



ASSESSMENT OF NUTRITIONAL STATUS, DIETARY INTAKE, AND IMPACT OF A TARGETED NUTRITION INTERVENTION AMONG TRIBAL ADOLESCENT GIRLS IN YAVATMAL DISTRICT

Nutritional Science

Snehal paul*

Department of Home Science, Matoshree Vimalabai Deshmukh College, Amravati, 444603, India. *Corresponding Author

Prof Dr. Sharmila Kubde

Department of Home Science, Matoshree Vimalabai Deshmukh College, Amravati, 444603, India.

ABSTRACT

Adolescence is a pivotal developmental phase marked by rapid physical growth and increased physiological demands, making nutritional adequacy critical for adolescent girls. In socioeconomically disadvantaged tribal regions, undernutrition and micronutrient deficiencies remain widespread. To evaluate the baseline anthropometric status, dietary nutrient intake, and baseline nutrition knowledge of tribal adolescent girls, and to determine the effectiveness of a structured educational intervention on their nutritional knowledge. A quasi-experimental one-group pre-test and post-test study was conducted among 1,000 tribal adolescent girls aged 10–15 years enrolled across 21 government Ashram schools in Yavatmal district, Maharashtra. Data were collected using standardized anthropometric procedures (height, weight, and Body Mass Index), a 24-hour dietary recall schedule compared against ICMR-NIN (2020) Recommended Dietary Allowances (RDA), and a validated 15-item nutrition knowledge questionnaire before and after a targeted educational intervention. The mean height, weight, and BMI of participants were 149.55 ± 4.04 cm, 36.09 ± 4.84 kg, and 16.11 ± 1.73 kg/m², respectively. Overall, 45.9% of the girls were classified as underweight (BMI < 18.5 kg/m²), while 54.1% were in the healthy weight range (18.5–23 kg/m²), with 0% overweight or obese. The 24-hour dietary recall revealed significant micronutrient shortfalls: mean daily calcium intake was 603.65 ± 70.40 mg (60.4% of RDA; $p < 0.001$), daily iron intake was 26.03 ± 4.11 mg (94.7% of RDA; $p < 0.001$), and total caloric intake was 2128.29 ± 217.37 kcal (96.7% of RDA; $p < 0.001$). The educational intervention significantly improved mean nutrition knowledge scores from 5.67 ± 2.53 (37.8%) at pre-test to 11.77 ± 2.12 (78.5%) at post-test ($t = 56.35$, $p < 0.001$, Cohen's $d = 1.782$). Tribal adolescent girls in Yavatmal district present high rates of undernutrition and imbalanced dietary intake characterized by severe calcium and mild iron deficits. Structured, school-based nutrition education is highly effective in increasing nutritional literacy, though sustainable health outcomes require parallel food enrichment and infrastructure improvements.

KEYWORDS

Tribal Health, Menstrual Health, Nutritional In Adolescence.

INTRODUCTION

Adolescence represents a critical window of development linking childhood to adulthood. During this phase, females undergo substantial pubertal growth spurts, changes in body composition, and the onset of menarche, all of which substantially elevate daily energy and micronutrient requirements [1,2]. In adequate dietary intake during this period impairs growth velocity, reduces bone mass accumulation, and increases vulnerability to iron-deficiency anemia and reproductive health complications [3,4]. In India, tribal populations face compounded socioeconomic vulnerabilities, including geographic isolation, agrarian reliance, limited parental literacy, and poor access to health infrastructure. Tribal adolescent girls in regions such as Yavatmal district, Vidarbha, Maharashtra, constitute a particularly marginalized group. While primary studies often explore general adolescent reproductive hygiene, the nutritional status and dietary patterns of tribal schoolgirls remain less documented [5,6,7]. This study specifically investigates the nutritional status, baseline dietary intake, and nutritional literacy of tribal adolescent girls studying in government residential (Ashram) schools in Yavatmal district. Furthermore, it measures the impact of a structured nutrition awareness program on improving their nutrition-related knowledge.

Methodology

Research Design and Setting

The study employed a quasi-experimental one-group pre-test and post-test design. It was conducted across 21 government Ashram schools situated in 10 administrative blocks (Pusad, Digra, Umarkhed, Ghatanji, Kelapur, Zari-Jamni, Maregaon, Ralegaon, Kalamb, and Yavatmal) within Yavatmal district, Maharashtra.

Sample and Selection Criteria

Purposive sampling was utilized to recruit 1,000 tribal adolescent girls [cite: 1]. The inclusion criteria strictly required respondents to: Be aged between 10 and 15 years. Belong to scheduled tribal communities. Have attained menarche (started menstruating). Be enrolled in the selected government Ashram schools

Data Collection Instruments

Anthropometric Measurements: Standardized techniques were utilized. Height was recorded to the nearest 0.1 cm using a calibrated stadiometer, and weight was recorded to the nearest 0.1 kg on a calibrated digital weighing scale. Body Mass Index (BMI) was computed using the standard formula:

$$\square\square\square = \frac{\square\square\square\square\square(\square\square)}{[\square\square\square\square\square(\square)]^2}$$

Participants were categorized based on age- and sex-specific adolescent growth standards into Underweight (BMI < 18.5), Healthy Weight (18.5–23), Overweight (23–25), and Obese (>25).

24-Hour Dietary Recall: Daily dietary intake was recorded through a structured 24-hour dietary recall schedule. Quantities of consumed foods were converted into nutrient values (calories, carbohydrates, protein, fat, calcium, iron, vitamin C, folate, and sodium) and compared against ICMR-NIN (2020) Recommended Dietary Allowances (RDA) for adolescent girls aged 10–15 years.

Nutrition Knowledge Questionnaire: A validated 15-item multiple-choice questionnaire (I-CVI = 0.83, S-CVI/Ave = 0.93, Cronbach's $\alpha = 0.751$ pre-test / 0.721 post-test) assessed concepts including balanced diets, macronutrients, iron/anaemia prevention, calcium, protein, and dietary management during menstruation. Each correct item received 1 point (Maximum Score = 15).

Educational Intervention

Following the baseline pre-test, participants underwent a standardized nutrition module utilizing visual charts, posters, pictorial handouts, interactive lectures, and food-group demonstrations emphasizing local iron- and calcium-rich foods. Post-intervention evaluations were administered after the implementation period.

Statistical Analysis

Data were analyzed using descriptive statistics (frequencies, percentages, means, standard deviations) and inferential tests:

One-sample t-tests compared observed nutrient intakes against ICMR-NIN RDA benchmark values.

Paired t-tests and Wilcoxon signed-rank tests evaluated changes between pre-test and post-test nutrition knowledge scores.

Pearson correlation coefficients analyzed relationships between BMI, age, and socioeconomic factors.

Effect sizes were quantified using Cohen's d .

RESULTS AND DISCUSSION

Socio-Demographic and Environmental Profile

The demographic profile confirmed a rural, socioeconomically constrained sample:

Age Distribution: 46.3% (n=463) were 15 years old, 26.0% (n=260) were 14 years, 18.3% (n=183) were 13 years, and 9.4% (n=94) were 10–12 years old.

Residence & Occupation: 92.5% resided in rural areas. Agriculture was the predominant household occupation (83.5% of fathers and 67.1% of mothers were farmers).

Parental Education: 42.2% of fathers and 54.4% of mothers had completed less than secondary education (below SSC).

Sanitation Facilities: 36.6% of households lacked any toilet facility, 10.7% utilized community toilets, 48.2% owned pit latrines, and only 4.5% had flush toilets (Z=28.04,p<0.001 against a 10% low-prevalence benchmark).

Anthropometric Status

The mean anthropometric values of the 1,000 tribal adolescent girls were as follows:

Based on BMI classifications:

- Underweight (BMI<18.5): 45.9% (n=459)
- Healthy Weight (BMI18.5-23): 54.1% (n=541).
- Overweight / Obese: 0.0% (n=0).

A significant positive correlation was observed between BMI and age (r=0.373,p<0.001), as well as between BMI and age at menarche (r=0.212,p<0.001). Family income showed no statistically significant correlation with BMI (r=0.060,p=0.057). The observed 45.9% underweight prevalence was significantly higher than the national adolescent benchmark of 25% (Z=15.26,p<0.001), underscoring chronic, widespread physical undernutrition among tribal girls in this district.

Dietary Nutrient Intake vs. ICMR-NIN (2020) RDA

Nutrient intake data derived from the 24-hour dietary recall were evaluated against ICMR-NIN (2020) reference standards for adolescent females aged 10–15 years:

Nutrient	Observed Mean ± SD	ICMR-NIN (2020) RDA	% of RDA Achieved	One-Sample t-test (p-value)
Calories (kcal)			96.7%	
Carbohydrates (g)			288.5%	
Protein (g)			182.8%	
Fat (g)			142.0%	
Calcium (mg)			60.4%	
Iron (mg)			94.7%	
Vitamin C (mg)			154.1%	
Folic Acid (mg)			392.5%	
Sodium (mg)			169.4%	

The dietary assessment reveals an imbalanced dietary structure rather than uniform malnutrition. While protein (182.8%), carbohydrates (288.5%), and fat (142.0%) met or exceeded recommendations, essential bone-forming and blood-building minerals were significantly deficient. Calcium intake was severely deficient, fulfilling only 60.4% of daily requirements (603.65mg vs. 1000mg RDA). Iron intake was slightly below RDA (94.7%; 26.03mg vs. 27.5mg RDA), which, coupled with ongoing menstrual blood loss, presents a high risk for iron-deficiency anemia.

Age-stratified intake demonstrated that mean calorie, iron, protein, and calcium intakes increased progressively from 10 to 15 years. However, even among 15-year-olds, mean calcium intake (675.34mg) remained far below the 1000mg daily requirement.

Impact of Educational Intervention on Nutrition Knowledge

Evaluation of the 15-item nutrition knowledge scale demonstrated marked improvements across all topic areas following the intervention:

Nutrition Topic Item	Pre-Test Correct (%)	Post-Test Correct (%)	Absolute Gain (%)
Balanced Diet Concept	7.7%	61.4%	+53.7%
Iron Prevents Anaemia	12.4%	74.6%	+62.2%
Iron-rich Food Source (Spinach)	51.3%	83.6%	+32.3%
Calcium Function (Bones & Teeth)	53.2%	79.2%	+26.0%
Protein Source (Pulses/Legumes)	29.6%	78.8%	+49.2%
Adolescent Nutritional Needs	11.4%	70.5%	+59.1%
Energy Foods (Carbohydrates)	14.9%	61.9%	+47.0%
Tissue Building (Protein)	54.1%	80.9%	+26.8%
Diet During Menstruation	10.1%	65.1%	+55.0%
Hydration During Menstruation	46.9%	89.3%	+42.4%
Healthy Foods (Fruits/Vegetables)	88.1%	96.2%	+8.1%
Recommended Meal Frequency (Meals)	7.9%	80.5%	+72.6%
Vitamin C for Iron Absorption	27.0%	60.7%	+33.7%
Healthy Beverage Choice	80.5%	97.9%	+17.4%
Benefits of Fruits & Vegetables	71.6%	96.7%	+25.1%

Overall, the mean composite nutrition knowledge score increased from 5.67±2.53 (37.8%) at baseline to 11.77±2.12 (78.5%) post-intervention. Paired inferential testing confirmed that this gain was statistically significant (t=56.35,p<0.001; Wilcoxon W=0.0,p<0.001). The intervention yielded a Cohen's d effect size of 1.782, indicating a very large practical improvement in nutritional literacy.

Conclusion and Recommendations

Conclusion

This study demonstrates that tribal adolescent girls in Yavatmal district experience substantial nutritional vulnerabilities, characterized by a 45.9% underweight prevalence and severe dietary deficits in calcium (60.4% of RDA) and iron (94.7% of RDA). Baseline nutritional knowledge was inadequate (37.8%). The implementation of a structured, culturally tailored nutrition awareness program produced significant improvements in nutritional literacy, nearly doubling knowledge scores (78.5%, p<0.001, Cohen's d=1.782).

Recommendations

Institutional Food Fortification: Government Ashram school meal programs should intentionally incorporate locally available, low-cost calcium- and iron-rich foods (such as ragi, sesame seeds, amaranth, green leafy vegetables, jaggery, and dairy products) to bridge dietary gaps. **Curricular Integration:** Nutrition and health education should be formally embedded into government tribal school curricula prior to menarche and sustained throughout secondary schooling.

Synergistic Infrastructure Support: Educational campaigns must be supported by structural upgrades, including the provision of safe drinking water, private sanitation, and regular iron-folic acid (IFA) supplementation.

REFERENCES

- Daniel, et al. (2023). Prevalence of anaemia in adolescent girls in India: A systematic review and meta-analysis .
- ICMR-NIN. (2020/2024). Nutrient Requirements for Indians and Recommended Dietary Allowances. Indian Council of Medical Research - National Institute of Nutrition.
- Kumar, et al. (2023). Undernutrition and anaemia among Indian adolescents: The role of socioeconomic conditions, dietary diversity, and hygiene practices .
- Priyadarshini, et al. (2023). Nutritional knowledge, attitude, and practices among adolescent girls in tribal districts.
- Shridhar, et al. (2017). Nutritional status of tribal adolescent girls using anthropometric measurements and haemoglobin estimation .
- Spetz, et al. (2019). The relationship between hormones, nutrition, and health during adolescence .
- World Health Organization (WHO). (2018/2020). Nutritional Requirements and Physiological Changes During Adolescence .