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An Efficient ODK Model to Identification and Prevalence of Anemia Problem in Adolescent Girls Aged between 10 to 19 Years in Karnataka Rural Areas

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ABSTRACT

Many adolescent girls from less wealthy families are facing anemia problems due to their financial conditions and they are not economically buying and use balanced diet foods. The girls aged from 10 to 19 years are treated as growing stage, they have to take enough fruits, nuts, vegetables, dal, meat, fish items to fulfill their balanced diet plan. Adolescent girls in this age are avoid to take food intake, parents lake of knowledge on nutritional items, financial position of households, not given preference to nutritional food, and due to these reasons adolescents girls are facing anemia problems at early stages. Already WHO announces that anemia problems in adolescent girls create health emergency very soon. As per medical reports 25 percentage of adolescent girls from India are facing anemia health issue. As per WHO reports death rate are also high in adolescent girls due to anemia problem. The research goal is to optimize the number of girls suffering with anemia by counselling their parent's and suggest balanced diet to adolescent girls. We proposed ODK model to gather data samples from Karnataka state rural areas and trainers or interviewers are sent to households to gather data about adolescents either offline or online ODK android apps. In this research with help of ODK toolkit data is gathered from 22856 households, number of adolescent girls are identified is 9072, number of girls tested and confirmed affected with anemia are 2628. At the end counseled adolescent girls parents about anemia, consequences of imbalanced diet nutritional foods, and suggested balanced nutrition's to predict from anemia problems at early stages.

Keywords: Home Science, ODK Model, Balanced Nutritional Diet, Anemia Problem, BMI, Prevalence

INTRODUCTION

WHO defined adolescence is the age from ten to nineteen years period. It is an important age where all parts of body are grown physically, psychologically and also except change in the behavior (Chauhan *et al.,* 2022). It is also crucial period adolescence girls need to take balanced diet to maintain growth or otherwise they may enter into nutrition deficiency problem or anemia problem. Anemia on adolescent girls has working in a wrong direction when compared with healthy girls (Nainggolan *et al.,* 2022). Most of the adolescence girls are having B12 vitamin deficiency, iron deficiency, folate deficiency, and all these deficiency leads to anemia with nutrition deficiency. worldwide around 1.8 billion are affected with anemia, and it is defined as optimal concentration level in hemoglobin, and anemia affected girls has RBC (read blood cells) cells count is less and also these cells are not capable to consume sufficient oxygen to the body that required based on their age factor (Kamruzzaman, 2021).

Hemoglobin is a protein cell that has iron in RBC that can be used to transfer oxygen between lungs and tissues and as well as it is used to transfer CO_2 between tissues and lungs (Kocaoz *et al.,* 2019). Patients who are suffering with anemia has hemoglobin thickness value less than threshold value and this is also depends on

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person gender, age, and daily habits (Ali *et al.*, 2020). As per WHO reports pregnant anemia patient's hemoglobin level is less than 11 g/ml and non-pregnant anemia patient's hemoglobin level is less than 12 g/ml. many girls in the global lost their life due to anemia problem that is from south Asia this count is high when compared with other parts of the world (Eswaranu *et al.*, 2021) Mostly adolescent girls or pregnant women are victim to anemia due to their monthly problems and pregnancy reasons. Therefore, anemia cases are reported more in girls or women than men (Mc Maughan *et al.*, 2022). More number of cases were reported in developing countries due to many peoples are below poverty and they are not in a position to maintain balanced diets.

Anemia is a disorder which is frequently occurred in adolescent girls due to the consequences of mental health conditions, physical health conditions and financial positions (Rose Clarke *et al.*, 2019). Breathing problem, weakness in the body, fatigue, depression, heavy usage of mobile phones, poor quality of life, anxiety, not able to do daily routine activities, and are leads to anemia condition (Sunuwar *et al.*, 2020). Anemia can also occur due to pale in skin, heavy heartbeat condition, irritating condition, and migraine headaches (Bahrami *et al.*, 2020). Pregnant women anemia patients this kind of problem leads to restrict baby growth, delivered baby with underweight, delivered baby in seventh month, and also sometimes mortality of both baby and women. In India around 17% of adolescent girls are affected with anemia due to physiological development in the body structure in this particular age of the life.

Related Work:

After completion of childhood age adolescence age is stated crucial period of life, it is the appropriate time to develop and grow, it will demand balanced nutritional intake, and also possibility to get nutrition deficiency (Smith *et al.*, 2019). Adolescent are facing deficiency in iron due to loss of iron during monthly period time and not preferred to take sufficient iron foods. Another deficiency is B12, it will produce RBC, and some of them are getting anemia due to their chronical histories of family. In addition to that, some of the conditions to anemia are restrictions in decision making capability, does not having autonomy in finance, and not checked health conditions frequently due to financial problems (Datta and Haider, 2022). Focusing anemia problem in adolescent girls is one of the development steps towards an opportunity to provide awareness on balanced nutritional guide and make them to enjoy their rest of the life (Kinyoki *et al.*, 2021).

Many researches are worked on parameters that are useful to prevent anemia problem on adolescent girls, many of them identified that money plays vital role which restrict the people to take fewer nutritional foods and their health (Bellizzi *et al.*, 2021). It is observed that adolescent girl born under below poverty are not taking sufficient food nutrition components, they are facing deficiency of B12 and iron, and these situations are leads to chances of getting anemia (Safiri *et al.*, 2021). From global public view region need more nutritional food than girls or women. The ladies with lowest education level does not have minimum knowledge and balanced diet with sufficient nutrition's and consuming improper nutritional food, and increase chance of getting anemia problems. Another side pregnant woman lost blood at the time of delivery, to recover from this case they haven't take appropriate food items if not they will enter into anemia problem. In addition to that some physiological factors, food habits, availability of food items, economic issues, parent choice of food selections, and all these factors are increased the chance of getting anemia problems in adolescent girls (Parvez *et al.*, 2021).

In Asia second highest death rate occurred due to anemia, in the time of pregnancy of adolescent girls (age from 15 to 19 years) the probability of death rate is high, and they cannot give birth to babies due to their immature physical growth. Try to protect not only health conditions of adolescent girls but also target to get good pregnancy results. In India nearly more than 60% of girls were suffering with anemia problem and 35% of boys in the age of adolescent suffering with anemia problems (Kasonde *et al.*, 2021).

First measure hemoglobin level of a person and then decide the complete status of health based on hemoglobin value. The people whose income is below average are not in a position to supply balanced nutrition diet to their children's and most of the girls from this category are suffering with anemia problems. These categories of girls are not in a position to recover from blood losses in the period of menstruation. Anemia affected adolescent girls are the major mortality in future, these girls will give birth to babies with underweight and in this research, we studied the anemia problem in rural and urban slum areas of Karnataka region with respect to the list of features are associated to get anemia problem at early stage (Liyew *et al.*, 2020).

Anemia is a one of the imbalanced nutrition in human body issue that can be resolved at early stages or otherwise patient has to face more consequences. The most of the problems are encountered during pregnancy period of adolescent girls between age 15 to 25 years. The research study models the various predictors of adolescent girls at the age between 6 months to 60 months those who are affected with anemia problem. Anemia problems in adolescent girls are categorized into low, moderate, and high infected, mostly high percentage of girls were affected with anemia due to nutritional imbalance (deficiency of iron). If the hemoglobin value is less than specified range (12 to 13 gm/dl) then anemia problem encountered. The root causes of anemia are identified by conducting various types of testing. Pregnancy women with anemia need to take iron substitutes in the form of tablets to predict from anemia problem (Kapil *et al.*, 2019).

To improve RBC count certain medicines were recommended for the patients those who are affected with severe anemia problem. As per the WHO reports, anemia is categorized into low, moderate and high (severe) and details are tabulated in Table 1.

Table 1: types of Anemia

Sr. No.	Anemia type	Hemoglobin in gm/dL
1.	Mild	8 to 12
2.	Moderate	5 to <8
3.	High	<5

Iron Deficiency Anemia (IDA) is frequently occurred anemia in our country where iron deficiency found in blood flow of human body. oxygen is supplied to entire body parts with help of proteins in RBC cell. Actually, human body needs iron supplement to prepare hemoglobin and if without iron body will prepare less hemoglobin that leads to anemia problem (Reshmi Takalkar, 2020).

METHODOLOGY

Prevalence of anemia using ODK Model:

The information used in this research was gathered through surveys in the form of questionnaires. In this survey around 22856 households are taken for testing in rural areas of Karnataka. The main idea of proposed research model is depicted in Fig. 1.

The data samples were gathered by reaching houses rural and urban areas and questionnaires are asked to

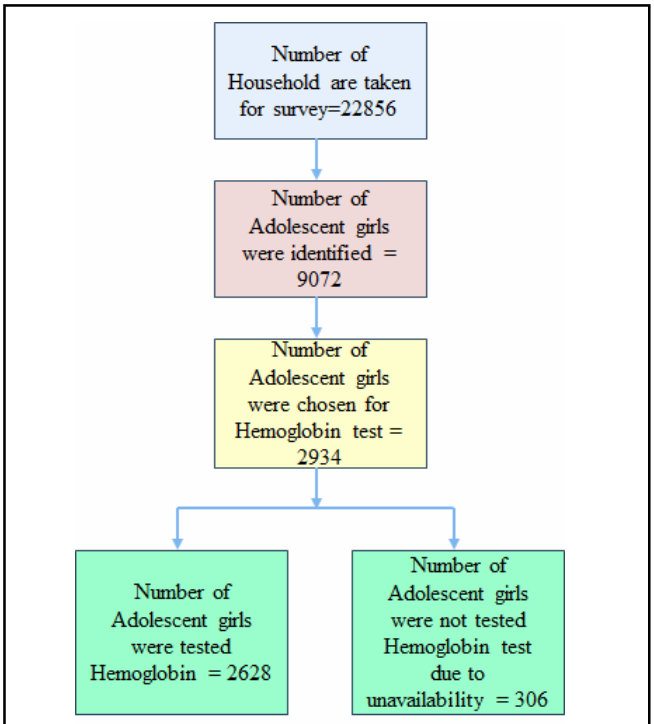

Fig. 1 : Proposed Research Model

mothers about their adolescent girls and the information of adolescent girls are collected by directly consulting girls. The complete information was gathered by using ODK tool (Open Data Kit) and which is available in the market as a open source and suitable to any android mobile device. ODK is a GUI (Graphical User Interface) that is working with minimum features and that can be easily handled by healthcare employees with minimum knowledge. In ODK tool, GPS (Global positioning system) tracking and SMS (short message service) are embedded to monitor data gathering. A total of 56 members are trained exclusively for one month about the various types of questionnaires to ask when the meet household mothers and all interviewers are females only taken to interact adolescent girls mothers, these members are trained on questionnaires, and how to practice fields at various types of community houses. A training manual also supplied to each and every interviewer, when they are visiting field. These members were formed into different teams and each one is lead by one supervisor. First questionnaires are decided and then uploaded into ODK tool and it can be used in the field either online mode or offline mode. All the data were collected by using ODK are maintained at a centralized server.

In order to maintain accuracy of data various types

of control strategies are maintained at various phases of data gathering approach. In this survey the targeted responders are mothers of adolescent girls and we preferred to use only female interviewers in the data gathering stage. Wealth index are constructed with help of PCA (Principal Component Analysis) for all social economic attributes. Each attribute is assigned a weightage based on the factors that are measured in a PCA. Scores are calculated for each household and standardize each household values by following mean value with zero and standard deviation with one. Ranks were allotted to each house, ranks are varied from 1 to 5, and rank 5 indicate wealthy household. From all adolescent participants blood is gathered by using lancet, a separate lancet are preferred to use for each participant and they calculate hemoglobin values with help of hemoglobin meter, in this process approximately seven different machines are used to calculate hemoglobin values. WHO (World health organization) threshold values are used to identify anemia patients.

Adolescent girls those are not pregnant Hb levels are less than 12 g/dl are treated as anemia, severity is classified as mild (Hb values are in between 10.00 to 11.90 g/dl), moderate (Hb values are in between 7.00 to 9.90 g/dl), and severe if Hb value is less than 7.0 g/dl. Adolescent girls with pregnant Hb levels are less than 11.00 g/dl are treated as anemia, severity is classified as mild (Hb values are in between 10.00 to 10.90 g/dl), moderate (Hb values are in between 7.00 to 9.90 g/dl), and severe if Hb value is less than 7.0 g/dl. Height of adolescent girls are measured in centimeters by using wooden base scale. Weights are measured in Kgs (kilograms). BMI (Body Mass Index) is calculated by using the following equation.

$$\text{BMI} = \frac{\text{Weight in Kgs}}{(\text{Height in meters})^2}$$

Adolescent age is in general treated as growth period, in this age the weight and height are frequently changed, and BAZ (BMI Age Z-score) values are preferred to evaluate nutritional values of adolescent girls. BAZ values are measured by using Anthro plus tool which is recommended by WHO.BAZ values are measured for all adolescent girls, nutritional values are measured and based on these values they are classified as malnutritional (BAZ value is less than -2SD), balanced nutritional (BAZ values in between -2SD to +1SD), and over nutritional (if BAZ value is greater than +1SD).STATA analysis tool is used to study the collected data from adolescent girls. In this research chi-square analysis and chi-square test is used to evaluate the relationship anemia and the relevant or associated symptoms to construct contingency matrix by considering level of significance is less than or equal to 0.05.Anemia risk factors in adolescent girls were analyzed by using Logistic regression and then measured CI (confidence interval) and COR (crude odd ratio) values.

RESULTS AND DISCUSSION

Performance Evaluation:

The details of adolescent girls gathered in this research is listed in table 1. From the data we come to know that nearly 91.5 percentage of participants age is in between 10 to 14 years, nearly 18.5 percentage of adolescents are wealthy and 19.1% are poor households, nearly 80% percentage are literate and that to from rural places nearly 85.4 percentage are literate. Around 60.1% adolescents are single and remaining are married and they are about to reach 19 years old, and 3.3 percentage are pregnant when we conducted survey.

From our data we come to know that nearly 51.58 percentage of adolescent girls are affected with anemia. From 51.58 percentage nearly 45.98 percentage of girls effected with mild anemia, 5.39 percentage of girls effected with moderate anemia, and 0.48 percentage of girls effected with severe anemia. From Table 2 mostly effected anemia cases age is from 10 to 14 years and comparatively it is less cases reported in the age from 15

Table 2: Adolescent participant girls characteristics

Properties	Value	Count	Percentage
Pregnant	Yes	90	14.00
	No	2338	98.60
Married	Yes	1006	38.30
	No	1622	61.70
Wealth status	Low	460	17.50
	Second	530	20.20
	Middle	552	21.00
	Fourth	590	22.40
	High	496	18.90
Region	Rural	2246	85.50
	Urban	382	14.50
Age in years	10–14	1258	47.90
	15–19	1370	52.10
Literacy	Literate	2122	80.80
	Illiterate	506	19.20

Table 3: Properties and status of anemia affected girls

Property	Value	Count Anemic	Percentage	Chi-Square	P-Value
Pregnant	Yes	14	17.59	24.182	<0.001
	No	1342	52.87		
Married	Yes	502	49.86	0.931	0.328
	No	852	52.68		
Wealth status	Poor	250	54.39	3.493	0.468
	Second lowest	288	54.28		
	Middle	280	50.69		
	Second high	304	51.48		
	High	234	47.17		
Region	Rural	1152	51.26	0.288	0.596
	Urban	204	53.37		
BMI	Full nutrition	1214	50.77	3.728	0.049
	Malnutrition	142	60.19		
Age (in years)	10–14	670	53.29	1.312	0.239
	15–19	686	50.08		
Food safety	Secure	398	51.79	0.0389	0.813
	Unsecure	958	51.46		

to 19 years .

The anemia cases were reported over adolescent girls are summarized in Table 3, nearly 54.39 percentage of girls from low income houses are affected with anemia.

From results we noticed that relationship between food safety and anemia, and prevalence of anemia varied approximately 51 percentage. When compared with area-wise prevalence is high (53.37%) than rural (51.26%). In case of pregnant adolescent girls around 15.59 percentage of affected with anemia and non-pregnant were affected 52.87 percentage.The girls consumed less nutritional food are highly effected (60.19 %) with anemia than girls consumed full nutritional food (50.77 %). We

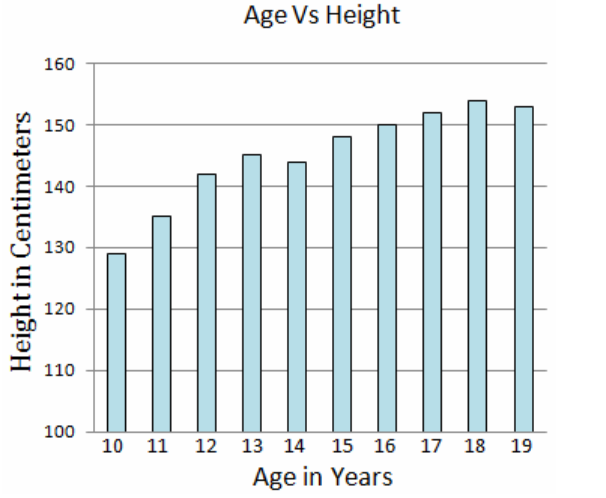

Fig. 2 : Height of adolescent girls

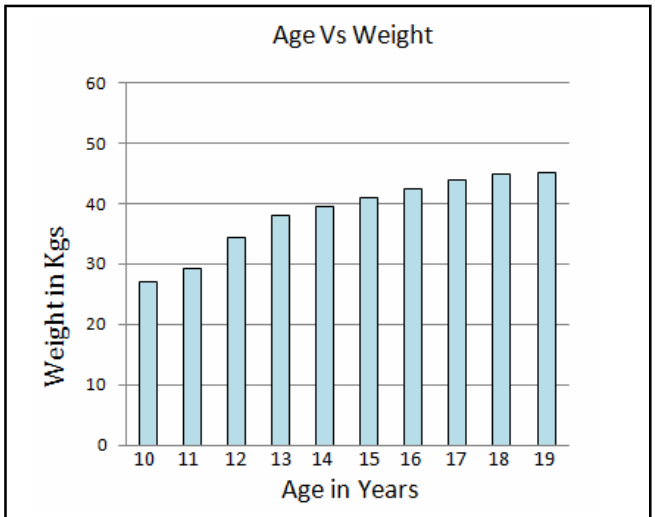

Fig. 3 : Weight of adolescent girls

observed that average height from 144.2 to 160.2 cm and weight from 40.12 kg to 52.45 kgs in anemia not effected adolescent girls. Hp values in non-anemia adolescent girls varied from 11.8 g/dl to 12.14 g/dl. Weight values and height values are measured and are shown in Fig. 2 and 3.

Conclusion:

In this research with help of ODK toolkit data is gathered from 22856 households, number of adolescent girls are identified is 9072, number of girls tested and confirmed affected with anemia are 2628. The girls aged from 10 to 19 years are treated as growing stage, they

have to take enough fruits, nuts, vegetables, dal, meat, fish items to fulfill their balanced diet plan. Adolescent girls in this age are avoid to take food intake, parents lake of knowledge on nutritional items, financial position of households, not given preference to nutritional food, and due to these reasons adolescents girls are facing anemia problems at early stages. From results we noticed that relationship between food safety and anemia, and prevalence of anemia varied approximately 51 percentage. When compared with area-wise prevalence is high (53.37%) than rural (51.26%). In case of pregnant adolescent girls around 15.59 percentage of affected with anemia and non-pregnant were affected 52.87 percentage. The girls consumed less nutritional food are highly effected (60.19 %) with anemia than girls consumed full nutritional food (50.77 %). We observed that average height from 144.2 to 160.2 cm and weight from 40.12 kg to 52.45 kgs in anemia not effected adolescent girls. Hp values in non-anemia adolescent girls varied from 11.8 g/dl to 12.14 g/dl. At the end counseled adolescent girl's parents about anemia, consequences of imbalanced diet nutritional foods, and suggested balanced nutrition's to predict from anemia problems at early stages.

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