 6-10 participants each]	What is malaria? Why is it important to discuss? What is the relation of malaria with local weather/region? What is the development condition of this locality? What are the strategies are adopted to eradicate malaria? What are the methods to eliminate malaria? How it is implemented at micro level? Who are the main stakeholders? What are the awareness activities undertaken? Any suggestion for zero elimination of malaria

medicines, generally known as Dishari, the local word. Even the interviewer also interviewed the resident who is a maoist-turned-layman. After interview with all stakeholders, the interviewer used the content analysis to analyse data. Proper care was also taken from collect data to coding to analysis.

Figure 1
Primary Study Conducted in Malakangiri District of Odisha, 2018-20



Source: Registrar General of India, 2013

Findings

Track, Test and Treat (3Ts) Method: Maximum villages and hamlets with very low population having high transmission of malaria are dispersed among large forest areas. Routine activities are continued to address malaria through the year. ASHA communicates about the local level malaria cases to the local health authority. Besides, routine programme, DAMAN programme (say camp) is arranged two times i.e. pre-monsoon (April-May-June-July) and post-monsoon (September-October-November-December) in a year at the anganwadi centre or school premise with a team consisting of both male and female health workers, health supervisor, NVBDCP staffs and officials of primary health center with the support of ASHA and AWW. Both the village have anganwadi centres and also water connectivity but school building is under construction in hard-to-reach area. Besides, road inaccessibility and non-connectivity of mobile network are also observed in hilly area. Sometimes the camp is continued for two days to cover all the population of that inaccessible area. In the camp, mass screening of all residents is conducted with the use of bivalent rapid diagnostic kits for early case detection and then all the confirmed positive cases are treated and monitored. Mass screening and treatment (MSAT) is conducted to target the asymptomatic cases. Besides, anthropometric measurement and haemoglobin estimation are done to know the nutritional status and particularly the anaemic cases of all the population of the village with special importance to pregnant mothers, lactating mothers, under-five children. The iron-folic acid (IFA) supplementation is distributed among anaemic cases and malnourished children are provided nutritional support through integrated child development services. As most of the residents of the villages go to agricultural field or block headquarter for their day to day activities in day time, a prior meeting is organized among members of GKS to mobilize the people for the DAMAN camp, where ASHA plays an important role for information dissemination, to achieve full participation of local residents, however, some residents are missed at the time of camp. It is observed sarapanch and ward member are also helping in the mobilization. Instead of their missing at the time of camp, the ground level health workers give their best to include them in the camp in the next day. It is also observed, sometimes, the anti-malaria drugs and testing kits are not available with ASHA. Some positive cases are found in these villages due to migration of labourers from the border-states of Andhra Pradesh and Chhattisgarh. It is also found that, community level health workers are concerned about their security due to their work in remote and maoist-infested areas. One of the interesting observations is noticed that the staffs and officials at micro level i.e. sub-district level (block level) are more interested and eager to participate in survey but it is not same in case of district level. However, some district level officials are also participated.

Regular and Compulsory Usage of Long-lasting Insecticidal Net (LLIN): LLINs are freely distributed among the population with proper survey and planning by both the health department and district administration. LLINs are contributed by the Global fund to fight AIDS, Tuberculosis and Malaria (GFATM). The couples are given double size net whereas single net is provided to any adult persons like son, daughter and any aged person. ASHAs are ringing the bell (*ghanta* in odia) at evening every day to remember the people to use the net regularly. The members of GKS, especially ASHA, AWW and ward member conduct night supervision to every resident of ward/hamlet/village to check and sensitize about the use of LLINs. Besides, staffs and officials from sub centre, primary health center, community health centre and national vector

Figure 2
Survey is Conducted during DAMaN Camp
at One of the Hard-to-reach Villages of Malakangiri District, Odisha



borne diseases control programme (NVBDCP) and district level are supervising and counselling the residents with the support of ground level team at night. In addition to, local school teachers, village level forest department representatives and village representatives of revenue department visit the household in their respective locality to check the usage of net and counsel for regular use of LLIN among residents during its initial distribution period. During night supervision, many times, people resist to use net still they counsel about the importance of regular and compulsory use of LLIN. It is observed that the maximum LLINs are tore up and also used for more than years.

Community Participatory Awareness Practices for Behavioural Change: Different information education and communication (IEC) awareness campaign strategies are introduced for behavioural change of the population. Folk shows are organized to disseminate malaria prevention knowledge among residents in the endemic village. Demonstrations are made regarding proper usage of LLINs, proper cleaning of net and its use for longer period (apprx. 3 to 4 years). Weekly sensitization meetings are organized among members of GKS to create awareness among community regarding proper usage of net and cleanliness drive like bush cutting and identification of waterlogging areas at these villages with monetary support from GKS. *Bacillus thuringiensis israelensis* (BTI) is sprayed in ponds, streams and water logging areas to kill developing mosquito larvae. Awareness programme to use LLIN is also conducted in school hostels in the hot spot areas. The use of full sleeve dress is promoted to prevent from mosquito bite. Indoor residual spray (IRS) is used in the houses of endemic villages with the support of health workers and GKS members.

Discussion

Every locality has its own setting and environment. The geo-ecological setting of Odisha, particularly Malakanagiri is the most conducive environment for malaria. Social infrastructures

and health human resources are not at required level. The economy is mostly depending on agriculture, livestock and forest products. Besides, to sustain their livelihood, tribes are also working as labourer and also migrate to nearest urban location (both inside and also outside of states) for better job opportunities. The socio-economic, educational, demographic condition of tribal population is low compared to other categories and malnutrition still persists. The indigenous tribal population has their own languages, traditional knowledge and cultural practices. The geographic location (say inaccessibility), poor infrastructures, lack of connectivity, inadequate health man power, low human development indicators and presence of left-wing-extremism are the major reasons for backwardness of these areas. Having all these challenges, the programmatic solution to combat malaria, *Durgam Anchalare Malaria Nirakaran* (DAMaN), the state government's malaria control programme in the inaccessible areas, supplementation to routine malaria activities plays a crucial role in the reduction of malaria.

The camp approach of DAMaN, a complete package of health care services at door step of residents not only for malaria but also to improve iron supplementation and nutritional support, the first of kind in India reveals that adoption of track, test and treat (3T) method through mass screening and testing (MSAT) using rapid diagnostic kits and treating malaria positive cases through anti-malaria medicine and most importantly its follow-up have improved the coverage of the population and also have reduced the malaria infection. Apart from it, Indoor residual spray (IRS) is the effective vector control measure. Besides, mass distribution of LLINs to every residents and one of the best practice like regular and compulsory usage of bed net at household are the efficient measures to prevent malaria. In addition to, community participatory awareness practices like ringing of bell by ASHA at night and night supervision for regular and compulsory use of bed net and dissemination of various malaria prevention messages and health education through the medium of traditional folk art based methods like folk dance, music, art, street plays, leaflets, posters, banners, advertisements in both print and electronic medias are the effective means of behaviour change communications which gradually change the perspective of usage of LLINs and work as preventive strategy against malaria. Similar studies also highlighted the reasons of reduction of malaria^{2, 3, 1}. The reduction in malaria cases is due to two important measures i.e. control measures and prevention measures. The scientific tools are used to control the infection whereas preventive measures are based on scientific knowledge dissemination and sustainable practices to prevent the infection. Putting scientific knowledge into practice promotes healthy behaviours and finally improves health seeking behaviours among population. This sustainable knowledge and practice centric approach is a learning experience for both service providers and receivers and has a lasting impact towards malaria elimination.

Lastly, community participation in the form of *gaon kalyan samiti*, local self-government, and community level organizations has played a key role not only in creating awareness but also community mobilization for the effective implementation of the DAMaN. Similar intervention studies were also seen in both India and outside⁶. A well-coordinated team work by both local health authority and field level health workers, especially ASHA, from DAMAN camp to case monitoring to night supervision has checked the malaria infection. Personal interactions like health worker to patient and doctor to patient is one of the effective way of communication in preventing malaria. Besides, inter-departmental convergence among departments of health and family welfare, women and child development and mission shakti, panchayati raj and drinking water, school and mass education, forest and environment, and revenue and disaster

management in micro level is the most meaningful strategy in curbing malaria case loads. The malaria elimination strategies are implemented by three important pillars of governance like government, involvement of various line departments and community participation in a concerted manner to eliminate malaria.

However, some programmatic deficiencies are visible at ground level. The concerns are loss of LLINs due to tearing, shortage of anti-malaria drugs and RDT kits, sense of fear among health workers due to left wing extremism and difficulty in accessibility to geographical inaccessible areas, incidence of malaria positive cases due to migration from neighbouring border-states. Similar study also found on migrant workers from other parts of India⁷. Besides, reluctance attitude of district level malaria officials during survey is a matter of concern. Bridging these existing deficiencies will improve outcomes and will make malaria elimination a reality. Besides these programmatic deficiencies, the study has some limitations because it does not cover the other part of story which is mostly discussed in the media.

The Way Forward

The study reveals Drugam Anchalre Malaria Nirakaran (DAMaN), the camp approach in supplementation to routine programme of malaria helps in the reduction of malaria in hard-to-reach areas. The success in malaria elimination lies on three important strategies. The first one is using of tools like tracking, testing and treating (3T) to control malaria. The second most important reason is regular and compulsory usage of long lasting insecticidal net (LLIN) to prevent malaria. Last but not the least, acceptance of sustainable community participatory awareness practices for behavioural change shows the path of success in eliminating malaria. The evidence based micro level malaria elimination strategies are based on sustainable knowledge and practice centric approach and support of government and community approach. However, some suggestions are made to strengthen malaria elimination strategies to be more meaningful. The suggestions thus recommend that the frequency of DAMaN camp should be increased from two times to three times in a year to strengthen coverage in inaccessible areas. Besides, both anti-malaria drugs and RDT kits should be sufficiently available with ASHA. Apart from, timely replacement of LLINs is essential where it is used more than years or tore-up. Besides, compulsory maintenance of inter-state migration data with active surveillance mechanism should be developed in panchayat level to reduce incidence of malaria to zero case. In addition to, arrangement of leadership enhance training programme for ASHA, increment of monetary incentives for community health workers and increase in security human resources in the inaccessible areas will motivate local level health workers and enhance their efficiency and security. Further, and most importantly, arrange of folk shows and street plays in tribal language by using the traditional folk art methods like tribal dances, music and musical instruments to disseminate health messages and involve reputed personalities from different field for health literacy campaign. Lastly, developing connectivity to remote and inaccessible areas and building of social infrastructures and recruitment of health human resources and focus on tribal research will help in malaria elimination in future. The lessons learnt from malaria elimination strategies from micro level, will help in achieving malaria free world by 2030 as envisioned by United Nations and World Health Organization. However, besides these micro level strategies, the good practice like use of mosquito net can be taken from Siridi Saibaba's daily rituals as a method of health education for general masses and health education should also be the part of school curriculum.

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Correlates Between Premenstrual Symptoms and Quality of Life among Women Academicians: A Biopsychosocial Approach

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Abstract

In recent times women face several challenges everyday due to demanding situations both at workplace and at home. Numerous research studies have indicated that stressful life situations, socio-economic factors, health and psychological aspects, lifestyle changes and hormonal fluctuations amongst others act as contributors to women's physical and mental health. In this context, quality of life of women is indispensable as their contribution to socio-economic development is crucial. It integrates the physical, psychological, socio-economic and cultural aspects of overall health. The present study attempts to identify the correlates that are pertinent to premenstrual symptoms and its impact on quality of life of women academicians in colleges. The findings showed that various socio-demographic, health and psychosocial factors contribute to symptoms experienced by women during the premenstrual phase, wherein the emotional disturbances are aggravated during this time and has adverse effects on overall personal life satisfaction and career growth, and this in turn impacts their quality of life. Hence, a biopsychosocial approach to alleviate the premenstrual symptoms and enhance the well-being of academic women is proposed in order to help them overcome stress and approach life's situations in an emotionally balanced way.

Key words: Premenstrual Symptoms, Biopsychosocial, Emotional Wellness, Mental Well-Being, Quality of Life, Work-Life Balance.

Introduction

Quality of life measures an individual's well-being from a multidimensional perspective. As per the National Health Policy 2002 and 2017, mental health disorders are prevailing more than it is visible on surface, wherein it is obvious that such disorders have significant relevance to quality of life of the affected individual and their families. In this regard, training a network of community members to provide psychological support and strengthen the mental health services in the country is highly essential^{1,2}. Also, the goal of Health Policy Unit of National Institute of Health and Family Welfare states that quality of life of people is improved through sustainable health, development activities and other health-related programs³. The World Health Organization (WHO) also mentions that quality of life is an individual's perception of his/her position in life which is contributed by their culture and value systems in relation to goals, life standards, expectations and concerns⁴. According to a study, mental health is highly influential for quality of

life, however, ever changing life's circumstances can trigger poor mental health episodes. This is affected by biopsychosocial factors such as socio-demographic, behavioural and physical health factors⁵. The biopsychosocial model of health describes that biological, psychological (thoughts, emotions and behaviors) and social (socio-economic, environmental and cultural) factors play a significant role in health and disease⁶.

In the current scenario, women are posed with innumerable challenges every day to balance their personal and professional life. Apart from these day-to-day stressful events, women also experience both physical and emotional stress during their monthly menstrual cycle. However, the changes that occur a week to ten days before the onset of menses, i.e., during the premenstrual phase or luteal phase of the menstrual cycle, are referred to as the premenstrual symptoms, which includes a range of physical, behavioural and emotional symptoms. Research studies conducted earlier have indicated that the premenstrual symptoms (PMS) inhibit the daily functioning of women including their work, personal activities, relationships and also adversely impacts quality of life⁷, which is also corroborated by another study mentioning that these symptoms significantly affect the quality of life especially during the premenstrual period^{8,9}. This condition can lead to a variety of physical consequences, psychological conditions, behavioural changes and social complications¹⁰. Also, when compared to other psychophysical conditions, PMS may be perceived as a less severe problem since it affects only a subset of women, however, this is an incorrect notion¹¹. Approximately 80% of women report that they experience at least one mood or physical symptom premenstrually and 38 per cent of them are unable to perform their daily activities due to this¹². A recent systemic review and meta-analysis conducted in India and Turkey reported that PMS was prevalent in 43–52.2 per cent women of reproductive age^{13,14}. Furthermore, the employees with moderate to severe PMS were found to perceive that their symptoms were preventing them from being fully present and their ability to carry out the job¹⁵.

Stress affects the body's normal functioning capacity including the cardiovascular, respiratory, gastrointestinal, endocrine, musculoskeletal and reproductive systems. It can also have significant impact in emotional variations, behavioural changes and thinking ability. Scientific research has proved the existence of mind-body connection and that emotions play a significant role in biological changes. A study conducted earlier has provided evidence for neural basis of mind-body connection and that stress and other mental states can affect organ's functioning leading to psychosomatic illnesses¹⁶. Also, Indian women employees are very serious towards their family commitments when compared to their professional responsibilities, and they develop severe stress and high degree of work-family conflict¹⁷.

Numerous stressors are identified that has adverse effects on health. It is evident that the body responds to various factors including thoughts, beliefs and emotions and these psychological patterns are developed since childhood from the family, environment, cultural and role expectations, etc. For women, apart from physical and mental health, reproductive health is of main concern as it involves hormonal fluctuations and cyclic changes every month. The emotional disturbances are caused by the family, work, social or other environmental factors, and also due to the changes that occur during the premenstrual phase of their monthly cycle, wherein these symptoms are triggered by both biological and psychosocial components. The current study aims at women academicians as emotional balance is vital to their overall well-being in order to impart

knowledge and deliver quality education to younger generations. Hence, this research emphasises on the psychological aspects of premenstrual symptoms induced by social factors and its effect on quality of life through a biopsychosocial approach.

Objective

To identify the relationship between independent and dependent variables as well as interrelationship amongst the dependent variables that are pertinent to premenstrual symptoms and its impact on quality of life of women academicians.

Methodology

The research study was conducted in five private arts & science colleges in the City of Coimbatore, Tamil Nadu upon receiving approval from the Institutional Human Ethics Committee of our University (AUW/IHEC/ws-20-21/XPD-03) and from heads of institutions of the respective colleges.

The sample has been drawn from a finite universe comprising of 639 women faculties, wherein the sample size (N) is 243. Based on the nature of the study, convenient sampling technique with exploratory research design and survey method was adopted. The study included only women faculties falling under the age-group of 26 - 49 years; however, faculties above 50 years, who have undergone hysterectomy and subjected to early menopause were excluded.

Data was collected through online questionnaire and only the faculties who were interested participated in this research. The confidentiality statement and non-disclosure of the collected data were informed to the participants in the online link. The questionnaire consisted of eleven independent variables: A) socio-demographic variables B) health variables and eleven dependent variables: C) premenstrual variables D) psychosocial variables and E) premenstrual symptom remedial variables.

Variables Classification

The eleven independent and eleven dependent variables are classified below. The independent variables are as follows:

A) Socio-Demographic Variables: i) A – Age (in years), ii) ES – Employment Status, iii) WE - Work Experience (in years), iv) MI - Monthly Income (in Rs.), v) FV – Family Values and vi) MS – Marital Status.

B) Health Variables: i) MF - Frequency of Menses (in days), ii) MD - Duration of Menses (in days), iii) NMP - No. of Menstrual Problems, iv) DMC - No. of other Diagnosed Medical Conditions and v) GMP - General Mood Problems. The variables NMP, DMC and GMP are multiple-choice response questions.

The dependent variables are as follows:

C) Premenstrual Variables: i) PS - No. of Physical Symptoms during premenstrual phase, ii) BS - No. of Behavioural Symptoms during premenstrual phase and iii) ED – Intensity of Emotional Discomfort experienced during premenstrual phase. The variables PS and BS are set of multiple-choice response questions. ED is a self-devised 5-point Likert-type scale with 15 items and each item is scored from 1 to 5 (1 = none, 2 = mild, 3 = moderate, 4 = severe, 5 = extremely severe).

D) Psychosocial Variables: i) TFB - Negative Thoughts, Feelings & Behaviour Patterns when generally stressed, ii) ITFB - Increase in negative Thoughts, Feelings & Behaviour Patterns during premenstrual phase, iii) CFS - Causes for Stress, iv) OPLS - Overall Personal Life Satisfaction and v) CG - Perception about Career Growth. The variables TFB and CFS are self-devised 5-point Likert-type scales with 14 and 12 items respectively and each item is scored from 1 to 5 (1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always). ITFB is a Yes/No/Sometimes question and both OPLS and CG are continuous scales ranging from 1 to 10 with '1' being the lowest and '10' the highest.

E) Premenstrual Symptom Remedial Variables: i) MPMS - Medicines / Supplements intake to reduce premenstrual symptoms, ii) EPMS - Exercise to reduce premenstrual symptoms and iii) FH - Food Habits. The variables MPMS and EPMS are Yes/No/Sometimes question and the variable FH is a self-devised 3-point Likert-type scale with 16 items scoring from 1 to 3 (1 = never, 2 = occasionally and 3 = regularly).

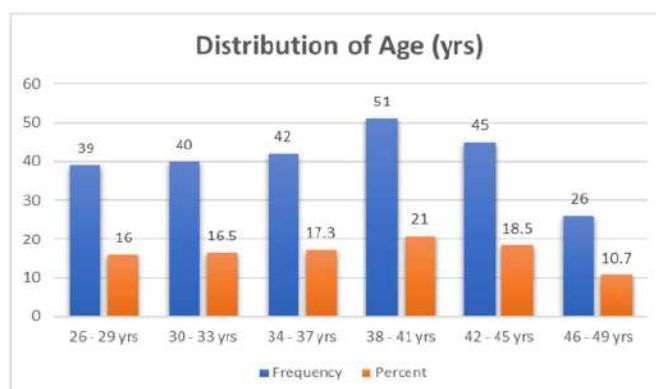
Analysis

The data were coded and analyzed using SPSS 25.0. Reliability test was performed for the constructed scales, which indicated that Cronbach's Alpha was > 0.5: Emotional Discomfort (ED) = 0.939; Thoughts, Feelings and Behaviour (TFB) = 0.868; Causes for Stress (CFS) = 0.849 and Food Habits (FH) = 0.715. Percentage analysis was done to identify the distribution of respondent's age and severity of emotional discomfort experienced by the respondents during the premenstrual phase. Thus, to determine the relationship between premenstrual symptoms and quality of life of the respondents, correlation analysis was performed between independent and dependent variables as well as amongst the dependent variables.

Findings

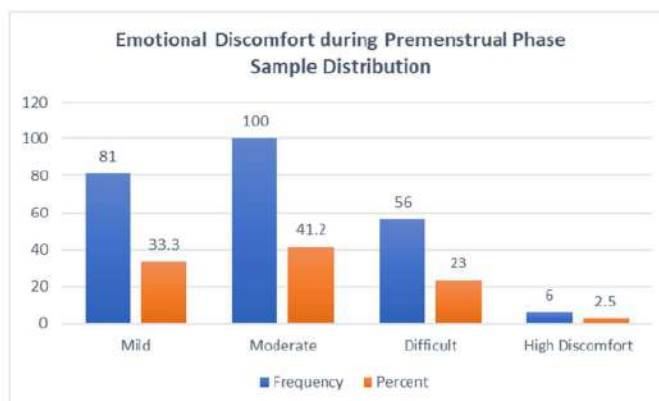
As given in Figure 1 below, the percentage analysis of age distribution shows a maximum of 21 per cent of the respondents are in the age group of 38-41 years followed by 18.5 per cent and 17.3 per cent in the groups of 42-45 years and 34-37 years respectively. While there are 16.5 per cent and 16 per cent in the age groups of 30-33 years and 26-29 years, the least is 10.7 per cent in the 46-49 years' group.

Figure 1
Age Distribution of Respondents (N = 243)



The given Fig. 2 below indicates percentage of emotional discomfort experienced during the premenstrual phase by the respondents. The severity of the discomfort was measured with a 15-item scale and it shows 41.2% experience moderate discomfort, 33.3% have low discomfort, 23% face difficulties emotionally and 2.5% face high discomfort.

Figure 2
Distribution of Emotional Discomfort during Premenstrual Phase (N = 243)



The relationship between independent and dependent variables relevant to premenstrual symptoms was analyzed and the Pearson's correlation coefficient showing statistically significant levels is given in Table 1 below.

Table 1
Correlation between Independent and Dependent Variables

	PS	BS	ED	TFB	ITFB	MPMS	EPMS	FH	CFS	OPLS	CG
A	-.152'	-.224**	-.312**	0.051	-0.101	-.147'	-0.066	-0.032	-0.084	0.028	0.008
ES	0.013	0.079	0.101	-0.014	0.029	-0.013	-0.069	0.014	.158'	-.162'	-0.095
WE	-0.060	-.162'	-.204**	-0.003	-0.073	-.158'	-0.043	-0.052	-.138'	0.102	.152'
MI	0.066	0.065	-.246**	-0.093	-0.043	-.151'	-0.008	-0.008	-.239**	.133'	.155'
FV	0.077	0.033	0.083	.224**	0.078	-0.049	-0.024	-0.075	.154'	-0.017	0.005
MS	0.120	0.062	0.013	0.064	0.101	-0.065	-0.017	-0.004	0.061	-0.094	0.012

MF	0.076	-0.014	-0.051	-.155*	0.054	.162*	0.105	-.138*	-0.001	-0.029	-0.036
MD	.159*	0.032	.163*	-0.055	0.030	0.097	0.104	-0.014	0.062	-0.033	-0.101
NMP	.207**	.138*	0.115	-0.106	0.073	.175**	.167**	0.114	0.089	-0.095	-.159*
DMC	.338**	.215**	.245**	.262**	.223**	.203**	.168**	-0.041	.206**	-.189**	-0.056
GMP	.489**	.609**	.433**	0.106	.228**	0.028	0.025	0.125	0.066	-0.066	-0.026

N = 243, ** P ≤ 0.01, * P ≤ 0.05

The analysis between independent and dependent variables from the above table 1 indicates that Age is significant with no. of physical symptoms, no. of behavioural symptoms and emotional discomfort during the premenstrual phase showing negative correlation of $r = -.152^*$, $-.224^{**}$ and -0.312^{**} respectively. It is also negatively correlated to medicines/supplements intake to reduce PMS with $r = -.147^*$. Employment Status showed $p < 0.05$ level of significance with overall personal life satisfaction at $r = -0.162^*$ and correlated to causes for stress with $r = 0.158^*$. Work Experience showed negative correlation to no. of behavioural symptoms and emotional discomfort during premenstrual phase with $r = -0.162^*$ and -0.204^{**} respectively and also negatively correlated to medicines/supplements intake to reduce PMS ($r = -.158^*$) and causes for stress ($r = -0.138^*$), but positively correlated to perception about career growth ($r = 0.152^*$). Monthly Income indicated perfect negative correlation with emotional discomfort ($r = -0.246^{**}$) and causes for stress ($r = -0.239^{**}$), positively correlated to overall personal life satisfaction ($r = 0.133^*$) and perception about career growth ($r = 0.155^*$) and negatively correlated to medicines/supplements intake to reduce PMS with $r = -0.151^*$. Family Values shows $p < 0.01$ level of significance with thoughts, feelings and behaviour patterns ($r = 0.224^{**}$) and $p < 0.05$ with causes for stress ($r = 0.154^*$). While the Frequency of Menses is negatively correlated to thoughts, feelings and behaviour patterns as well as food habits with $r = -0.155^*$ and -0.138^* respectively and positively correlated to medicines/supplements intake to reduce PMS with $r = .162^*$, the Duration of Menses highlighted positive correlation to no. of physical symptoms and emotional discomfort during premenstrual phase with $r = 0.159^*$ and 0.163^* respectively. The No. of Menstrual Problems is negatively correlated to perception about career growth with $r = -0.159^*$ and showed perfect positive correlation to no. of physical symptoms during premenstrual phase, medicines/supplements intake and exercise to reduce PMS with $r = 0.207^{**}$, 0.175^{**} and 0.167^{**} respectively and also indicated positive significance to no. of behavioural symptoms with $r = 0.138^*$. The No. of other Diagnosed Medical Conditions showed perfect positive correlation to no. of physical symptoms, no. of behavioural symptoms and emotional discomfort during premenstrual phase; thoughts, feelings and behaviours patterns when stressed; increase in thoughts, feelings and behaviours during premenstrual phase, medicines/supplements intake and exercise to reduce PMS and causes for stress showed positive correlations ($r = 0.338^{**}$, 0.215^{**} , 0.245^{**} , 0.262^{**} , 0.223^{**} , 0.203^{**} , 0.168^{**} and 0.206^{**} respectively). However, it showed perfect negative correlation to overall personal life satisfaction ($r = -0.189^{**}$). Likewise, the General Mood Problems shows perfect positive correlation to no. of physical symptoms, no. of behavioural symptoms, emotional discomfort and increase in negative thoughts, feelings and behaviour patterns during premenstrual phase with $r = 0.489^{**}$, 0.609^{**} , 0.433^{**} and 0.228^{**} respectively.

The Table 2 below highlighted interrelationship amongst the dependent variables relevant to premenstrual symptoms with Pearson's correlation coefficient at significant levels.

Table 2
Correlation amongst Dependent Variables

	PS	BS	ED	TFB	ITFB	MPMS	EPMS	FH	CFS	OPLS	CG
PS	1	.522**	.306**	.205**	.148*	0.089	0.113	-0.113	0.096	-.154*	-0.074
BS		1	.428**	.147*	.236**	0.038	0.071	-0.028	0.033	-0.125	0.001
ED			1	.337**	.363**	0.084	0.084	-0.058	.367**	-.261**	-.163*
TFB				1	.352**	-0.007	-0.021	-0.064	.595**	-.340**	-.146*
ITFB					1	-0.003	.169**	0.085	.248**	-0.122	-0.061
MPMS						1	.271**	0.069	0.044	-0.104	-0.077
EPMS							1	0.087	0.073	0.040	0.049
FH								1	-0.061	0.066	0.072
CFS									1	-.489**	-.371**
OPLS										1	.521**
CG											1

N = 243, ** P ≤ 0.01, * P ≤ 0.05

From the above table 2 it is inferred that the analysis amongst the dependent variables showed No. of Physical Symptoms during premenstrual phase is positively correlated to no. of behavioural symptoms and emotional discomfort during premenstrual phase; thoughts, feelings and behaviours patterns when stressed and increase in thoughts, feelings and behaviours during premenstrual phase with $r = 0.522^{**}$, 0.306^{**} , 0.205^{**} , 0.148^* respectively and negatively correlated to overall personal life satisfaction with $r = -0.154^*$. The No. of Behavioural Symptoms showed positive significance to emotional discomfort during premenstrual phase; thoughts, feelings and behaviours patterns when stressed and increase in negative patterns during the premenstrual phase with $r = 0.428^{**}$, 0.147^* and 0.236^{**} respectively. The Emotional Discomfort has perfect positive correlation, $r = 0.337^{**}$, 0.363^{**} and 0.367^{**} with negative thoughts, feelings and behaviour patterns when generally stressed; increase in these patterns during the premenstrual phase and causes for stress respectively. It also showed negative correlation to overall personal life satisfaction ($r = -0.261^{**}$) and perception about career growth ($r = -0.163^*$). The Thoughts, Feelings and Behaviour patterns when generally stressed has $p < 0.01$ level of significance with increase in negative patterns during the premenstrual phase ($r = 0.352^{**}$), causes for stress ($r = 0.595^{**}$), overall personal life satisfaction ($r = -0.340^{**}$) and also has $p < 0.05$ level of significance with perception about career growth ($r = -0.146^*$). The Increase in Thoughts, Feelings and Behaviour patterns during the premenstrual phase indicated perfect positive correlation to exercise to reduce PMS and causes for stress with $r = 0.169^{**}$ and 0.248^{**} respectively. Likewise, the Medicines/Supplements intake to reduce PMS is perfectly correlated to exercise to reduce PMS ($r = 0.271^{**}$). Causes for Stress and Overall Personal Life Satisfaction showed perfect negative correlation amongst themselves with $r = -0.489^{**}$ and showed perfect negative and positive correlation ($r = -0.371^{**}$ and $r = 0.521^{**}$) respectively to perception about career growth.

Discussion

The findings of the study revealed that the physical and behavioural symptoms experienced during the premenstrual phase is correlated to various socio-demographic, health and psychosocial variables. However, the emotional discomfort experienced during the premenstrual phase is prevalent among majority of the respondents and possible relationships exist between various independent and dependent variables that contribute to emotional disturbances such as

age, work experience, monthly income, duration of menses, diagnosed medical conditions and other general mood problems. These emotional disturbances contribute to increase in negative psychological patterns during the premenstrual phase, which induces stress. Also, the induced stress is significant with the women's perception about their personal life satisfaction and professional growth. In recent times, college faculties face work-related issues as their employment is based on work experience and is categorized into temporary, contractual or permanent status resulting in financial burden and emotional discomfort. Similar studies have showed that severity of premenstrual symptoms in each cycle is associated with the level of stress during the previous month. Women who are exposed to high stress are more likely to report severe symptoms twenty-five times more than those who were not exposed¹⁸. Also, based on the current study women's low monthly income increases the stress and in turn increases the emotional discomfort during the premenstrual phase implying that socio-economic status contributes significantly to life satisfaction levels and career growth.

The present study also showed that negative psychological patterns is also related to family values, frequency of menses and diagnosed medical conditions; however, increase in these negative patterns during the premenstrual phase is mainly attributed to medical conditions and general mood problems experienced by the respondents. Family values such as being orthodox, liberal or moderate determines in shaping the role and responsibility of the women in the family and society. Based on each family's moral values and cultural expectations, the psychological patterns, i.e., the thinking process, behavioural styles and way of expressing emotions or feelings are moulded since childhood. Previous research studies have mentioned that women's premenstrual distress is tied to feminine constructions based on culture, idealised femininity and other relational issues, wherein this distress is considered as dysfunctional pathologic condition, which in turn results in self-objectification. However, a shift in this positioning can have a significant effect on women's experience of distress by facilitating self-care development, acknowledging bodily changes across the menstrual cycle and association of feelings about the 'Self'¹⁹⁻²¹.

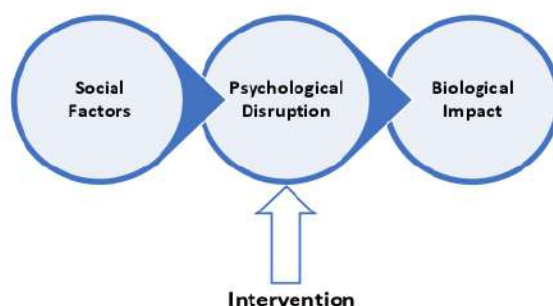
Other studies indicated that women with premenstrual symptoms displayed more irritable and depressed mood instability, which was present at other times and not only during the premenstrual phase. However, the mood instability increased during the seven days before the onset of menses, which may be a manifestation of an underlying problem of mood dysregulation²². Studies conducted earlier revealed that premenstrual symptoms are associated with alterations in emotion regulation both at explicit and implicit levels and should focus more on cognitive-emotional approach and its relation to biological changes²³. The present study also revealed that premenstrual symptom remedial variables such as the medicines/supplements and exercises can be effective to reduce the no. of menstrual symptoms and other diagnosed conditions; however, increase in negative psychological patterns during the premenstrual phase is highly correlated with induced stress and diminished exercise. Hence, a more psychological approach is required to reduce the stress thereby decreasing the severity of premenstrual symptoms.

Studies conducted earlier also indicated that stress induced by work and increasing responsibilities may produce or aggravate the premenstrual symptoms. It is suggested that approaches by self-help and self-awareness along with other mind-based interventions may help

the affected women to overcome these symptoms so that they may increase their work productivity and quality of life²⁴. Moreover, a study conducted earlier mentions that management of these symptoms should be done by integrative holistic approach based on each individual such as creating awareness, self-screening, lifestyle and diet modifications, stress coping strategies, pharmacological and other alternative therapies, etc²⁵. Other research findings have pointed out that the sensory inputs received from the environment enter conscious awareness based on the individual's beliefs and that there is potential for possible change and growth in terms of biochemical process. Hence, the choice to change the thoughts, beliefs and receptive to new sensory information will result in behavioural pattern changes and this new experience and perception will help the body to respond in newer ways²⁶.

Based on the findings from the current study and other supportive earlier research studies, the following intervention approach to alleviate the premenstrual symptoms and enhance the quality of life is proposed in Fig. 3 below.

Figure 3
Biopsychosocial Approach to PMS



As depicted in the figure 3 above, intervention at the psychological level including awareness of 'self', therapeutic techniques for handling emotions in a positive way by reframing the mind to approach things from a different perspective as well as other customized rehabilitation procedures will provide desired biological changes thereby alleviating the premenstrual symptoms.

Limitations and Suggestions

The limitation of this study is that samples were included only from private arts & science colleges. Hence, the future researchers shall include samples from various academic institutions, both governmental and non-governmental, to compare results.

Recommendations and Conclusion

The study highlighted that both positive and negative correlations exist amongst the socio-demographic, health, premenstrual, psychosocial and premenstrual symptom remedial variables

that has an impact on quality of life of women academicians. However, the emotional discomfort experienced during the premenstrual phase affects their life satisfaction and career growth levels. Keeping in view the phenomenal contributions of academicians to future generations, recommendations for the policy makers, governmental and institutional governing bodies include devising orientation and awareness programs for the faculties focusing on the importance of premenstrual wellness and its impact on psychological well-being, wherein its contribution to their quality of life is significant. Intervention techniques can be developed based on the biopsychosocial perspective including self-care and implementation of support groups in academic institutions, which can be extended to other working women professionals also. The participants can adopt various remedial measures based on their choice such as physical exercises, relaxation and stress-reduction techniques, mindfulness-based therapies, dietary and lifestyle modifications, psychological and other alternative therapies to take care of their health. Moreover, the mental well-being of women academicians is highly essential as education is the foundation for shaping an individual to become a dedicated citizen for serving the nation.

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The Resilience of the Aspirational District Programme During the COVID-19 Pandemic: Examining Key Performance Indicators and Health System Adaptability

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Abstract

This study examines the impact of the COVID-19 pandemic on the applicability of health Key Performance Indicators (KPIs) and the adaptability of health systems within the Aspirational District Program (ADP) framework. Valuable insights are gained on the effects of the pandemic on healthcare systems by examining trends and differences in KPIs across several districts. Out of the 16 indicators tested for the purpose, over 81 per cent demonstrated secular trend indicating resilience of ADP during the pandemic. However, the relevance of ADP indicators for COVID impact study remains inconclusive, with only 3 indicators demonstrating discernible negative impact. This research also contributes to the knowledge base by shedding light on the interplay between health indicators and health systems. The results emphasize the need for future research to better comprehend the long-term effects of COVID-19 on health outcomes in the context of the ADP framework. The insights gained can inform policymakers and program implementers in developing targeted interventions and strategies to strengthen healthcare system resilience and further improve health outcomes in ADP districts.

Key words: Aspirational District Program, NITI Aayog, Health Indicator, COVID-19, Public Health

JEL Code: I18, P46

Introduction

The Organization for economic cooperation and development (OECD) defines health system resilience as the capacity of health systems to prepare for shocks, minimize the adverse consequences, recover as swiftly as possible, and adjust by learning lessons (*Health Systems Resilience - OECD*, 2021)¹. The importance of health system resilience has reached unprecedented levels with the advent of the COVID-19 pandemic (Fleming *et al.*, 2022)². The COVID-19 pandemic has brought about unparalleled disruption to our lives and health systems (European Observatory on Health Systems and Policies, 2022)³. It has revealed the limitations of many health systems, including those previously regarded as high-performing and resilient (Haldane *et al.*, 2021)⁴. This raises questions about the dependability of the metrics used thus far to evaluate health systems (El Bcheraoui *et al.*, 2020)⁵. Key Performance Indicators (KPIs) provide quantifiable metrics that establish the foundation for evidence-based Health Information Management (Fenton and Smith, 2019)⁶.

The present research aims to gain insight into the resilience of the Indian health system by evaluating the influence of COVID-19 on health KPIs within the context of NITI Aayog's flagship Aspirational District Program (ADP). ADP seeks to transform the most underdeveloped districts across the country by promoting convergence of schemes, collaboration among stakeholders, and competition among districts (*Aspirational Districts Programme | NITI Aayog, 2018*)⁷.

The theoretical basis for the Aspirational District Program (ADP) emerged from the recognition of regional disparities and inequalities in India, which hinder the holistic development of the country (Kushre, 2022)⁸. Despite India's high growth trajectory expected to alleviate poverty (GoI, 2022)⁹, the quality of life for many citizens does not align with this progress, as indicated by India's rank of 132 out of 191 countries on the UNDP's 2020 Human Development Index (*India Ranks 132 on the Human Development Index as Global Development Stalls | United Nations Development Programme, 2022*)¹⁰. The human development approach prioritizes the well-being of people, viewing economic growth and wealth as means to development, rather than an end in itself (Sourav, 2019)¹¹. Notably, there is considerable heterogeneity in living standards across India (GOI, 2022)⁹, with significant inter-state and inter-district variations. By uplifting districts that have lagged behind in achieving key social outcomes, India seeks to advance its position on the human development index and bridge the regional development gap.

Overview of the Aspirational District Program (ADP)

The recognition to tackle regional disparity that impacted India's Human Development resulted in the formation of the Aspirational District Program (ADP) in 2018. ADP aims to address the developmental obstacles faced by these regions and promote inclusive and sustainable growth. The program targets the rapid transformation of the 112 comparatively less developed districts in India. Key components of the program include the selection of crucial performance measures across various sectors that are vital for enhancing the quality of life and economic productivity of the population. In this context, 49 indicators have been chosen across five sectors, namely Health and Nutrition, Education, Agriculture and Water Resources, Financial Inclusion, and Skill Development, and Basic Infrastructure. Districts are encouraged to catch up with the top-performing district within their own state and then aspire to become one of the leading districts in the country by competing with and learning from others in the spirit of competitive and cooperative federalism (*Aspirational Districts Programme | NITI Aayog, 2018*)⁷. Under ADP, the performance of districts is consistently monitored based on the progress made on these indicators. This progress is utilized to rank districts that have shown improvement in the aforementioned indicators on a monthly basis. ADP highlights the importance of evidence-based planning, robust monitoring and evaluation systems, and a collaborative approach involving central and state governments, district administrations, and other stakeholders.

Table 1
ADP Themes

Theme	Weightage (%)	Number of Indicators	Number of Data Points
Health and Nutrition	30	13	31
Education	30	8	14
Agriculture and Water Resources	20	10	12

Financial Inclusion and Skill Development	10	11	16
Basic Infrastructure	10	7	8
Total	100	49	81

Source: NITI Aayog, Government of India (2023)

Health Indicators in Aspirational District Program (ADP)

The Health Indicators in Aspirational District Program can be grouped into several high-level categories based on the aspects of health they measure. These categories include maternal health, nutrition, child health, infectious diseases, and healthcare infrastructure. The cumulative weight assigned to each category reflects its relative importance in assessing the impact of COVID-19 on health within the Aspirational District Program (ADP) framework.

The weight of maternal health indicators (1.1, 1.2, 1.3, 2, 3.1, 3.2, 4.1, 4.2, 5) constitutes a significant proportion of the total weight. These indicators focus on various facets of maternal care, such as the utilization of antenatal care, deliveries in healthcare institutions, access to skilled birth attendants, breastfeeding practices, and management of anemia.

Child health and nutrition (6.1, 6.2, 6.3, 7, 8.1, 8.2, 8.3, 8.4, 9.1, 9.2, 10.1, 10.2, 11) also carry significant weight. These indicators concentrate on breastfeeding practices, birth weight, nutritional status, coverage of immunization, and management of childhood ailments like diarrhea and malnutrition.

Infectious disease indicators (12.1 and 12.2) evaluate the impact of COVID-19 on the management and treatment of tuberculosis (TB). Though they hold a comparatively lower weight than other categories, they still play a crucial role in understanding the implications of the pandemic on efforts to control infectious diseases.

Healthcare infrastructure indicators (13.1, 13.2, 13.3, 13.4, 13.5, 13.6, 13.7) assess the availability and quality of healthcare facilities and services. These indicators encompass aspects like the conversion of health centers into Health and Wellness Centers (HWCs), adherence to public health standards, availability of specialized services, functionality of referral units, and the organization of health and sanitation campaigns.

Table 2
Health and Nutrition KPI Categories

Indicator Category	Cumulative Weight (%)
Maternal Health	9
Child Health and Nutrition	13.5
Infectious Diseases	1.5
Healthcare Infrastructure	6
Total	30

Source: Same as Table 1

The selection of indicators is critical for capturing the essential aspects of health in the ADP framework. The chosen indicators cover a wide range of health outcomes and service delivery elements, ensuring a comprehensive evaluation.

The choice of indicators is based on their relevance to the target population and the availability of trustworthy data sources. These indicators are obtained from validated sources through well-

established systems, developed by the Ministry of Health and Family Welfare (MoHFW). The frequency of data collection underscores the need for regular monitoring and timely intervention.

Table 3
Health and Nutrition KPI Data-points

Reference No.	Description of the variable / Monitorable Data-points
1.1	Per centage of Pregnant Women receiving four or more antenatal care check-ups against total ANC registrations
1.2	Per centage of ANC registered within the first trimester against total ANC registrations
1.3	Per centage of pregnant women (PW) registered for ANC against estimated pregnancies
2	Per centage of pregnant women taking Supplementary Nutrition under the ICDS programme regularly
3.1	Per centage of Pregnant women having severe anaemia treated against PW having severe anaemia tested cases
3.2	Per centage of Pregnant Women tested for Haemoglobin 4 or more than 4 times for respective ANCs against total ANC registration
4.1	Sex Ratio at birth
4.2	Per centage of institutional deliveries out of total estimated deliveries
5	Per centage of home deliveries attended by an SBA (Skilled Birth Attendance) trained health worker out of total home deliveries
6.1	Per centage of new-borns breastfed within one hour of birth
6.2	Per centage of low-birth-weight babies (Less than 2500 gms)
6.3	Proportion of live babies weighed at birth
7	Per centage of underweight children under 5 years
8.1	Per centage of stunted children under 5 years
8.2	Per centage of children with Diarrhoea treated with ORS
8.3	Per centage of children with Diarrhoea treated with Zinc
8.4	Per centage of children with ARI in the last 2 weeks taken to a health facility
9.1	Per centage of Severe Acute Malnutrition (SAM)
9.2	Per centage of Moderate Acute Malnutrition (MAM)
10.1	Breastfeeding children receiving adequate diet (6-23 months)
10.2	Non-Breastfeeding children receiving adequate diet (6-23 months)
11	Per centage of children fully immunized (9-11 months) (BCG+ DPT3 + OPV3 + Measles1)
12.1	Tuberculosis (TB) case notification rate (Public and Private Institutions) against estimated cases
12.2	TB Treatment success rate among notified TB patients (public and private)
13.1	Proportion of Sub centres/ PHCs converted into Health and Wellness Centres (HWCs)
13.2	Proportion of Primary Health Centres compliant to Indian Public Health Standards
13.3	Proportion of functional FRUs (First referral units) against the norm of 1 per 5,00,000 population (1 per 3,00,000 for hilly terrain)
13.4	Proportion of specialist services available in District hospitals against 10* core specialist services
13.5	Per centage of Anganwadis centres/Urban PHCs reported to have conducted at least one Village Health Sanitation and Nutrition Day / Urban Health Sanitation and Nutrition Day/ respectively in the last one month

13.6	Proportion of Anganwadis with own buildings
13.7	Per centage of First referral units (FRU) having labour room and obstetrics OT NQAS certified (i.e., meet LaQShya quidelines)

Source: Champions of Change Dashboard, NITI Aayog, Government of India (2023)

Notes: Periodicity: Monthly - 1, Quarterly - 2, Annually - 3

Table 4
Health and Nutrition Key Performance Indicators

Indicator Reference	Weight in Hand N (per cent)	Weight in overall (per cent)	Source (Periodicity)	Entered in dashboard by	Validated by Survey (Quarterly)
1.1	2	0.6	HMIS, MoHFW (3)	DC/DM	Yes
1.2	3	0.9	HMIS, MoHFW (1)	DC/DM	Yes
1.3	3	0.9	HMIS, MoHFW (1)	DC/DM	Yes
2	3	0.9	Project monthly progress report-ICDS (1)	DC/DM	Yes
3.1	5	1.5	HMIS, MoHFW (1)	DC/DM	Yes
3.2	4	1.2	HMIS, MoHFW (3)	DC/DM	Yes
4.1	3	0.9	HMIS, MoHFW (1)	DC/DM	
4.2	4	1.2	HMIS, MoHFW (1)	DC/DM	Yes
5	3	0.9	HMIS, MoHFW (1)	DC/DM	Yes
6.1	4	1.2	HMIS, MoHFW (1)	DC/DM	Yes
6.2	3	0.9	HMIS, MoHFW (1)	DC/DM	Yes
6.3	3	0.9	HMIS, MoHFW (1)	DC/DM	Yes
7	7	2.1	Project monthly progress report-ICDS (1)	DC/DM	Yes
8.1	2	0.6	Survey (2)	Survey Agency	
8.2	2	0.6	Survey (2)	Survey Agency	
8.3	2	0.6	Survey (2)	Survey Agency	
8.4	2	0.6	Survey (2)	Survey Agency	

9.1	3	1	Project monthly progress report-ICDS (1)	DC/DM	Yes
9.2	2	0.5	Project monthly progress report-ICDS (1)	DC/DM	Yes
10.1	3	1	Survey (2)	Survey Agency	
10.2	2	0.5	Survey (2)	Survey Agency	
11	10	3	HMIS, MoHFW (1)	DC/DM	Yes
12.1	2.5	0.75	RNTCP/Nikshay MIS (1)	DC/DM	
12.2	2.5	0.75	RNTCP/Nikshay MIS (1)	DC/DM	
13.1	6	1.8	NHM-MIS (2)	DC/DM	Yes
13.2	5	1.5	HMIS, MoHFW (2)	DC/DM	Yes
13.3	1.5	0.45	NHM-MIS (2)	DC/DM	Yes
13.4	2	0.6	HMIS, MoHFW and ICDS (2)	DC/DM	Yes
13.5	2	0.6	HMIS, MoHFW (1)	DC/DM	
13.6	2	0.6	Project monthly progress report-ICDS (2)	DC/DM	
13.7	1.5	0.45	District Health Officer (1)	DC/DM	Yes
Total	100	30			

Source: Same as Table 3

Notes: Periodicity: Monthly - 1, Quarterly - 2, Annually - 3

Previous Studies on Health Indicators and their Relevance

KPIs are certain, quantifiable aspects of health and social care that can be used to gauge the quality of the provided services (Marshall, 2002)¹². KPIs are also deemed as indicators that are based on benchmarks established through academic literature or, by the consensus of professionals (*KPI-Guidance-Version1.1-2013.Pdf*, 2013)¹³. On the other side the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) in the United States says that KPIs are not meant to be used as direct indicators of quality but rather as alarms that let us know when there is room for improvement in the method and results of service-user care (Turpin *et al.*, 1996)¹⁴. The need for healthcare assessment and evaluation has been fueled by the realization that there are disparities in the quality of healthcare provided as well as worries about the cost of providing poor quality of healthcare (Kelley *et al.*, 2006)¹⁵.

Measurement helps healthcare professionals in their effort to deliver the best treatment by promoting learning, regulation, and accountability in addition to quality improvement (*Pringle et al., 2002*)¹⁶. KPIs make it easier to quantify healthcare trends as an indicator of quality. They draw conclusions regarding the caliber of the care given and point out areas that need more research (*Campbell et al., 2003*)¹⁷.

The selection of indicators is just as important as the overall importance of KPIs as a metric for measurement. To choose and create a proper KPI, it is crucial to describe the measurement's objectives, justifications, and target audience (*KPI-Guidance-Version1.1-2013.Pdf, 2013*)¹³. It is crucial to keep in mind that the KPI selection process will be influenced by whether the measurement's objective is benchmarking, either internally for quality improvement objectives or externally against standards or other organizations.

It is crucial that the KPI utilized accurately evaluates results that are due to the performance of the healthcare system in which they are implemented because healthcare outcomes are sometimes the result of a mix of factors (*Helfert et al., 2005*)¹⁸.

1. Study Area, Data and the Sample

The research utilized the Champions of Change Dashboard (*Niti Aayog, 2018*)⁷ developed for ADP as a reliable data source for health-related metrics. The sample group consisted of 112 program districts. Data for April were collected over six years (2018-2023) to understand the health system's performance during the COVID-19 pandemic. Month of April was picked for study as it coincided with the country's lockdown in 2020 and 2021.

To ensure accuracy and reliability, a rigorous data cleaning exercise was performed based on the followed criteria. Indicators with values of zero or over 100% for April were excluded. Similarly, districts with values zero or values over 100% for any indicator during 2018-2023 were removed from that indicator's study.

Following a thorough data cleaning, 16 indicators were selected for analysis. These indicators showed non-zero and non-100% values, making them suitable for assessing the pandemic's impact on the health system in aspirational districts. Furthermore, the analysis included a minimum of 73 districts, chosen based on the availability of reliable and relevant data. The inclusion of a substantial number of districts enhances the study's robustness.

Temporal Classification

The study period was split into three separate phases in order to permit a thorough analysis: the Pre-COVID period (2018–2019), the COVID period (2020–2021), and the Post-COVID period (2022–2033). This time division permits a comparison of health indicators and provides information on how the pandemic has differing effects on the health system in aspirational districts throughout the course of these stages.

Methodology

To analyze the relevance and resilience of health Key Performance Indicators (KPIs) in the context of the COVID-19 pandemic, a systematic methodology was employed.

The research focused on upto 91 districts, carefully selected to ensure representativeness across different regions and populations. Data collection involved capturing specific health and nutrition

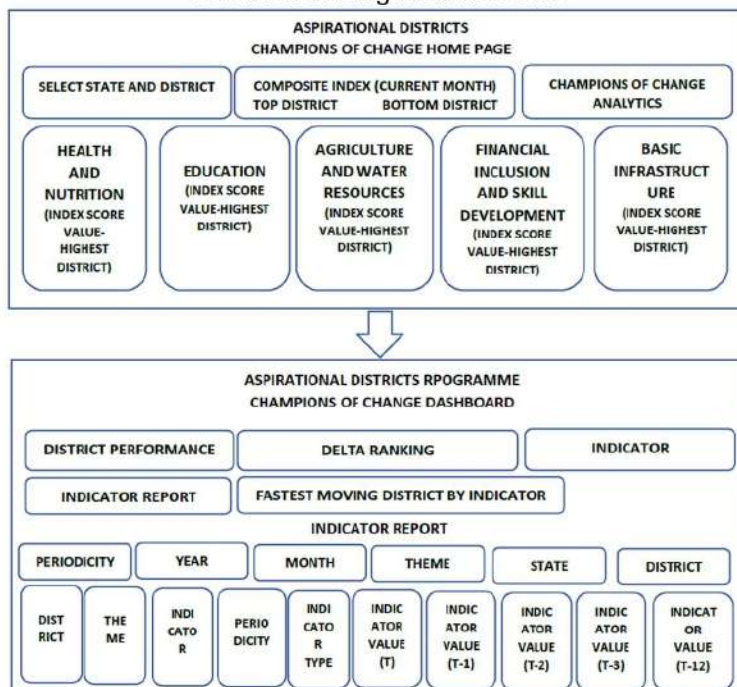
indicators during three distinct time periods: Pre-COVID (2018-2019), COVID (2020-2021), and Post-COVID (2022-2023), with emphasis on the month of April for consistency and comparability.

The Analytics section on the Champions of Change NITI Aayog website takes us to the Champions of Change Dashboard. The dashboard has sections on District Performance, Delta Ranking and Indicator. Under the section Indicator the default sub section Indicator Report contains state and district wise thematic indicator data on different timescale.

Since the present study is focused on analyzing Health Key Performance Indicators, the thematic area Health and Nutrition was searched in the database. The search returns result from the database for all indicators across all districts. The report having the entries under the heading periodicity highlight the frequency of data collection whereas the heading T, T-1, T-2, T-3 and T-12 indicate backward sequence of months, with T indicating current month.

Further analysis of data factored in the periodicity of indicator and the specific month for which the data was needed. Aspirational District Programme was launched in the month of January 2018. The first complete lockdown in India remained in force from April 2020 to May 2020 (*Then and Now: One Year since India's Covid-19 Lockdown | India News News, The Indian Express, 2021*)¹⁹, and was repeated in the month of April the following year with beginning of restriction on the outset of second wave (*Omicron: 2nd Wave of Covid Wreaked Havoc in Delhi in 2021; Omicron Shadow in 2022 - The Economic Times, 2022*)²⁰. With April being the common month in the two years of pandemic, the research focused on gathering data for the month of April to gauge the impact of COVID induced lockdown.

Figure 1
Dashboard Navigation Flowchart



Source: Champions of Change Dashboard, NITI Aayog, Government of India (2023)

The above search criteria were systematically used to generate reports for all Health and Nutrition KPIs. Since the report was generated in the month of June, in the month filter the month of June was selected which resulted in Indicator Value (T) indicating values for the month of June and consecutively the Indicator Value (T-2) indicating values for the month of April. This was followed by a rigorous data cleaning exercise to arrive at relevant district indicator group fit for performing the test.

Table 5
Dashboard Search Criteria

Periodicity	Year	Month	Theme	State Name	District Name	Output (no. of rows)
All	2018	Jun	Health and Nutrition	All	All	2581
All	2019	Jun	Health and Nutrition	All	All	2559
All	2020	Jun	Health and Nutrition	All	All	2556
All	2021	Jun	Health and Nutrition	All	All	2543
All	2022	Jun	Health and Nutrition	All	All	2602
All	2023	Jun	Health and Nutrition	All	All	1632

Source: Same as Table 3

To be able to develop an understanding of the relevance and resilience of health indicators during COVID it was decided to compare the indicator values obtained during COVID years with Pre-COVID and Post-COVID values. Consecutively, the time period was divided as 2018-2019 Pre-COVID years, 2020-2021 COVID years and 2022-2023 Post COVID years with focus being on the values collected in the month of April.

Six consecutive search operations produced a total of 14,473 district-indicator data points, categorized as Pre-COVID, COVID, and Post-COVID for ease of processing. After calculating average values for each period, following careful elimination of inconsistent data points, the final list included 16 relevant indicators out of 31.

Now to proceed with testing the impact of COVID we had to test the change in mean observed across the three time periods for each indicator. We have 3 methods to compare the means- z-test, t-test and ANOVA. All these methods are parametric method (Mishra, Pandey, *et al.*, 2019)²¹. We choose parametric test because our data is normally distributed (Mishra, Singh, *et al.*, 2019)²². z-test and t-test are used to compare the means between two groups, whereas ANOVA is used to compare the means among three or more groups. Since we had to compare the mean across three different time periods, to determine the statistical significance of observed changes, one way analysis of variance (ANOVA) test was performed. In ANOVA, when using one categorical independent variable, it is called one-way ANOVA, whereas for two categorical independent variables, it is called two-way ANOVA. In our study we have only one categorically independent variable represented by different periods, whereas the dependent variables are the indicators measured or observed.

The ANOVA analysis aimed to identify indicators with significant differences in means between the Pre-COVID, COVID, and Post-COVID periods. The resulting p-values were utilized to determine statistically significant changes.

The F crit value, which functioned as a critical threshold to separate significant changes from chance variations, was also produced during the ANOVA analysis. The significance level alpha for the study's purposes was set at 5 per cent.

Indicators that showed notable changes before and during the COVID-19 period were identified using the results of the statistical study. The trends and impact of these indicators were further classified, revealing the adaptability and resilience of health KPIs in the face of the epidemic.

Findings and Discussion

Using one-way ANOVA analysis and trend analysis, the effect of the COVID-19 pandemic on several health key performance indicators (KPIs) within the context of the Aspirational District Program (ADP) was evaluated. The findings shed important light on the precise effects of the pandemic on the metrics used.

The ANOVA analysis of ANC registration within the first trimester reveal significant increase in mean per centage from Pre-COVID) to COVID and further to Post-COVID period, indicating positive progress. The trend showed a rising pattern, suggesting improved early registration. These findings emphasize the importance of maternal healthcare during the pandemic and highlight the need to sustain efforts to enhance ANC registration.

The ANOVA analysis showed a significant influence of COVID on the ratio of pregnant women (PWs) registering for ANCs to all estimated pregnancies. Comparing the COVID period to the Pre-COVID and Post-COVID periods, the mean was lower and the variance was larger. The trend analysis revealed a mixed trend, underlining the necessity for more research to comprehend the variables affecting ANC registration at various times.

While the ANC registration increased for the first trimester, there was an overall dip for total ANC registration during COVID. Confusion, financial distress and temporary suspension of health services in the rural countryside meant that pregnant women could not track the foetus's health status (Bankar & Ghosh, 2022)²³.

The ANOVA analysis's findings also indicated that COVID had an impact on the per centage of children who were fully immunized (9 to 11 months). The mean during the COVID period was lower compared to the Pre-COVID and Post-COVID periods. The trend study showed a mixed trend, highlighting the need for continued efforts to maintain high immunization coverage.

The findings are commensurate with (Khan et al., 2021)²⁴ which highlights the complete suspension of immunization services in the month of April, except for hepatitis B, BCG and OPV.

The ANOVA analysis revealed that the COVID had a significant impact on the tuberculosis (TB) case notification rate since the mean for the COVID period was lower than the means for the Pre-COVID and Post-COVID periods. The findings of the trend analysis revealed a mixed trend, highlighting the need for continuing efforts in case notification and detection.

On the other side, ANOVA analysis revealed significant results for the TB treatment success rate. The mean during the COVID and Post-COVID periods was greater than it was during the Pre-COVID period, indicating improved treatment outcomes. The trend analysis revealed that from the Pre-COVID to the Post-COVID periods, the success rate of TB treatment rose.

India accounts for a quarter of global TB cases (Sathiyamoorthy et al., 2020)²⁵. While the ADP indicator demonstrate a secular improvement in TB treatment success rate for the month of April, the dip in notification rate is governed by same factors of disruption in health services as monthly tuberculosis notification rates plummeted to below 84,000 by April 2020 (Aggarwal et al., 2022)²⁶.

The per centage of pregnant women who consistently took Supplementary Nutrition as part of the ICDS program showed significant results, with a higher mean during the COVID and Post-COVID periods compared to the Pre-COVID period. The effectiveness of the program was demonstrated by the trend analysis, which showed that the consumption of supplemental nutrition rose from the Pre-COVID to the Post-COVID periods. This further highlights the resilience of ADP, as the national average for 2021 saw about 14per cent fall in beneficiaries (Khandelwal et al., 2022)²⁷.

According to the findings of the ANOVA analysis, significant results were found for the per centage of pregnant women who received therapy for severe anemia. The mean was higher during the COVID and Post-COVID periods than it was during the Pre-COVID period, indicating improvements in the management of severe anemia. The trend analysis revealed that the trend in the treatment of severe anemia increased from the Pre-COVID to the Post-COVID period. It is noteworthy as during the same period the budget for Anemia Mukh Bharat (AMB) increased by 2per cent and 18per cent for FY 2020–2021 and FY 2021–202, respectively (Saini et al., 2022)²⁸.

The ANOVA analysis showed no significant results on the sex ratio at birth. The means for the three periods didn't differ significantly from one another. However, the trend study revealed a rising pattern.

Significant results were found for the ratio of institutional deliveries to all expected deliveries. In comparison to the Pre-COVID period, the mean during the COVID and Post-COVID periods was greater, indicating an upward trend in institutional delivery rates.

Similarly, significant values were found for the proportion of home births attended by a skilled birth attendant (SBA) trained health professional, with a greater mean during the COVID period compared to the Pre-COVID period. The trend analysis showed that the use of SBAs during births increased steadily from the Pre-COVID to the Post-COVID periods, showing advancements in skilled birth attendance.

At the same time at national level the substantially reduced numbers of pregnant women hospitalised for labour management suggests an increase in the number of unattended deliveries (Kumari et al., 2020)²⁹.

The ANOVA analysis further revealed significant results for the proportion of infants that were breastfed within an hour of delivery. In comparison to the Pre-COVID period, the mean increased during the COVID and Post-COVID periods. From the Pre-COVID to the Post-COVID periods, the trend analysis showed a growing trend in early breastfeeding which reflected better infant care practices.

The ANOVA analysis revealed no significant results on the per centage of low birth weight infants. The means for the three periods didn't differ significantly from one another. However, the trend analysis revealed a declining trend, highlighting the positive results of health and nutrition interventions.

ANOVA results for per centage of live babies weighed at birth give significant results. As a result of better neonatal care practices, the mean during the COVID and Post-COVID periods was greater than it was during the Pre-COVID period. The trend analysis showed that the practice of weighing newborns increased from the Pre-COVID to the Post-COVID period.

However, In a study carried out on the foeto-maternal outcome at VMMC & Safdarjung Hospital a high rate of prematurity of 36.84per cent and low birth weight rate of 42.50per cent was derived, (Marwah et al., 2022)³⁰, indicating varying outcomes of health and nutrition interventions in Aspirational and Non Aspirational Districts.

The results of the ANOVA analysis produced significant results on the proportion of underweight children under the age of six. In comparison to the Pre-COVID period, the mean was lower during the COVID and Post-COVID periods. Indicating possible improvements in child nutrition, the trend analysis revealed a declining trend in underweight children from the Pre-COVID to Post-COVID period.

The ANOVA analysis on the proportion of severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) in children under 6 years gave significant results. Indicating possible improvements in child nutrition, the means during the COVID and Post-COVID periods were lower than those during the Pre-COVID period. Both moderate and severe acute malnutrition showed a declining trend from the Pre-COVID to the Post-COVID period.

Table 6 Summary Statistics

Indicator	No. of Districts	M ₁	V ₁	M ₂	V ₂	M ₃	V ₃	P-value	F Value	F c
1.2	91	73.16	205.1	80.17	194.78	86.96	96.45	0	26.192723	3.029
1.3	91	92.97	92.12	80.55	467.86	95.41	37.07	0	29.028696	3.029
11	83	87.09	139.29	75.73	558.65	92.19	73.35	0	22.941233	3.032
12.1	91	73.83	340.74	58.79	408.57	86.08	213.99	0	52.97886	3.029
12.2	86	80.49	176.21	88.43	95.27	89.56	63.55	0	18.821276	3.031
2	74	87.26	228.93	91.44	209.79	96.29	36.12	0.000106	9.543835	3.037
3.1	83	76.05	418.93	89.68	209.25	94.94	162.09	0	29.946254	3.032
4.1	91	937.42	2,387.36	944.98	3,309.62	952.1	2,254.59	0.159132	1.850589	3.029
4.2	90	67.73	354.54	68.65	424.95	77.69	292.06	0.000596	7.635021	3.029
5	73	42.84	701.46	57.07	901.16	68.83	921.54	0.000001	14.696315	3.037
6.1	89	93.58	67.19	97.03	8.59	97.99	6.19	0	17.519507	3.029
6.2	88	11.63	40.27	10.65	41.47	9.56	36.26	0.093301	2.393607	3.030
6.3	90	96.72	29.89	98.59	5.31	99.36	1.26	0.000002	13.594487	3.029
7	87	19.82	164.8	13.48	107.66	9.79	63.13	0	19.993671	3.030
9.1	80	3.97	71.1	1.87	5.38	1.27	2.53	0.002558	6.121422	3.03
9.2	82	12.49	82.77	7.84	47.72	5.46	24.04	0	20.317629	3.032

Source: Author's estimate based on ANOVA Analysis of Health and Nutrition KPI data collected from NITI Aayog Champions of Change Dashboard (2023)

Notes: M₁ indicates Pre-COVID Mean; M₂ is COVID Mean; M₃ is Post- COVID Mean; V₁ stands for Pre-COVID Variance; V₂ stands for COVID Variance; V₃ stands for Post-COVID Variance.

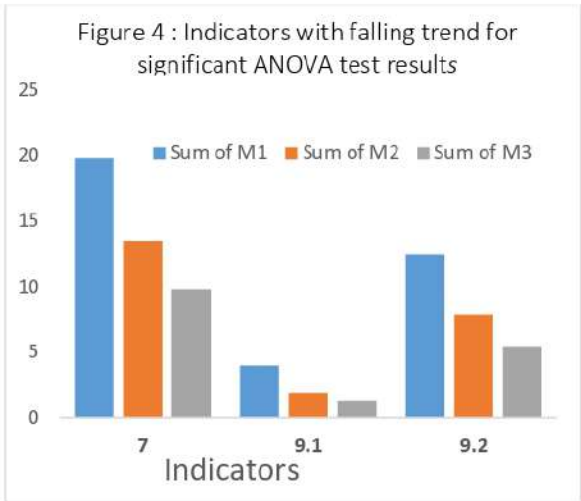
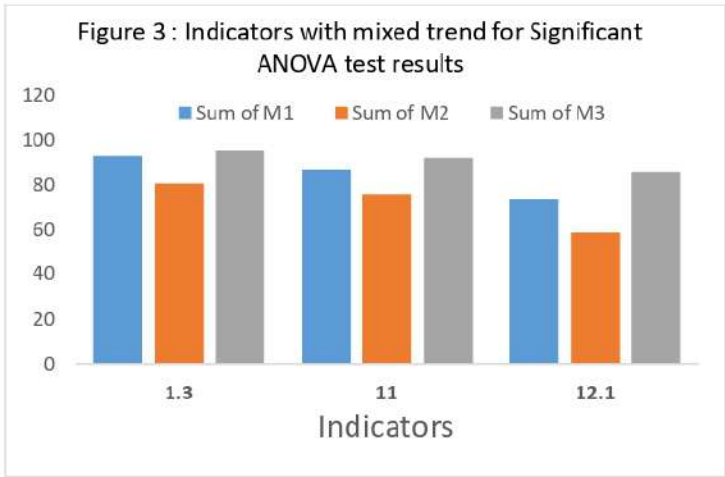
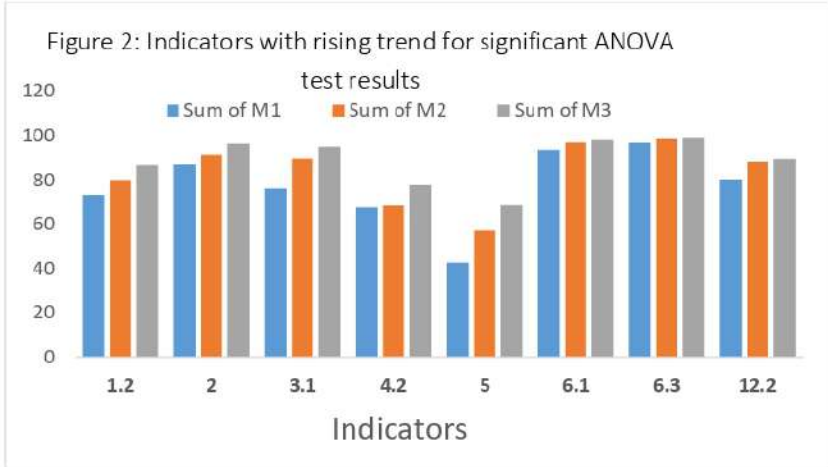
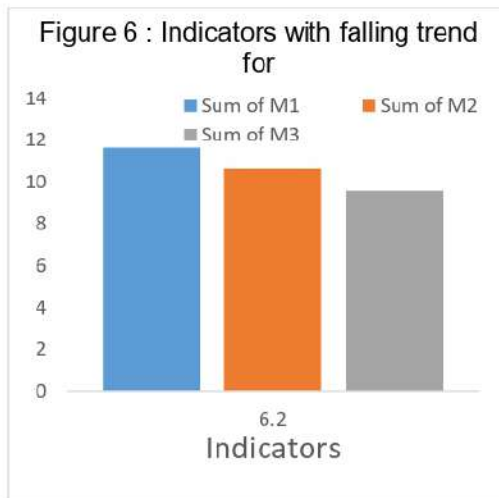
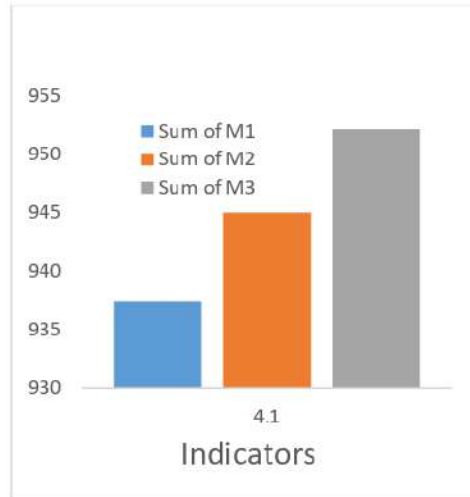


Figure 5
Indicators with rising trend for non-significant ANOVA test results



Source: Author's estimate based on ANOVA Analysis of Health and Nutrition KPI data collected from NITI Aayog Champions of Change Dashboard (2023)

Conclusion

This study looks at how COVID-19 affects the ADP's health KPIs. The study evaluates the significance of health indicators in capturing the effect of pandemic and the adaptability of health systems by analyzing health indicators from the Pre to Post COVID time period. 16 Indicators out

of 31 Health and Nutrition data points of the ADP were shortlisted for study. Based on how they performed during the research period, these indicators were divided into five different groups.

Group 1, which had eight indicators, had an increasing trend and a substantial variance in the mean. Although the healthcare system's resistance to the pandemic was obvious, Indicator's relevance to the COVID impact assessment was inconclusive. Three variables from Group 2 were noteworthy for the analysis because they exhibited high Mean variation and mixed trends, which suggested that they had an effect on the health system over the COVID period. The relevance to the COVID research was ambiguous for Group 3, which included 3 indicators and shown considerable Mean variation and a negative secular trend, showing resilience. Finally, groups 4 and 5, each with one indicator, exhibited non-significant Mean variation. Their secular rising and falling trends demonstrated the robustness of the healthcare system but fell short of establishing relevance for COVID impact study.

The study divides the indicators into five groups based on performance and trends, but additional research is required to determine how directly these groupings relate to the COVID impact study. It draws attention to the necessity of strong health systems within the ADP that take infrastructure, inequities, and access to healthcare into account. The findings may be used by decision-makers to protect advancements in sustainable health systems and human development. Future research should examine the long-term impacts of COVID, compare ADP and non-ADP districts, use qualitative techniques, meticulously clean the data, use bigger samples, and account for confounding factors for a better understanding of context and causality.

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Assessment of Anthropometric Measurement and Dietary Intake among Rag Pickers in Bhubaneswar City, Odisha

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Abstract

The present study was attempted to assess the Body mass index (BMI) of rag pickers based on average daily food intake, average daily Macronutrient and micronutrient. The primary data were collected from 200 samples rag pickers households having at least one person engaged in the profession of rag picking. The study was conducted in Bhubaneswar city where the main authorized municipal solid waste management (MSW) dump is located i.e., at Bhuasuni site and near Sanik School. It was found from the present study that maximum respondents were underweight and consume very less diet as compare to the RDA.

Key words: Rag pickers, Municipal solid waste (MSW), Nutrient intake, BMI status, macro nutrient, Micro nutrient

Introduction

The Rapid growth of urbanization, industrialization and economic development raise people's living standards while also contributing to the generation of large amounts of Municipal solid waste (MSW), and its management has become a major environmental issue in India. Rag pickers played an important role in waste management in the nineteenth and twentieth centuries, but they were excluded from society and their work was classified as unorganized sector work. They are the most vulnerable group and marginalized section of people yet they are the unsung heroes of the *Swaccha Bharat Abhiyan*. Their contribution is directly related to a country's GDP growth and recycling. Few case studies have been done on their health and nutritional status, but many have been done on their socioeconomic situation and occupational health risks. This gap has been closed by the current research¹.

An essential technique in determining a person's nutritional status is anthropometry assessment. According to Naidu et al², the ratio of body weight to height squared can be used to assess the severity of chronic energy deficit (CED) in adults. Undernutrition or inadequate dietary intake can be viewed as a primary contributor to a number of negative consequences on a person's ability to develop and maintain good health. Malnutrition is caused by dietary intakes that do not satisfy the demands of the body. Malnutrition is a health concern induced by an excessive food intake (over nutrition) or an inadequate or unbalanced diet that lacks all of the elements (undernutrition) required for healthy nutritional status³.

Table 1

Height of Rag pickers

Height Gender	Standard Height	Range of	Actual	Deficiency
	(NIN) (cm)	Height (cm)	Mean (Cm)	(%)
Male N=95	172.72	167-173	169	3.72
Female N=105	160.02	159-163	158	2.02

The height of rag pickers is depicted in Table 1 and in contrast to NIN, the mean height of both males and females was determined to be 169cm and 158cm, respectively, with a deficit of 3.72 per cent in males and 2.02 per cent in females. However, there was no substantial discrepancy in mean height between the reference height and the mean height of both males and females.

Weight of Rag Pickers**Table 2**

Weight of Rag Pickers

Weight Gender	Standard	Range of	Actual	Deficiency
	Weight (Kg) (NIN)	Weight (Kg.) (Min-Max)	Mean weight (Kg)	(%)
Male N=95	65	59-66	61.60	3.4
Female N=105	55	46-57	52.45	2.55

The weight of rag pickers is depicted in Table 4.3.1.2 and Fig 4.3.1.2. It was found that the minimum range of weight among the male was (59-66 Kg) and female was (46-57 kg). In comparisons to NIN, the mean weight of both males and females was found to be 61.60Kg. and

52.45Kg. respectively, with a deficient of 3.4per cent of males and 2.55 per cent of females. However, there was no substantial discrepancy in mean weight between the reference weight and the mean weight of both males and females.

BMI Status of Rag Pickers

Adult male and female can use the body mass index (BMI), a measurement of body fat based on height and weight. It is a straightforward way to evaluate an adult's nutritional and physical health. may be used for extensive surveys ideal for evaluating malnutrition.

Table 3
BMI Status of Rag Pickers

BMI	BMI Status (Kg/m ²)	Reference BMI (NIN)	Frequency (%)	Actual Mean of BMI (Kg/m ²)	Range of BMI
MALE (N=95)	NORMAL	18.5-24.9	22 (23.15)	21.98	21.71-21.98
	UNDERWEIGHT	<18.5	73 (76.84)	18.39	18.12-18.46
FEMALE (N=105)	NORMAL	18.5-24.9	30 (28.57)	21.80	21.07-22.37
	UNDERWEIGHT	<18.6	75 (71.42)	18.32	18.19-18.35

(Overweight, Osese-1 and obese-2 BMI status has not found from the present study)

Table 3 depicts the BMI status of rag pickers. (BMI) of rag pickers of rag pickers. It was observed from the table that the minimum to maximum range of normal BMI among both male and female was 21.71-21.98 kg/m² for male and 21.07-22.3721.98 kg/m². In case of underweight BMI, the maximum to minimum range of BMI among male and female was found (18.12-18.46 Kg/m²) for male and (18.19-18.32Kg/m²) for female which was less than the reference range i.e. (<18.5 Kg/m²).

Overweight, Osese-1 and obese-2 BMI status was not found from the present study. The actual mean of normal BMI of both male and female was found to be 21.98 Kg/m²&21.80Kg/m² respectively whereas the underweight BMI was found 18.39 Kg/m² for male and 18.32 Kg/m²for female. It was observed that most of the respondents both male 76.84% and female 71.42% were underweight BMI categories whereas 23.15% of male and 28.57% of female were under normal categories. This result is in support of Williams et.al (2019) that inadequate fats and Protein which is associated with high prevalence of underweight.

Table 4
Mean Nutrient Intake of Rag Pickers

Sl.No.	Nutrients	Male	RDA	Z- Value	Female	RDA	Z-Value
1	Energy (K.cal)	3158.51 ±6.4	3940	121.98*	2258.01 ±5.31	2850	111.29*
2	Protein(gm)	51.17 ±1.84	60	4.79*	49.2 ±2.5	55	2.32*
3	Fat(gm)	17.28 ±2.08	40	10.92*	17.42 ±1.99	30	6.32
4	Calcium(mg)	252 ±1.68	600	207*	253 ±1.91	600	182*
5	Iron(mg)	18.81 ±2.38	17	0.76	18.61 ±2.07	21	1.12
6	Vitamin-C(µg)	18.6 ±2.24	18.6	9.5*	19.2 ±2.64	40	7.9*

*Significant at 5% level

Table 4 shows the information on comparisons of average nutrient intake by the male and female rag pickers with RDA value of Indian Council of Medical Research (ICMR). It was found that mean actual nutrient intake of male rag pickers was less than RDA for all nutrient except the mean actual intake of iron i.e., 3158.51 kcal ± 6.4, 51.57 g ± 1.84, 23.28 g ± 2.08, 252 g ± 1.68 & vitamin-c 18.6 mg ± 2.24 respectively. Iron intake was found excess i.e., 100 per cent. The percentage of nutrient adequacy was more for protein 85.28 per cent and calorie 80.16 per cent. However, the percentage of adequacy for fat, calcium and vitamin-c varied from 42 per cent to 58.2 per cent respectively. Statistically protein, iron and vitamin-c consumption of respondents in comparisons to RDA found to be insignificant in this study whereas calorie, fat and calcium consumption in comparisons to RDA were found to be statistically significant. Similar findings were also observed by A. Sarkar et al.⁴

It was found that mean actual nutrient intake of female rag pickers was less than RDA for all nutrient i.e., 2258.01 kcal ± 5.31, 49.2 g ± 2.5, 17.42 g ± 1.99, 253 g ± 1.91, 18.61 g ± 2.07 and 19.2 mg ± 2.64 for calorie, protein, fat, calcium, iron and vitamin-c respectively. The percentage of nutrient adequacy was more for protein 89.45 per cent, iron 88.62 per cent and calorie 79.22 per cent. However, the percentage of adequacy for fat, calcium and vitamin-c varied from 42.1 per cent to 58.07 per cent respectively. Statistically calorie and calcium consumption of respondents in comparisons to RDA found to be significant in this study whereas protein, fat iron and vitamin-c consumption in comparisons to RDA were found to be statistically insignificant. Similar findings were also observed by A. Sarkar et al.⁴

Table 5
Distribution of BMI with Macro and Micro Nutrient Intake by Rag Pickers

BMI	Gender		Calorie (kcal)	Protein (gm)	Fat (gm)	Calcium (mg)	Iron (mg)	Vitamin-c (µg)
Undernutrition (<18.5) (73)	Male	RDA	3940	60	40	600	17	40
		mean	3159.72	51.21	17.3	252.36	18.66	18.76
		SD	6.16	1.96	1.94	1.7	2.24	2.36
z - value		126.66	4.48**	11.70**	204.49**	0.74	9.0	
Normal (18.5-24.9)	mean	3158.13	51.16	17.29	251.99	19.36	18.19	
	SD	7.29	1.37	2.56	1.59	2.83	1.8	

(30)		z - value	107.25*	6.45*	8.87*	218.8*	0.83	12.11*
Undernutrition (<18.5) (75)	Female	RDA	2850	55	30	600	21	40
		Mean	2250.33	49.46	17.32	252	18.52	19.22
		SD	5.21	2.42	2.05	1.91	1.87	2.63
		Z-Value	113.75*	2.28*	6.18*	181.92*	1.32	7.90*
Normal (18.5-24.9) (30)		Mean	2258.23	48.57	17.68	252.43	18.84	19.28
		SD	5.90	2.62	1.84	1.95	2.53	2.73
		Z-Value	100.3*	2.45*	6.69*	178.24*	0.85	7.58

*Significant at 5% level

Table 5 depicts the information related to distribution of BMI with macro & micro nutrient intake by rag pickers (Both male and female)

Underweight BMI with Nutrient Intake of Male Rag Pickers

Table 5 shows the information on comparisons of statements underweight BMI and average nutrient intake by the male rag pickers with RDA value of Indian Council of medical research (ICMR). It was found that mean actual nutrient intake of male rag pickers in underweight BMI categories was less than RDA for all nutrient intake i.e., 3159.72kcal/d \pm 6.16, 51.21g/d \pm 1.96, 17.3g/d \pm 1.94, 252.36g/d \pm 1.7 & vitamin-c 18.76 mg/d \pm 2.36 respectively while iron intake was found excess i.e., 109.76 per cent. The percentage of nutrient adequacy was more for protein (85.35%) and calorie (80.15%). However, the percentage of adequacy for fat, calcium and vitamin-c varied from 42.06 per cent to 46.9 per cent respectively. Statistically protein, fat, iron and vitamin-c consumption of respondents in comparisons to RDA found to be insignificant in this study whereas calorie and calcium consumption in comparisons to RDA were found to be statistically significant. Similar findings were also observed by Sarkar et.al.⁴

Normal BMI with Nutrient Intake of Male Rag Pickers

Table 5 shows the information on comparisons of normal BMI with average nutrient intake by the male rag pickers with RDA value of Indian Council of medical research (ICMR). It was found that mean actual nutrient intake of male rag pickers in normal BMI categories was less than RDA for all nutrient i.e., 3158.72kcal/d \pm 7.29, 51.16g/d \pm 1.37, 17.29g/d \pm 2.56, 251.99g/d \pm 1.59 and vitamin-c 18.19 mg/d \pm 1.8 respectively. Iron intake was found excess i.e., 100 per cent. The percentage of nutrient adequacy was more for protein 85.35 per cent followed by calorie 80.19 per cent and vitamin-c i.e. 46.9 per cent. However, the percentage of adequacy for fat and calcium was 42.06 per cent and 46.9 per cent.

Statistically protein, fat, iron and vitamin-c consumption of respondents in comparisons to RDA found to be insignificant in this study whereas calorie and calcium consumption in comparisons to RDA were found to be Statistically significant. Similar findings were also observed by A. Sarkar et.al.⁴

This it can be inferred that the mean intake of nutrients in case of both underweight and normal BMI of male respondents was not noticeable but inadequate food intake between them in comparisons to RDA was observed in this study.

Underweight BMI with Nutrient Intake of Female Rag Pickers

Table 5 shows the information on actual mean nutrient intake of the female rag pickers having underweight BMI in comparisons with RDA value of Indian Council of medical research (ICMR). It was found that mean actual nutrients intake of female rag pickers was less than RDA for all nutrient i.e 2257.33 kcal/d \pm 5.21, 49.46g /d \pm 2.42, 17.32 g/d \pm 2.05, 252.52g/d \pm 1.91,18.52g/d \pm 1.87 and 19.22mg \pm 2.63 for calorie, protein, fat, calcium, iron and vitamin-c respectively. The percentage of nutrient adequacy was more for protein 89.92 per cent followed by iron 88.99 per cent and calorie 79.21 per cent. However, the percentage of adequacy for fat, calcium and vitamin-c varied from 42.08 per cent to 57.73 per cent respectively. Statistically actual mean calorie and calcium consumption of respondents in comparisons to RDA was found to be significant in this study whereas protein, fat iron and vitamin-c consumption in comparisons to RDA was found to be statistically insignificant. Similar findings were also observed by Sarkar et.al⁴

Normal BMI with Nutrient Intake of Female Rag Pickers

Table 5 shows the information on actual mean nutrient intake of the female rag pickers having normal BMI in comparisons with RDA value of Indian Council of medical research (ICMR). It was found that mean actual nutrient intake of female rag pickers was less than RDA for all nutrients i.e., 2258.23kcal/d \pm 5.90, 48.57g/d \pm 2.62, 17.68g/d \pm 1.84, 252.43g/d \pm 1.95, 18.84g/d \pm 2.53 and 19.28mg \pm 2.73 for calorie, protein, fat, calcium, iron and vitamin-c respectively. The percentage of nutrient adequacy was more for iron 89.71 per cent followed by protein 88.99 per cent and calorie 79.23 per cent. However, the percentage of adequacy for fat, calcium and vitamin-c were varied from 42.07 per cent to 578.93 per cent respectively. Statistically calorie and calcium consumption of respondents in comparisons to RDA found to be significant in this study whereas protein, fat iron and vitamin-c consumption in comparisons to RDA were found to be statistically insignificant. Similar findings were also observed by Sarkar et.al.⁴

Interpretation of BMI with Macro and Micro Nutrient Intake by Male Rag Pickers

Protein, fat, and carbohydrate are the three main macronutrients. Our bodies receive quick energy from carbs. Amino acids, which are found in protein, are crucial for the synthesis of muscle, skin, blood, and significant brain and nervous system components. Additionally, fat is essential for the growth of the brain, insulation, energy reserves, cell function, and organ protection. Micronutrient deficiency (Hidden hunger) is caused by Iron, iodine, zinc, folate, and vitamin A deficiencies are classified as “Generalized Global Micronutrient Deficiencies.” According to FAO, 40.6 per cent of the population (268 million people) would endure moderate or severe food insecurity in 2021, a 1.1 per cent rise over 2020.

It has been determined that food insecurity is linked to micronutrient imbalance. Food insecurity is a public health issue since it affects a diverse range of people. It is distinguished by food insecurity, a lack of basic nutrients, a lack of nutritional education, inadequate storage conditions, poor absorption, and poor overall nutrition.

Result of present study revealed that the actual mean nutrient intake of the both male & female rag pickers were deficient for calorie, protein, fat, calcium and vitamin-c in comparisons to RDA

except iron intake in case of male rag pickers. Thus, it can be Inferred from this result that deficient food in intake ultimately lead to deficient nutrient intake

Relationship of Certain Parameters with BMI

In the table 6 below, key factors including working hours, meal frequency, height, weight, calcium, iron, and vitamin C were taken into account along with Body Mass Index (BMI) to determine their association.

It was observed from the Table 6 that the different parameters such as working time, frequency of meal has a direct effect on the BMI but found statistically insignificant. The working time and frequency of meal per day are found having positive and significant relationship with the BMI. It indicates that the working time and food consumed by the rag-pickers has a significant positive impact on their stamina to work and stamina is often influenced by the BMI. The height is negative and significantly related to BMI. It implies that more the height less the BMI. It implies that if height is not matching with the weight, then it may have adverse effect on BMI. The weight is found positive and significantly related to BMI. It indicates more the weight higher will be BMI. It implies that healthy figure with standard of a person is required for good BMI. The iron has a positive and significant impact on the BMI. It indicates that the consumption of iron through food or otherwise will add to the BMI. It can be inferred from the above analysis that even though the BMI depends more on the Trait of a persons there are also other factors influencing the BMI. However, the income is again directly or indirectly a constraint in maintain a good or standard physic which is reflected in BMI.

Table 6
Relationship of Certain Parameters with the BMI
(Dependent Variable: BMI)

Parameters	Coefficients	P-value
Intercept	34.59787 *	3.18E-17
D ₁	0.05011	0.389852
Working Time	0.018459 **	0.093497
Frequency of meal	0.094427 **	0.080693
Height	-19.9938 *	2.2E-145
weight	0.35137 *	6.2E-128
calcium	-0.00557	0.704007
Iron	0.025107 *	0.043577
Vitamin c	-0.00273	0.797568
R ²	0.921254	
F	636.5942	

Note: * indicates the level of significance and 5% level is taken as threshold level here

** indicates the level of significance at 10%

Conclusion

The biggest health issues include low body mass index (BMI) and high levels of undernutrition (based on BMI), especially among adults who work as rubbish pickers in rural areas of developing countries. Due to their severe workloads, heavy workers who lack essential nutrients risk developing non-communicable diseases including diabetes, lung issues, skin issues, anemia,

and other non-communicable diseases. The current study focused on the adult male and female rag pickers' nutritional condition and found that rag pickers needed to execute balanced meals and nutrition programmes effectively. It is suggested that they include less expensive nutritious food products in their diet to maintain good physical and mental health. Health and nutrition studies should be prioritized for future study to improve the quality of life of rag pickers.

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