

Knowledge of school teachers in recognition of early Signs of selected nutritional deficiencies among Children aged 5-14 years

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Abstract:

Nutritional deficiencies remain an important public health concern among school-aged children and can adversely affect physical growth, cognitive development, learning ability, academic performance, and overall health. Since children spend a substantial proportion of their daily lives in school, teachers are strategically positioned to observe changes in their physical appearance, behaviour, activity, and academic functioning. Adequate knowledge among schoolteachers regarding the early signs of common nutritional deficiencies may therefore facilitate timely identification, referral, and appropriate intervention. The study aimed to assess the knowledge of schoolteachers regarding the recognition of early signs of selected nutritional deficiencies among children aged 5–14 years and to determine the association between teachers' knowledge scores and selected demographic variables. A descriptive, non-experimental research design was adopted. The study was conducted among 100 schoolteachers working in selected schools at Kolar, Karnataka. Participants were selected using a convenience sampling technique. Data were collected using a structured knowledge questionnaire consisting of 40 items covering general concepts of nutritional deficiencies, protein-energy malnutrition, vitamin A deficiency, anaemia, and iodine deficiency disorders. Descriptive and inferential statistics were used for data analysis. The overall mean knowledge score of the schoolteachers was 25.55 out of a maximum possible score of 40, corresponding to a mean percentage of 63.87%, with a standard deviation of 3.276. Most participants (84%) had a moderate level of knowledge, whereas 16% demonstrated adequate knowledge; none were classified as having inadequate knowledge. Among the assessed domains, the highest mean percentage score was observed for iodine deficiency (71.12%), followed by general concepts (70.00%), anaemia (69.00%), and protein-energy malnutrition (64.54%). The lowest knowledge score was observed for vitamin A deficiency (49.44%). A statistically significant association was identified between knowledge scores and age ($p = 0.044$), place of residence ($p = 0.015$), educational qualification ($p = 0.018$), and monthly income ($p = 0.028$). No significant association was observed with gender, religion, marital status, number of children, family type, dietary pattern, professional experience, previous information, or source of information. The findings indicate that the majority of schoolteachers possessed a moderate level of knowledge regarding the recognition of early signs of selected nutritional deficiencies among school-aged children. The comparatively lower knowledge regarding vitamin A deficiency highlights an important educational gap. Structured educational initiatives and appropriate informational resources may strengthen teachers' ability to recognize early warning signs and facilitate timely referral of children requiring further nutritional and health assessment.

Keywords:

School teachers; Nutritional deficiencies; School children; Early recognition; Protein-energy malnutrition; Vitamin A deficiency; Anaemia; Iodine deficiency; Knowledge assessment.

1. Introduction:

Adequate nutrition is fundamental to the healthy growth, development, and overall well-being of children.

School age represents an important period of continued physical growth, cognitive development, and establishment of dietary behaviours that may influence health throughout life. Appropriate nutrition during middle childhood and adolescence supports the development of the body and brain and contributes to educational achievement and cognitive functioning (UNICEF, 2025). In contrast, inadequate intake or utilization of essential nutrients may result in nutritional deficiencies that adversely affect physical growth, immunity, learning capacity, and general health.

Nutritional deficiencies occur when the intake, absorption, or utilization of essential nutrients is insufficient to meet physiological requirements. Micronutrient deficiencies, particularly deficiencies of iron, vitamin A, and iodine, remain important nutritional concerns globally and disproportionately affect children and other vulnerable population groups (World Health Organization, 2025). In addition, inadequate intake of energy and protein may contribute to protein-energy malnutrition, which can impair normal growth and development. Micronutrients are essential for multiple physiological functions, and deficiencies during childhood may have consequences for physical and functional development (Berger et al., 2024).

Among the major nutritional problems affecting children, protein-energy malnutrition, vitamin A deficiency, nutritional anaemia, and iodine deficiency disorders are of particular public health importance. Protein-energy malnutrition may manifest through poor growth, underweight, muscle wasting, changes in hair and skin, and, in severe cases, oedema. Vitamin A deficiency may initially present with impaired dark adaptation and can progress to characteristic ocular manifestations. Iron deficiency and anaemia may be associated with pallor, fatigue, weakness, reduced attention, and impaired learning, while iodine deficiency can adversely affect thyroid function, growth, and neurodevelopment. These conditions may develop gradually, making early recognition particularly important.

School-aged children spend a considerable proportion of their daily lives within the school environment. Consequently, schools provide an important setting for health promotion, nutrition education, and early identification of health-related concerns. Teachers interact with children regularly and may be among the first adults outside the family to observe persistent changes in a child's physical appearance, activity level, behaviour, classroom participation, or academic performance. Their knowledge and awareness may therefore contribute to the early recognition of possible nutritional problems and timely referral of affected children for appropriate health assessment.

The ability of teachers to contribute effectively to school-based nutrition and health promotion depends partly on their level of knowledge. Previous research has demonstrated that nutrition education provided to teachers can improve their nutrition-related knowledge and may positively influence their role in school nutrition education (Elmas et al., 2020). However, teachers may differ considerably in their understanding of specific nutritional deficiencies and their early manifestations. Identifying these knowledge gaps is important for designing targeted educational interventions and practical informational resources.

Early recognition of nutritional deficiencies is particularly relevant because visible or behavioural signs may appear before a condition is formally diagnosed or before severe complications develop. Teachers are not expected to diagnose nutritional disorders; however, awareness of warning signs may enable them to identify children who require further evaluation by parents, school health personnel, or healthcare professionals. Strengthening teachers' knowledge may therefore support a broader school-health approach involving observation, health education, appropriate referral, and collaboration between schools, families, and health services.

Against this background, the present study was undertaken to assess the knowledge of school teachers regarding the recognition of early signs of selected nutritional deficiencies—namely protein-energy malnutrition, vitamin A deficiency, anaemia, and iodine deficiency disorders—among children aged 5–14 years in selected schools at Kolar, Karnataka. The study also examined the association between teachers' knowledge scores and selected demographic variables. The findings were intended to identify areas of adequate knowledge as well as important knowledge gaps and to support the development of an information booklet for schoolteachers.

1.1. Objectives of the study:

1. To assess the knowledge of schoolteachers regarding the recognition of early signs of selected nutritional deficiencies among children aged 5–14 years.
2. To determine the association between the knowledge scores of schoolteachers and selected demographic variables.
3. To develop an information booklet on the recognition of early signs of selected nutritional deficiencies among school-aged children.

2. Materials and methods:

2.1. Research approach:

The present study adopted a quantitative descriptive survey approach to assess the knowledge of schoolteachers regarding the recognition of early signs of selected nutritional deficiencies among children aged 5–14 years. A descriptive approach was considered appropriate because the primary purpose of the study was to systematically assess and describe the existing level of knowledge among schoolteachers without introducing or manipulating any intervention during the assessment phase.

The study focused on the existing knowledge of teachers concerning selected nutritional deficiencies that may occur among school-aged children. These included protein-energy malnutrition, vitamin A deficiency, anaemia, and iodine deficiency disorders. The descriptive survey approach enabled the investigator to collect standardized information from a defined group of schoolteachers and to quantify their knowledge using a structured knowledge questionnaire.

In addition to determining the overall level of knowledge, the study examined knowledge across specific nutritional-deficiency domains. The approach also enabled the investigator to explore whether differences in knowledge scores were associated with selected demographic characteristics of the participating schoolteachers.

2.2. Research design:

A non-experimental descriptive research design was used for the study. The design was selected because the investigator intended to assess the existing knowledge of schoolteachers regarding the recognition of early signs of selected nutritional deficiencies without manipulating the study environment or exposing participants to an experimental intervention.

The study was therefore observational in nature. Information was collected from participants at the time of assessment using a structured questionnaire. The principal outcome of interest was the knowledge score obtained by each schoolteacher regarding the early recognition of selected nutritional deficiencies among children aged 5–14 years.

The research design also included an assessment of the relationship between the participants' knowledge scores and selected demographic variables. The findings obtained through the descriptive assessment were subsequently used to identify areas of relatively adequate knowledge and areas requiring further educational support. Based on the identified educational needs, an information booklet was developed for schoolteachers.

2.3. Study setting:

The study was conducted in selected schools located in Kolar, Karnataka, India. The setting was selected on the basis of geographical proximity, feasibility, familiarity with the study area, and accessibility for conducting the data-collection process.

Schools represent an appropriate setting for the assessment of teachers' knowledge regarding nutritional deficiencies because teachers have regular interaction with children during the school years. The study setting therefore provided direct access to the target population of schoolteachers who were involved in the education and routine observation of children within the specified age group.

Before conducting the study, the investigator obtained the necessary permission from the concerned authorities. Data collection was carried out within the selected school settings while maintaining the routine functioning of the institutions as far as possible.

2.4. Study population:

The target population of the study comprised **schoolteachers working in selected schools at Kolar**. The study specifically focused on schoolteachers because they regularly interact with school-aged children and may have opportunities to observe visible or behavioural changes that could indicate possible nutritional problems.

The accessible population consisted of teachers who were available in the selected schools during the period of data collection and who met the predetermined eligibility criteria of the study.

2.5. Sample and sample size:

The sample consisted of **100 schoolteachers** working in selected schools at Kolar. These participants constituted the sample for the main study and provided the data used for the assessment of knowledge and analysis of associations with selected demographic variables.

The sample included teachers with different demographic and professional characteristics, including variations

in age, gender, educational qualification, professional experience, place of residence, family characteristics, dietary pattern, previous exposure to information regarding nutritional deficiencies, and sources of such information.

A total sample size of 100 participants was used for the final analysis. Each participant completed the structured knowledge questionnaire according to the established data-collection procedure.

2.6. Sampling technique:

A non-probability convenience sampling technique was used to select the participants. School teachers who met the eligibility criteria, were available during the data-collection period, and expressed willingness to participate were included until the required sample size of 100 participants was achieved.

The use of convenience sampling facilitated recruitment of eligible participants from the selected schools within the available study period and setting. Since the study was descriptive and conducted within selected educational institutions, this technique enabled the investigator to obtain data from accessible members of the target population.

2.7. Eligibility criteria:

Predetermined inclusion and exclusion criteria were applied to identify eligible participants and maintain consistency in participant selection.

- **Inclusion Criteria**

School teachers were included in the study if they:

1. we're working in the selected schools during the study period.
2. were available at the time of data collection; and
3. we're willing to participate in the study.

- **Exclusion Criteria**

School teachers were excluded if they had already undergone an in-service educational programme specifically related to the recognition of early signs of selected nutritional deficiencies. This criterion was applied because previous formal training on the study topic could potentially influence the baseline knowledge assessed through the questionnaire.

Study Variables

The principal study variable was the knowledge of schoolteachers regarding the recognition of early signs of selected nutritional deficiencies among children aged 5–14 years. Knowledge was assessed using the structured knowledge questionnaire developed for the study.

Selected demographic variables were also collected to describe the characteristics of the participants and to examine their association with knowledge scores. These variables included age, gender, religion, marital status, number of children, place of residence, educational qualification, professional experience, monthly income, type of family, dietary pattern, previous information regarding nutritional deficiencies, and source of information.

The analysis of these variables enabled the investigator to determine whether the distribution of knowledge scores differed significantly according to selected participant characteristics.

2.8. Selection and development of the data-collection tool:

The data-collection instrument was developed specifically to assess the knowledge of schoolteachers regarding the recognition of early signs of selected nutritional deficiencies among children. Development of the tool was undertaken after an extensive review of relevant literature and consultation with experts from the fields of community health nursing, paediatric nursing, nutrition, and dietetics.

The initial version of the structured knowledge questionnaire consisted of 48 knowledge items. The items were designed to assess different aspects of teachers' knowledge regarding nutritional deficiencies and their early manifestations among children.

The initial questionnaire was subjected to expert evaluation and further refinement. Based on expert opinion, selected items were modified, deleted, or added. Item analysis was also undertaken, and certain items were simplified or modified to improve their suitability and clarity. Following this process, the final structured knowledge questionnaire consisted of **40 knowledge items**.

The final instrument was designed to provide both an overall measure of knowledge and domain-specific information regarding teachers' understanding of the selected nutritional deficiencies.

2.9. Description of the data-collection instrument:

The structured knowledge questionnaire consisted of **two major parts**.

Part I: Demographic Characteristics

The first part of the questionnaire collected information regarding the demographic and background characteristics of the participants. The variables included:

- age.
- gender.
- religion.
- marital status.
- number of children.
- place of residence.
- educational qualification.
- professional experience.
- monthly income.
- type of family.
- dietary pattern.
- previous information regarding the recognition of nutritional deficiencies; and
- source of previous information.

These variables were used to describe the study sample and subsequently examine their association with participants' knowledge scores.

Part II: Structured Knowledge Questionnaire

The second part consisted of **40 knowledge items** related to the recognition of early signs of selected nutritional deficiencies among children aged 5–14 years.

The questionnaire assessed five major knowledge domains:

1. **General concepts of nutritional deficiencies** – 3 items.
2. **Protein-energy malnutrition** – 11 items.
3. **Vitamin A deficiency** – 9 items.
4. **Anaemia** – 9 items; and
5. **Iodine deficiency** – 8 items.

Together, these domains provided a structured assessment of both general and condition-specific knowledge regarding selected nutritional deficiencies.

2.10. Scoring Procedure and Interpretation of Knowledge Scores:

Each knowledge item had a predetermined correct response. A score of **1** was awarded for every correct answer, whereas a score of **0** was assigned for an incorrect answer. Since the final questionnaire consisted of 40 items, the maximum possible total knowledge score was **40**.

The individual scores obtained by the participants were calculated and interpreted according to the predetermined classification criteria:

- **Less than 50%:** Inadequate knowledge.
- **50–75%:** Moderate knowledge; and
- **Above 75%:** Adequate knowledge.

This classification was used to determine the overall distribution of participants according to their level of knowledge regarding the recognition of early signs of selected nutritional deficiencies.

In addition to the overall knowledge classification, domain-specific mean scores, mean percentages, and standard deviations were calculated. This allowed comparison of knowledge across the five assessed areas and facilitated identification of domains in which teachers demonstrated relatively higher or lower levels of knowledge.

2.11. Content validity of the instrument:

Content validity was established to determine whether the structured knowledge questionnaire adequately represented the content areas relevant to the recognition of early signs of selected nutritional deficiencies among children.

The developed questionnaire was submitted to **10 experts** from relevant professional fields, including community health nursing, paediatric nursing, nutrition, and dietetics. A criterion checklist was used to obtain expert opinions regarding the relevance and suitability of the items.

The experts reviewed the questionnaire and provided suggestions regarding the content, wording, relevance, and clarity of individual items. Based on their recommendations, selected questions were simplified and modified. Necessary changes were incorporated before preparation of the final version of the instrument.

Following expert review and item modification, the final structured knowledge questionnaire consisted of **40 items**. The final instrument was subsequently used for the pilot study and main data collection.

2.12. Reliability of the instrument:

Reliability of the structured knowledge questionnaire was assessed to determine the consistency of the instrument in measuring the intended knowledge construct.

The **split-half method** was used to establish the reliability of the questionnaire. The items were divided into two halves, and the relationship between the scores obtained from the two parts was assessed. The reliability coefficient was calculated using the **Karl Pearson correlation approach**.

The obtained reliability coefficient was $r = 0.72$. On the basis of this value, the structured knowledge questionnaire was considered sufficiently reliable for use in the present study.

3. Pilot study:

A pilot study was conducted before the main study to assess the feasibility of the research procedure and determine whether the proposed data-collection method could be implemented effectively in the selected setting.

The pilot study was conducted from **19 December 2012 to 26 December 2012** among **10 schoolteachers**. Participants were selected using the convenience sampling technique.

Before administering the questionnaire, the investigator introduced herself, explained the purpose of the study, and assessed the participants' willingness to take part. Participants were assured that the information provided by them would remain anonymous and confidential, and written informed consent was obtained.

The structured knowledge questionnaire was then administered to the participants. The pilot study provided an opportunity to evaluate the feasibility of participant recruitment, questionnaire administration, and the overall data-collection procedure.

The findings of the pilot study showed an overall mean percentage knowledge score of **64.25%**, with a standard deviation of **2.90**. The pilot study indicated that the study procedure and instrument were feasible for use in the main investigation.

4. Main data-collection procedure:

The main study was conducted from **5 January 2013 to 27 January 2013** among 100 schoolteachers working in selected schools at Kolar.

Before beginning data collection, formal permission was obtained from the concerned school authorities. Eligible teachers were approached according to the sampling procedure. The investigator introduced herself and explained the purpose and nature of the study to the potential participants.

Participation in the study was voluntary. The willingness of each participant to take part in the study was ascertained before administration of the questionnaire. Participants were assured that their responses would be treated confidentially and that anonymity would be maintained.

Written informed consent was obtained from the participants before data collection. The structured knowledge questionnaire was then administered to assess their knowledge regarding the recognition of early signs of selected nutritional deficiencies among children aged 5–14 years.

The completed questionnaires constituted the primary data source for the study. Responses were subsequently organized and prepared for statistical analysis.

4.1. Development of the information booklet:

An **information booklet** was developed as an educational resource for schoolteachers regarding the recognition of early signs of selected nutritional deficiencies among children.

The booklet was developed using information obtained from:

- review of relevant literature.
- discussions with subject experts.
- books and journals; and
- other relevant informational resources.

The content of the information booklet focused on the selected nutritional deficiencies assessed in the study, namely:

- protein-energy malnutrition.
- vitamin A deficiency.

- nutritional anaemia; and
- iodine deficiency disorders.

The booklet included information regarding the basic meaning of the selected nutritional deficiencies, their causes, early signs, and relevant management and preventive measures. The purpose of the booklet was to provide systematically organized and understandable information that could support schoolteachers in improving their awareness of common nutritional problems among children.

4.2. Content validation of the information booklet:

The initial draft of the information booklet was prepared by the investigator and submitted to **nine experts** from the fields of community health nursing and paediatric nursing.

The experts reviewed the content and provided suggestions regarding the relevance, organization, and suitability of the information presented. Minor modifications recommended by the experts were incorporated into the booklet. Following revision, the final version of the information booklet was prepared.

The booklet was intended to serve as a supportive educational resource based on the identified need to strengthen schoolteachers' knowledge regarding the early recognition of selected nutritional deficiencies.

4.3. Data management and statistical analysis:

After completion of data collection, the responses obtained from the participants were organized for analysis. A master data sheet was prepared to systematically record the responses and scores of all participants.

Both **descriptive and inferential statistics** were used to analyse and interpret the data in accordance with the objectives of the study.

Descriptive statistics were used to summarize the characteristics of the participants and their knowledge scores.

The demographic variables were presented using **frequencies and percentages**.

The overall and domain-specific knowledge findings were analysed using:

- frequency.
- percentage.
- mean.
- mean percentage; and
- standard deviation.

These measures were used to describe the distribution and central tendency of the participants' knowledge scores and to identify differences in knowledge across the assessed nutritional-deficiency domains.

Inferential statistical analysis was undertaken to examine the association between knowledge scores and selected demographic variables. The **chi-square test** was used for this purpose.

The demographic variables examined for association with knowledge scores included age, gender, religion, marital status, number of children, family type, place of residence, dietary pattern, educational qualification, monthly income, professional experience, previous information, and source of information.

A **p-value of less than 0.05 ($p < 0.05$)** was considered statistically significant.

4.4. Ethical considerations:

Ethical principles were considered throughout the conduct of the study. Formal permission was obtained from the concerned authorities before initiating data collection in the selected schools.

Potential participants were informed about the purpose of the study before their participation was requested. Their willingness to participate was ascertained, and **written informed consent** was obtained before administration of the structured knowledge questionnaire.

Participation was voluntary, and the information provided by the participants was treated confidentially. Anonymity and confidentiality were maintained during data collection and handling of the study information. The study involved assessment of knowledge through a structured questionnaire and did not involve manipulation of the participants or administration of an experimental intervention during the data-collection phase.

4.5. Methodological overview:

In summary, the study employed a quantitative descriptive survey approach and a non-experimental descriptive design to assess the knowledge of 100 schoolteachers regarding the recognition of early signs of selected nutritional deficiencies among children aged 5–14 years. Participants were selected from selected schools in Kolar using a convenience sampling technique.

Data were collected using a validated and reliable 40-item structured knowledge questionnaire covering

general concepts, protein-energy malnutrition, vitamin A deficiency, anaemia, and iodine deficiency. The instrument demonstrated a reliability coefficient of $r = 0.72$. A pilot study was conducted before the main investigation to establish the feasibility of the study procedure.

The collected data were analysed using descriptive statistics, including frequencies, percentages, means, mean percentages, and standard deviations. The chi-square test was used to examine associations between knowledge scores and selected demographic variables, with statistical significance established at $p < 0.05$. An information booklet was also developed and validated as an educational resource addressing the early recognition of selected nutritional deficiencies among school-aged children.

5. Results:

A total of **100 schoolteachers** participated in the study. The findings were analysed using descriptive and inferential statistics and are presented under three major areas: demographic characteristics of the participants, level and domain-wise distribution of knowledge regarding selected nutritional deficiencies, and association between knowledge scores and selected demographic variables.

5.1 demographic characteristics of the participants:

Among the 100 schoolteachers, the largest proportion (38%) were aged 21–30 years, followed by 26% aged 41–50 years, 19% aged 51 years or above, and 17% aged 31–40 years. Most participants were male (60%), married (82%), and residing in urban areas (62%). Regarding educational qualification, 36% had completed a Bachelor of Education (B. Ed) and another 36% had completed a Master of Education (M.Ed). More than half of the participants belonged to nuclear families (56%), while 85% reported following a mixed diet. Most teachers (80%) had previously received information regarding the recognition of early signs of malnutrition.

Table. 1: Demographic Characteristics of the Study Participants (N = 100)

Characteristic	Category	n	%
Age (years)	21–30	38	38.0
	31–40	17	17.0
	41–50	26	26.0
	≥51	19	19.0
Gender	Male	60	60.0
	Female	40	40.0
Religion	Hindu	42	42.0
	Muslim	23	23.0
	Christian	35	35.0
Marital status	Single	18	18.0
	Married	82	82.0
Number of children	One	40	40.0
	Two	41	41.0
	Three	19	19.0
Family type	Nuclear	56	56.0
	Joint	44	44.0
Place of residence	Rural	38	38.0
	Urban	62	62.0
Dietary pattern	Vegetarian	15	15.0
	Mixed	85	85.0
Educational qualification	D.Ed	18	18.0
	B.Ed	36	36.0
	M.Ed	36	36.0
	D.P.Ed	10	10.0
Monthly income (₹)	10,001–15,000	18	18.0
	15,001–20,000	17	17.0
	>20,000	65	65.0
Professional experience	Up to 5 years	17	17.0
	6–10 years	35	35.0

	11–15 years	23	23.0
	>15 years	25	25.0
Previous information	Yes	80	80.0
	No	20	20.0
Source of information	Mass media	30	30.0
	Friends and family members	50	50.0
	No previous information	20	20.0

5.2. Level of knowledge regarding selected nutritional deficiencies:

The assessment of overall knowledge revealed that **84% of the schoolteachers had a moderate level of knowledge**, whereas **16% had an adequate level of knowledge** regarding the recognition of early signs of selected nutritional deficiencies. None of the participants were classified as having inadequate knowledge.

Table. 2: Distribution of Participants According to Overall Knowledge Level (N = 100)

Knowledge level	Score criterion	n	%
Inadequate knowledge	<50%	0	0.0
Moderate knowledge	50–75%	84	84.0
Adequate knowledge	>75%	16	16.0
Total		100	100.0

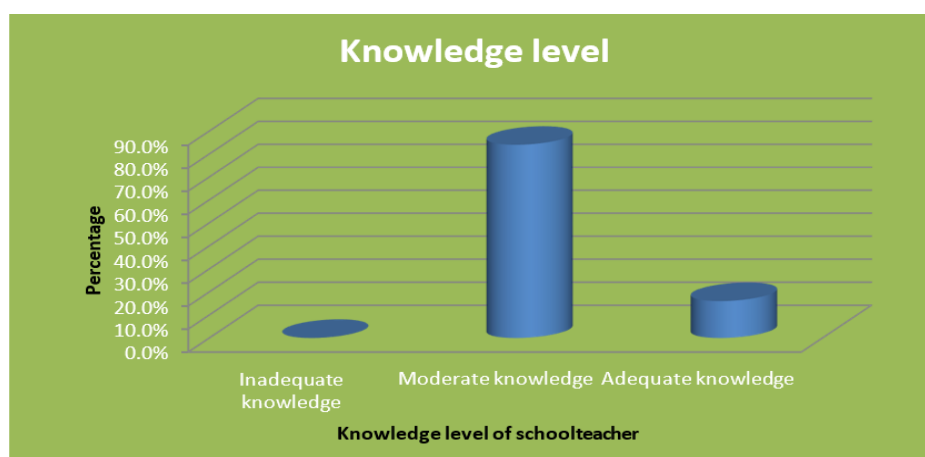


Figure. 1: Distribution of schoolteachers according to their level of knowledge regarding the recognition of early signs of selected nutritional deficiencies

The predominance of moderate knowledge indicates that although most teachers possessed some awareness of nutritional deficiencies, opportunities remained for strengthening their ability to recognize early signs and symptoms.

5.3. Domain-wise knowledge scores:

The overall mean knowledge score was **25.55 out of 40**, corresponding to a mean percentage score of **63.87%**, with a standard deviation of **3.276**. Considerable variation was observed across the different knowledge domains.

The highest mean percentage score was observed for **iodine deficiency (71.12%)**, followed by **general concepts (70.00%)**, **anaemia (69.00%)**, and **protein-energy malnutrition (64.54%)**. The lowest mean percentage score was observed for **vitamin A deficiency (49.44%)**, indicating that this was the most prominent area of knowledge deficit among the participating schoolteachers.

Table. 3: Domain-Wise Knowledge Scores of Schools Teachers (N = 100)

Knowledge domain	No. of items	Maximum score	Mean	Mean %	SD
General concepts	3	3	2.10	70.00	0.628
Protein-energy malnutrition	11	11	7.10	64.54	1.382
Vitamin A deficiency	9	9	4.45	49.44	1.466

Anaemia	9	9	6.21	69.00	0.608
Iodine deficiency	8	8	5.69	71.12	1.475
Overall knowledge	40	40	25.55	63.87	3.276

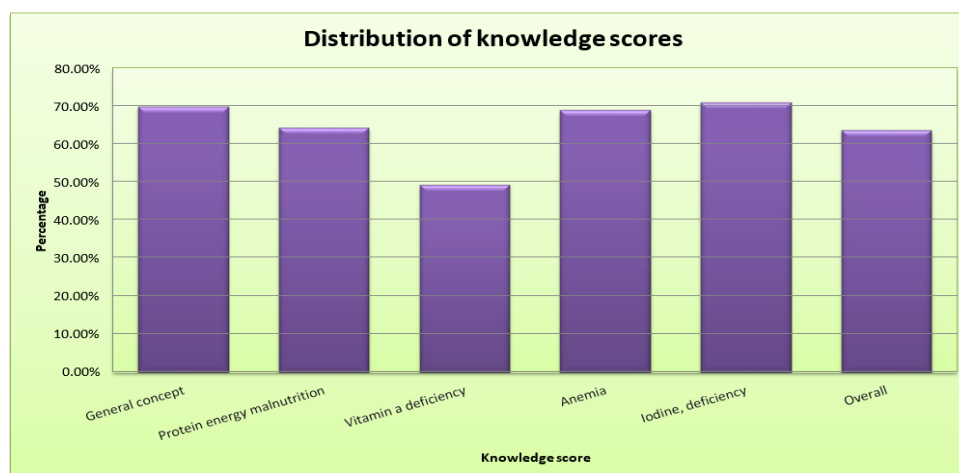


Figure. 2: Mean percentage scores of schoolteachers across different knowledge domains related to selected nutritional deficiencies

The domain-wise analysis demonstrated a marked knowledge gap regarding vitamin A deficiency, for which the mean percentage score was below 50%. In comparison, knowledge regarding iodine deficiency and general nutritional concepts was relatively higher.

5.4. Association between knowledge scores and selected demographic variables:

The association between the knowledge scores of schoolteachers and selected demographic variables was examined using the chi-square test. Statistically significant associations were observed between knowledge scores and **age** ($\chi^2 = 8.105$, $p = 0.044$), **place of residence** ($\chi^2 = 5.943$, $p = 0.015$), **educational qualification** ($\chi^2 = 10.060$, $p = 0.018$), and **monthly income** ($\chi^2 = 7.128$, $p = 0.028$).

No statistically significant association was observed between knowledge scores and gender, religion, marital status, number of children, family type, dietary pattern, professional experience, previous information, or source of information ($p > 0.05$).

Table. 4: Association Between Knowledge Scores and Selected Demographic Variables (N = 100)

Demographic variable	χ^2 value	df	p-value	Inference
Age	8.105	3	0.044	Significant
Gender	0.065	1	0.799	Not significant
Religion	1.366	2	0.505	Not significant
Marital status	3.561	1	0.059	Not significant
Number of children	3.105	2	0.212	Not significant
Family type	0.822	1	0.365	Not significant
Place of residence	5.943	1	0.015	Significant
Dietary pattern	0.123	1	0.726	Not significant
Educational qualification	10.060	3	0.018	Significant
Monthly income	7.128	2	0.028	Significant
Professional experience	4.565	3	0.207	Not significant
Previous information	0.879	1	0.349	Not significant
Source of information	0.883	2	0.643	Not significant

Statistical significance was considered at $p < 0.05$.

Overall, the findings demonstrated that the majority of participating schoolteachers had a moderate level of knowledge regarding the early recognition of selected nutritional deficiencies. Knowledge was comparatively strongest in the domain of iodine deficiency and weakest in relation to vitamin A deficiency. Selected sociodemographic characteristics, particularly age, place of residence, educational qualification, and monthly income, were significantly associated with teachers' knowledge scores.

6. Discussion:

The present study assessed the knowledge of schoolteachers regarding the recognition of early signs of selected nutritional deficiencies among children aged 5–14 years. The findings demonstrated that the majority of schoolteachers possessed a moderate level of knowledge, although considerable variation was observed across specific nutritional-deficiency domains. The results highlight both the potential role of teachers in the early recognition of nutritional problems among school children and the need for targeted educational initiatives to address specific knowledge gaps.

The overall mean knowledge score was 25.55 out of 40, corresponding to a mean percentage of 63.87%. A large majority of the participants (84%) had moderate knowledge, while only 16% demonstrated adequate knowledge. None of the participants were categorized as having inadequate knowledge. These findings suggest that schoolteachers possessed a basic level of awareness regarding nutritional deficiencies but lacked comprehensive knowledge sufficient for consistent recognition of all relevant early signs. Similar concerns regarding gaps in teachers' nutrition-related knowledge have been reported in previous studies, indicating that teachers may require structured and continuing nutrition education to strengthen their knowledge and confidence in promoting child health (Soliah et al., 2006).

The moderate overall knowledge observed in the present study is particularly relevant because teachers interact with school-aged children on a regular basis and may observe changes in their physical appearance, behaviour, activity, concentration, and classroom performance. Teachers are not expected to clinically diagnose nutritional disorders; however, their ability to recognize possible warning signs may contribute to timely communication with parents and referral to appropriate health professionals. School-based health and nutrition initiatives increasingly recognize the importance of the school environment and school personnel in promoting healthy dietary practices and supporting the well-being of children (World Health Organization, 2021).

A notable finding of the present study was the variation in knowledge across the five assessed domains. The highest mean percentage score was observed for iodine deficiency (71.12%), followed by general concepts of nutritional deficiencies (70.00%), anaemia (69.00%), and protein-energy malnutrition (64.54%). In contrast, the lowest mean percentage score was recorded for vitamin A deficiency (49.44%). This variation indicates that teachers' knowledge was not uniform across different nutritional conditions and that certain deficiencies may be less easily recognized than others.

The comparatively higher knowledge regarding iodine deficiency may be related to greater public awareness of iodine deficiency disorders and the widespread promotion of iodized salt as an important public health intervention. Iodine is essential for thyroid hormone synthesis and normal growth and neurodevelopment, while inadequate iodine intake can result in a spectrum of iodine deficiency disorders (Zimmermann and Boelaert, 2015). Public health campaigns focusing on iodized salt may have contributed to greater awareness of iodine-related health problems among the general population, including schoolteachers.

Knowledge regarding anaemia was also relatively high, with a mean percentage score of 69.00%. Anaemia, particularly iron-deficiency anaemia, remains a major nutritional concern among children and adolescents. Common manifestations such as pallor, fatigue, weakness, reduced activity, and difficulties with attention may be observable in school settings. Iron deficiency can adversely affect cognitive and behavioural functioning, and previous research has demonstrated an association between iron deficiency and poorer educational or cognitive outcomes among school-aged children (Haltermann et al., 2001). Therefore, teachers' awareness of possible manifestations of anaemia may have practical relevance for identifying children who require further health assessment.

Knowledge regarding protein-energy malnutrition was moderate, with a mean percentage score of 64.54%. Visible manifestations of undernutrition, such as low body weight, poor physical growth, muscle wasting, and changes in general appearance, may be more readily recognized than some micronutrient-specific manifestations. Previous research has shown that teachers may commonly associate malnutrition with visible thinness or low body weight, while having less comprehensive knowledge of its broader manifestations and consequences (Sherman and Muehlhoff, 2007). This suggests that nutrition education for teachers should extend beyond easily visible signs and include less obvious physical, behavioural, and functional indicators.

The most important domain-specific knowledge gap identified in the present study concerned vitamin A deficiency, for which the mean percentage score was only 49.44%. Vitamin A is essential for normal vision, immune function, growth, and epithelial integrity, and deficiency can lead to ocular manifestations ranging from impaired dark adaptation to xerophthalmia and, in severe cases, irreversible visual impairment (Sommer and Vyas, 2012). The relatively low score in this domain indicates a need for greater emphasis on the early manifestations of vitamin A deficiency in educational programmes developed for schoolteachers.

The present study also examined the association between knowledge scores and selected demographic characteristics. Significant associations were observed between knowledge scores and age ($p = 0.044$), place

of residence ($p = 0.015$), educational qualification ($p = 0.018$), and monthly income ($p = 0.028$). These findings suggest that teachers' knowledge may be influenced by differences in educational exposure, socioeconomic circumstances, access to information, and accumulated life experience. However, because the study employed a descriptive cross-sectional design, these associations should not be interpreted as evidence of causal relationships.

Educational qualification was significantly associated with knowledge scores. This finding may indicate that differences in educational background influence exposure to health-related information or the ability to access and interpret nutrition information. Nutrition-related educational interventions for teachers may therefore need to account for differences in baseline knowledge and educational preparation. Previous intervention studies have shown that structured nutrition education can improve teachers' nutrition knowledge, supporting the value of targeted training programmes within school settings (Elmas et al., 2020).

Place of residence was also significantly associated with knowledge scores. Differences between rural and urban participants may reflect variations in access to health information, educational resources, healthcare services, and public health communication. Nevertheless, the direction and practical significance of this association should be interpreted cautiously, particularly because the study was conducted among a relatively small sample from selected schools in one geographical area.

In contrast, no statistically significant association was found between knowledge scores and gender, religion, marital status, number of children, family type, dietary pattern, professional experience, previous information, or source of information. These findings indicate that the observed knowledge level was not uniformly explained by these characteristics. Of particular interest, previous exposure to information was not significantly associated with knowledge scores, suggesting that mere exposure to information may not necessarily ensure accurate or comprehensive understanding. The quality, content, frequency, and source of nutrition education may be more important than exposure alone.

The findings of the present study have practical implications for school health programmes. Since 84% of teachers demonstrated only moderate knowledge and vitamin A deficiency emerged as the weakest knowledge domain, educational interventions should be designed to address specific gaps rather than provide only broad general information. Training materials should focus on simple and observable warning signs, clarify the distinction between recognition and clinical diagnosis, and provide clear guidance regarding communication with parents and referral to appropriate health services.

The development of an information booklet as part of the present study was therefore relevant to the identified educational needs. A concise, visually accessible, and evidence-based educational resource may assist teachers in understanding the early signs of common nutritional deficiencies. However, an information booklet alone may not be sufficient to achieve sustained improvement in knowledge. Combining written educational materials with structured training sessions, interactive discussions, periodic reinforcement, and coordination with school health personnel may provide a more comprehensive approach to strengthening teachers' role in school health promotion.

Overall, the study demonstrates that schoolteachers represent an important but potentially underutilized resource in the early recognition of nutritional problems among school-aged children. The moderate overall knowledge level and substantial deficit in knowledge regarding vitamin A deficiency indicate a need for targeted educational support. Strengthening teachers' awareness of early warning signs may contribute to earlier identification and referral of children at nutritional risk while reinforcing the broader role of schools in promoting child health and well-being.

7. Limitations:

The findings of the present study should be interpreted in the context of several limitations. First, the study included only 100 schoolteachers from selected schools in Kolar, which limits the generalizability of the findings to teachers in other geographical and educational settings.

Second, a non-probability convenience sampling technique was used, which may have introduced selection bias and reduced the representativeness of the sample.

Third, knowledge was assessed using a structured questionnaire and therefore reflected participants' responses to specific knowledge items rather than their actual ability to recognize nutritional deficiencies in real-life school settings.

Fourth, the cross-sectional descriptive design allowed the assessment of knowledge and associated demographic factors at a single point in time but did not permit conclusions regarding causality.

Finally, the study assessed selected nutritional deficiencies—protein-energy malnutrition, vitamin A deficiency, anaemia, and iodine deficiency disorders—and therefore did not provide a comprehensive assessment of teachers' knowledge regarding all forms of nutritional deficiency affecting school-aged children.

8. Recommendations:

Based on the findings of the study, the following recommendations are proposed:

1. Periodic nutrition education and awareness programmes should be organized for schoolteachers to strengthen their knowledge regarding the early recognition of nutritional deficiencies among children.
2. Educational interventions should place particular emphasis on nutritional conditions for which knowledge is comparatively low, especially vitamin A deficiency.
3. Simple, evidence-based, and visually accessible educational resources should be made available to teachers as supplementary tools for school health promotion.
4. School health programmes should promote collaboration among teachers, parents, nurses, nutrition professionals, and other healthcare providers to facilitate the timely assessment and referral of children with suspected nutritional problems.
5. Similar studies should be conducted with larger and more diverse samples across different geographical regions to improve the generalizability of findings.
6. Future studies should use experimental or quasi-experimental designs to evaluate the effectiveness of structured teaching programmes and information booklets in improving teachers' knowledge.
7. Longitudinal research may be undertaken to assess the retention of knowledge following educational interventions and to examine whether improved teacher awareness contributes to earlier referral and better nutritional outcomes among school-aged children.

9. Conclusion:

The present study assessed the knowledge of schoolteachers regarding the recognition of early signs of selected nutritional deficiencies among children aged 5–14 years in selected schools at Kolar, Karnataka. The findings revealed that the majority of schoolteachers had a moderate level of knowledge, with an overall mean percentage score of 63.87%. Although none of the participants demonstrated inadequate overall knowledge, only 16% had an adequate level of knowledge, indicating considerable scope for improvement.

Knowledge varied across the assessed nutritional-deficiency domains. Teachers demonstrated comparatively higher knowledge regarding iodine deficiency, general nutritional concepts, and anaemia, whereas vitamin A deficiency emerged as the most prominent area of knowledge deficit. These findings emphasize the importance of providing targeted nutrition education rather than relying solely on general awareness.

Significant associations were observed between knowledge scores and age, place of residence, educational qualification, and monthly income. However, no significant association was found with gender, religion, marital status, number of children, family type, dietary pattern, professional experience, previous information, or source of information. These findings suggest that teachers' knowledge may vary according to selected sociodemographic characteristics, although the cross-sectional nature of the study does not permit causal interpretations.

School teachers interact with children regularly and are therefore well positioned to observe persistent changes in physical appearance, activity, behaviour, and classroom functioning. While teachers should not be expected to diagnose nutritional disorders, improved awareness of possible early warning signs may facilitate communication with parents and timely referral for professional assessment. Structured educational programmes and appropriately designed informational resources may therefore strengthen the contribution of teachers to school-based health promotion and early identification of children at nutritional risk.

10. Implications of the study:

The findings of the study have implications for school health practice, nursing practice, nursing education, nursing administration, and future research.

10.1. Implications for school health and nursing practice:

School health personnel and community health nurses can play an important role in strengthening teachers' knowledge regarding common nutritional deficiencies among children. Periodic educational sessions may be organized to familiarize teachers with observable warning signs of protein-energy malnutrition, vitamin A deficiency, anaemia, and iodine deficiency disorders.

Particular emphasis should be placed on areas in which teachers demonstrate lower knowledge, especially the early manifestations of vitamin A deficiency. Teachers should also be provided with clear guidance regarding the limits of their role: their responsibility is to recognize possible warning signs, communicate concerns appropriately, and facilitate referral rather than make a clinical diagnosis.

10.2. Implications for nursing education:

Nursing students and healthcare professionals involved in community and school health should be prepared to provide effective nutrition education to teachers, parents, and children. Educational programmes should emphasize practical communication skills and the development of simple, understandable, and evidence-based teaching materials.

Nursing education can also encourage students to participate in school-based health-promotion activities, including nutritional assessment, health education, early identification of health concerns, and appropriate referral. Such activities may strengthen collaboration between schools and healthcare services.

10.3. Implications for nursing administration:

Nurse administrators and school health programme coordinators may consider organizing periodic continuing education and awareness programmes for schoolteachers. Training programmes should be based on identified knowledge gaps and should include practical information on the early recognition of common nutritional deficiencies.

Collaboration between educational institutions, school authorities, community health nurses, paediatric healthcare professionals, and nutrition experts may support the development of comprehensive school-based nutrition initiatives. Educational resources such as information booklets may be used as supplementary materials during such programmes.

10.4. Implications for research:

The findings provide baseline information regarding schoolteachers' knowledge of selected nutritional deficiencies in the study setting. Future research may evaluate the effectiveness of structured educational interventions, information booklets, digital learning resources, or combined training approaches in improving teachers' knowledge and retention of information.

Further studies may also explore whether improved teacher knowledge contributes to better identification and referral of children with suspected nutritional problems.

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