"ASSOCIATION OF SERUM VITAMIN D LEVELS WITH SEVERITY OF ACUTE RESPIRATORY TRACT INFECTIONS IN CHILDREN "

By

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IN

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ABSTRACT

BACKGROUND: Vitamin D (D_2, D_3, or both) is a secosterol produced endogenously in the skin from sun exposure and also obtained from foods that naturally contain vitamin D, foods fortified with vitamin D and supplements. Vitamin D has long been known to play a role in the skeletal system and calcium homeostasis; the deficiency of which causes rickets and osteoporosis**.** There is growing evidence that vitamin D also contributes positively to pulmonary health. Vitamin D deficiency is a common and important nutritional deficiency in children in India. Clinical and subclinical vitamin D deficiency in children has been reported to be a significant risk factor for severe acute respiratory tract infection. There is evidence to suggest that subclinical vitamin D deficiency is common in India despite lying in a low latitude and having sunshine in plenty.

OBJECTIVES:

1. To measure the serum levels of vitamin D in children aged between two months and five years with ARTI.
2. To classify vitamin D status of children with ARTI in relation to serum 25(OH) D levels.
3. To associate the severity of ARTI with serum vitamin D levels

MATERIALS AND METHODS: A cross sectional observational hospital based study was conducted over a period of one year in 82 ARTI cases fulfilling the inclusion criteria defined by revised classification and treatment of childhood

pneumonia under Integrated management of childhood illnesses(IMCI). Clinical data was recorded in a semi structured proforma. For all enrolled, cases 2ml of venous sample collected and stored at -80^0 C and the samples were used for Vitamin D estimation using Micro Vue -25-OH Vitamin D Kit and Vitamin D levels were classified as per the Endocrine Society recommendations.

METHOD OF STATISTICAL ANALYSIS: Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of frequencies and proportions. Chi-square test was used as test of significance for qualitative data. Yates correction was applied where ever applicable.

RESULTS:

- 82 cases were included in the study.
- Cases were classified into 3 groups as per revised classification and treatment of childhood pneumonia under IMCI. Serum vitamin D estimation was done and cases were classified based on the levels of 25(OH)D levels.
- Out of 82 subjects in the study, 13 (15.8%) had no pneumonia while 38(46.4%) had pneumonia and 31 (37.8%) had severe pneumonia or very severe disease.
- In the study out of 82 subjects, almost half (58.5%) had insufficient serum Vitamin D levels while 34.2% had deficient levels. Only 7.3% had sufficient levels.

- Pneumonia and severe pneumonia or very severe disease was found in increasing frequency in children with insufficient and deficient serum Vitamin D levels which was found to be statistically significant ($p<0.001$).
- Significant association existed between serum Vitamin D levels and the following factors: presence of clinical pallor, socioeconomic status, duration of exposure to sunlight.
- In the study, inadequate exclusive breast feeding, presence of clinical pallor and passive smoking along with decreased levels of serum vitamin D were found to be modifiable risk factors in prevention of acute respiratory tract infections.

- **CONCULSION:** Variables from this short study showed statistically significant associations between severity of ARTI and serum vitamin D levels($p<0.001$). Results from this study also shows that deficiency of vitamin D is a modifiable risk factor in prevention of ARTI. Health education on the importance of sunlight exposure of young children should be reinforced in mothers and the general community. Vitamin D supplementation should be advocated in order to prevent the morbidity and mortality secondary to ARTI , which globally contribute to morbidity worldwide.

KEYWORDS: Acute respiratory tract infection; children; 25-hydroxyvitamin D3

ABBREVATIONS

WHO	World Health Organization
UV B	Ultraviolet B
25[OH] D	25-hydroxyvitamin D
AMP	Antimicrobial Peptide
CAMP	Cathelicidin antimicrobial peptide
ARTI	Acute respiratory tract infections
7-DHC	7-dehydrocholestrol
VDR	Vitamin D Receptors
PTH	Parathyroidhormone
IOM	Institute of Medicine
RDAs	Recommended dietary allowances
IU	International Units
ng	Nanogram
ml	Mililiter
nmol	nanomol
Hib	Haemophilusinfluenza type b
IMCI	Integrated Management of childhood illness

EIA	Enzyme Linked Immunosorbent Assay
HRP	Horseradish peroxidase
RSV	Respiratory syncytial virus
OR	Odds ratio
CI	Confidence interval

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INTRODUCTION

INTRODUCTION

Vitamin D is a fat-soluble vitamin obtained from either diet (food or supplements) or synthesized by skin, with skin as the predominant source[1]. Ultraviolet B (UV B) light is absorbed by the skin and 7-dehydrocholesterol is converted to previtamin D3, which is then converted to vitamin D3. Vitamin D3 is metabolized in the liver to 25-hydroxyvitamin D (25[OH] D) which is an inactive compound, but is considered the best marker for individual vitamin D status. 1, 25-dihydroxyvitamin D ($1,25[OH]_2D$) is the active metabolite, produced by 1-a-hydroxylase in the kidneys[1].

The major role of vitamin D is bone mineralization and calcium metabolism, by way of its endocrine like actions. But, recently Vitamin D is found to have many other roles in the body, including modulation of cell growth & immune function and reduction of inflammation[1]. Also, vitamin D is now shown to have an important role in fighting infections by increasing antimicrobial peptide (AMP), cathelicidin antimicrobial peptide (CAMP) and defences in the body[2]. Many gene encoding proteins that regulate cell proliferation, differentiation and apoptosis are shown to be modulated at least in part by vitamin D[3].

The recent focus of Vitamin D is on its role in non skeletal conditions including immunity[4]. Low vitamin D status has also been associated with an increased risk of type 1 diabetes mellitus, cardiovascular disease, certain cancers, cognitive decline, depression, pregnancy complications, autoimmunity, allergy, and even frailty[1]. There is growing evidence that vitamin D also contributes positively to pulmonary health[1]. With the recent links between vitamin D and immune function, there has been increasing interest in the role of vitamin D in respiratory infections. In some observational studies, it was observed that low vitamin D level in blood is associated with the increased incidence of respiratory tract infections[5].

Vitamin D deficiency is widely prevalent in a subclinical form in children and adults[6].There is evidence to suggest that subclinical vitamin D deficiency is common in India despite lying in low latitude and having plentiful sunshine. Modern day life styles have significantly reduced the total duration of sun exposure in children. UV B rays, having shorter wavelength, tend to scatter earlier or later in the day and hence cutaneous vitamin D synthesis is maximum between 10 AM and 3 PM, the time when most of the children are either in school or indoors. Exposure of only face, hands and arms due to clothing versus whole body isassociated with marked differences in Vitamin D synthesis predisposing to decreased levels of Vitamin D[7].

Acute respiratory tract infection (ARTI) is a major public health problem worldwide.ARTI isa substantial cause of morbidity and mortality in young children, in both developed and developing countries. ARTI is an acute infection of any part of respiratory tract and related structures including paranasal sinuses, middle ear and pleural cavity[8]. In young children, ARTI is responsible for an estimated 3.9 million deaths worldwide, with 90% deaths due to bacterial pneumonia. In the developing countries, seven out of 10 deaths happen due to ARTI in under 5-year age group[8].

Hospital records from states with high infant mortality rate shows that up to 13% of inpatient deaths in paediatric wards are due to ARTI. On an average, children below 5 years of age suffer about five episodes of ARTI per child per year, thus accounting for about 238 million attacks. Although most of the attacks are mild and self-limiting episodes, ARTI is responsible for about 30-50% visits to health facilities and for about 40% admissions to hospital [8] .

In India, about 26.3 million cases of ARTI were reported in 2011, with an incidence rate of about 2,173 cases per lakh population[9]. ARTI contributes to 15-30% of all under five deaths in India and most of these deaths are preventable[9]. A number of social and environmental factors are associated with ARTI morbidity and mortality in childhood. Various risk factors associated with ARTI are poverty, malnutrition, low birth weight, inadequate breast feeding, overcrowding, poor housing conditions, micronutrient deficiency,indoor and outdoor air pollution[10].Various steps have beentaken for the prevention and control of ARTI all over the world which include exclusive breast feeding up to six months of age, vaccinations, providing adequatenutrition, encouraging hand washing and intake of micronutrients like zinc[11].Vitamin D deficiency is a common and important nutritional deficiency of children in India. Clinical and subclinical vitamin D deficiency in children has been reported to be a significant risk factor for severe ARTI.Studies have shown that incidence of ARTI are more in individuals who have lower levels of vitamin D[13]. Respiratory illnesses, like asthma, have a greater risk of developingwith low levels of vitamin D[14]. There have been many studies to suggest that subclinical Vitamin D deficient levels predisposes to ARTI [5,6,7] but seldom studies have been done to associate the serum levels of Vitamin D and severity of ARTI . Hence this present study has been taken up.

OBJECTIVES

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1. To measure the serum levels of vitamin D in children aged between two months and five years with ARTI.
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REVIEW OF LITERATURE

REVIEW OF LITERATURE

VITAMIN D

Vitamin D (D_2, D_3, or both) is a secosterol produced endogenously in the skin from sun exposure. It is also obtained from foods that naturally contain vitamin D, foods fortified with vitamin D and supplements. Vitamin D from skin and diet is metabolized in liver to 25(OH) D which is used to determine patient"s Vitamin D levels[1].

HISTORY

Vitamin D discovery is dated as early as 1914 when American researchers Elmer McCollum and Marguerite Davis found a substance in cod liver oil which had anti rachitic property. In 1925 it was established that when 7-dehydrocholesterol (7-DHC) is irradiated with light, a form of a fat-soluble vitamin is produced (now known as D_3)[15].Alfred Fabian Hess showed "light equals vitamin D". The structure of vitamin D2 was deduced in 1931 by Askew et al.The structure of vitaminD3 was determined through synthetic means by Windaus et al[16] (Figure 1). In 1971–72 the further metabolism of vitamin D to active forms was discovered. Both 25(OH) D and 1, 25$(OH)_2$ D were identified by a team led by Michael F. Holick in the laboratory of Hector DeLuca[16]**.** Vitamin D was discovered with many other vitamins and is classed as a vitamin even now. However, findings from the second half of the 20th century showed that vitamin D is truly a prohormone and not a vitamin[15].

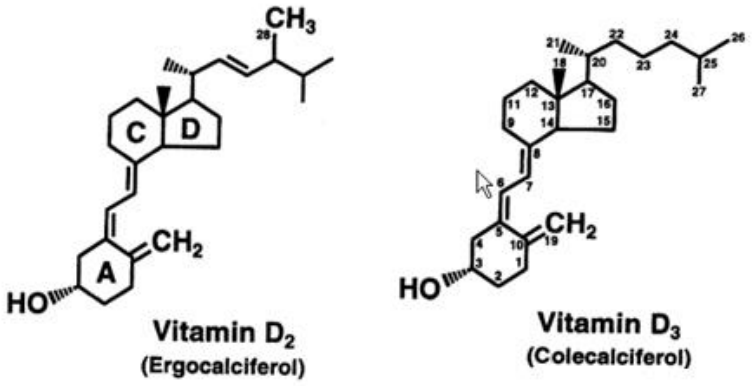
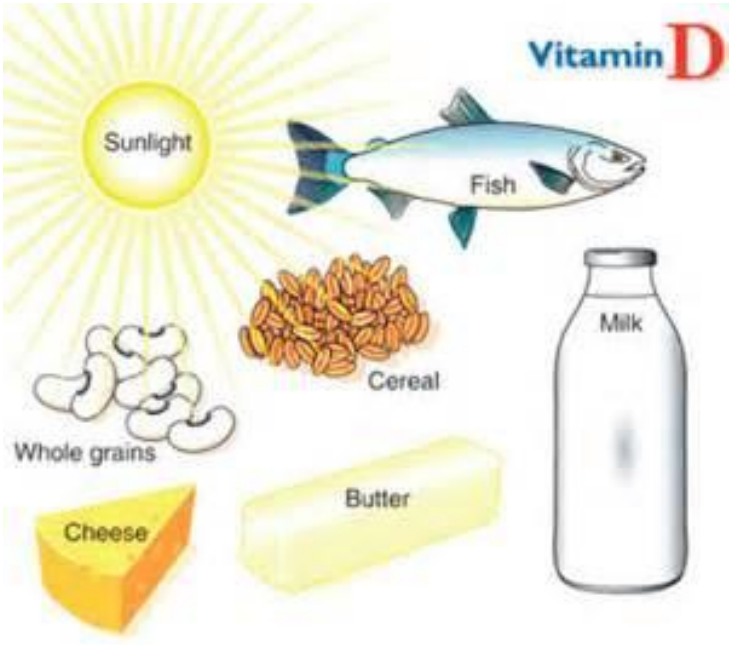


Figure 1: Showing structure of Vitamin D

SOURCES AND SYNTHESIS OF VITAMIN D

Vitamin D is produced endogenously in the skin from sun exposure and also obtained from foods that naturally contain vitamin D like cod liver oil and fatty fish (e.g. salmon, mackerel, and tuna),UV-irradiated mushrooms, foods fortified with vitamin D, and supplements[17].- **Figure 2**

Figure 2:Showing sources of Vitamin D



During exposure to sunlight, 7-DHC in the skin is converted to previtamin D3. The 7-DHC is present in all the layers of human skin. It is seen that 10,000 to 20,000 IU of vitamin D are produced in 30 minutes of whole-body exposure, in the skin of most vertebrate animals, including humans. Once previtamin D3 is synthesized in the skin, it undergoes a heat-induced membrane-enhanced isomerization to vitamin D3. Cutaneous vitamin D3 production is influenced by skin pigmentation, sunscreen use, time of day, season, latitude, altitude, and air pollution. Once formed, vitamin D3 is ejected out of the keratinocyte plasma membrane and is drawn into the dermal capillary bed by the vitamin D binding protein (DBP).Vitamin D that is ingested is incorporated into chylomicron which is released into the lymphatic system, and enters the venous blood where it binds to DBP and lipoproteins and transported to the liver. Vitamin D2 and vitamin D3 are 25-hydroxylated by the 25-hydroxylase (CYP2R1) to produce the major circulating vitamin D metabolite, 25(OH) D which is used to determine a patient‟s vitamin D status. This metabolite undergoes further hydroxylation by the 25(OH) D-1α-hydroxylase (CYP27B1) in the kidneys to form the secosteroid hormone 1α, 25-dihydroxyvitamin D [1, $25(OH)_2D$][1]. - **Figure 3**

The renal 1α -hydroxylation is closely regulated, being enhanced by parathyroid hormone (PTH),hypocalcemia and hypophosphatemia and inhibited by hyperphosphatemia, fibroblast growth factor-23, and $1,25(OH)_2D$ itself. The $1,25(OH)_2D$ performs many of its biologic functions by regulating gene transcription through a nuclear high-affinity vitamin D receptor (VDR). This active metabolite of vitamin D binds to the nuclear VDR, which binds retinoic acid X receptor to form a heterodimeric complex that binds to specific nucleotide sequences in the DNA known as vitamin D response elements. Once bound, a variety of transcription factors attach to this complex, resulting in either up-regulation or down regulation of the gene‟s activity. There are an estimated 200 to 2000 genes that have vitamin D response

elements that are influenced indirectly, possibly by epigenetics, to control a multitude of genes across the genome[1].

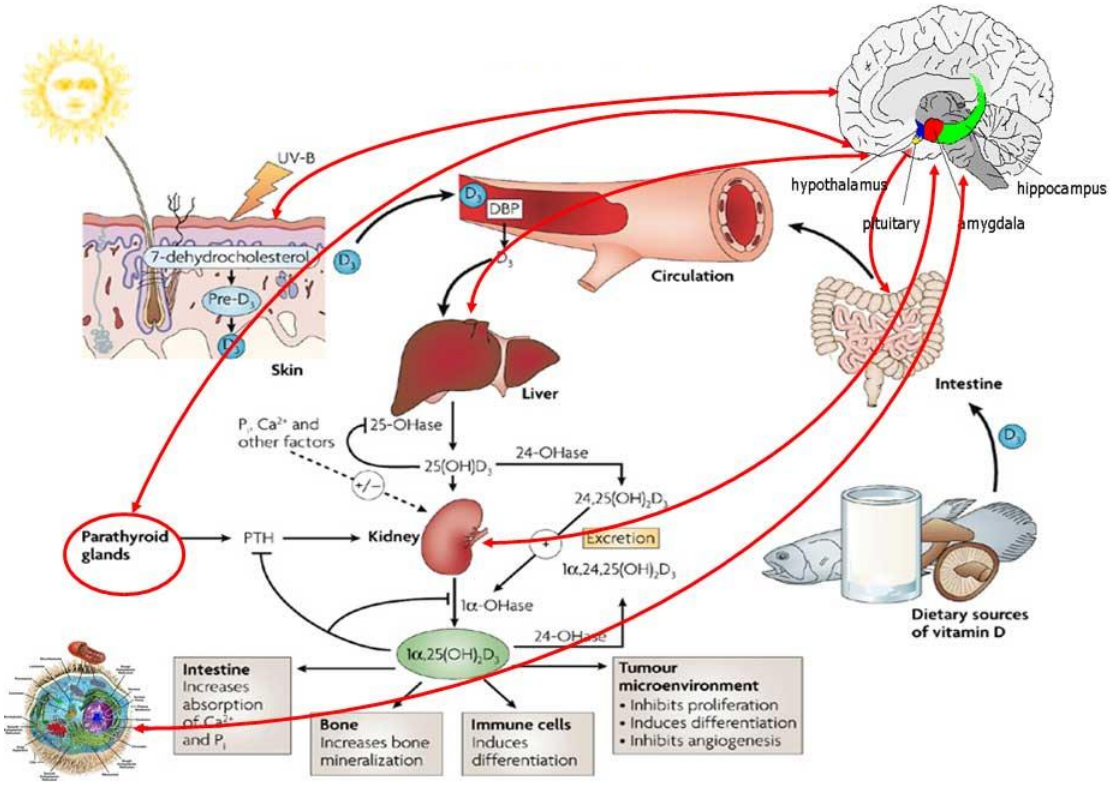


Figure 3: Showing endogenous synthesis and metabolism of Vitamin D

FUNCTIONS OF VITAMIN D

One of the major physiologic functions of vitamin D is to maintain serum calcium and phosphorus levels in a healthy physiologic range to carry out a variety of metabolic functions and to maintain the bone metabolism[18].

Vitamin D maintains serum calcium concentrations within the physiologically acceptable range. It enhances absorption of calcium and phosphorus from the gut. It promotes mineralization of bone collagen, maturation and remodelling. It also helps in maintenance of

growing skeleton and adult bones and muscle health throughout the life. In the kidney it increases tubular absorption of phosphorus and maintains its homeostasis[19].

The $1,25(OH)_2D$ interacts with its VDR in the small intestine to increase the efficiency of intestinal calcium absorption from approximately 10% to 15% up to 30% to 40% and intestinal phosphorus absorption from approximately 60% to 80%. It also interacts with VDR in the osteoblasts to stimulate a receptor activator of nuclear factor kB ligand, which inturn interacts with receptor activator of nuclear factor kB on immature preosteoclasts, stimulating them to become mature bone-resorbing osteoclasts .The mature osteoclast removes calcium and phosphorus from the bone to maintain blood calcium and phosphorus levels. In the kidneys, $1,25(OH)_2D$ stimulates calcium reabsorption from the glomerular filtrate. It is very important to note, however, that in vivo both vitamin D and parathyroid hormone are required for this mobilization event[18].-**Figure 4**

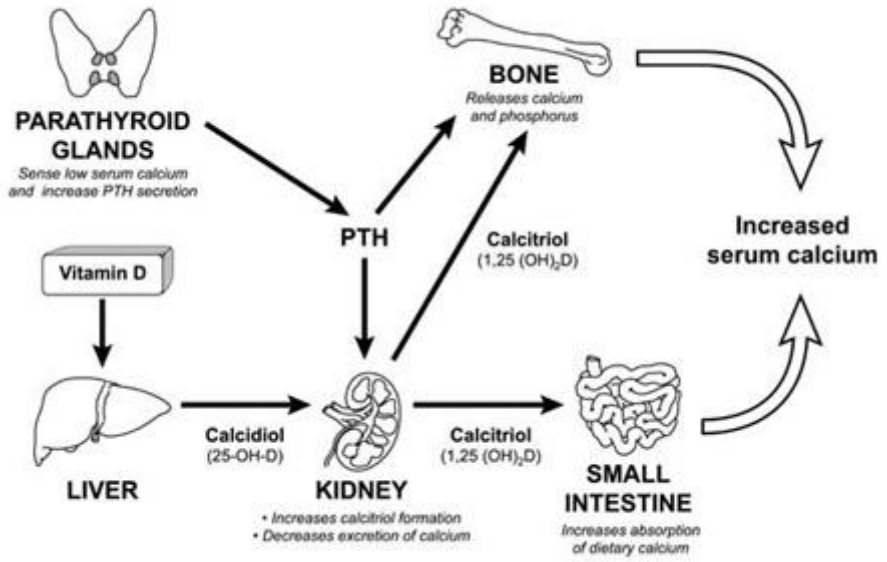


Figure 4 :Showing the role of Vitamin D in the calcium homeostasis

The VDR is present in most tissues and cells in the body This production probably depends on the availability of circulating 25(OH)D, indicating the biological importance of sufficient blood levels of this vitamin D metabolite. The estimated 2000 genes that are directly or indirectly regulated by $1,25(OH)_2D$ have a wide range of proven biological actions, including inhibiting cellular proliferation and inducing terminal differentiation, inhibiting angiogenesis, stimulating insulin production, inducing apoptosis, inhibiting renin production, and stimulating macrophage cathelicidin production[19].

RECOMMENDED DIETARY ALLOWANCES

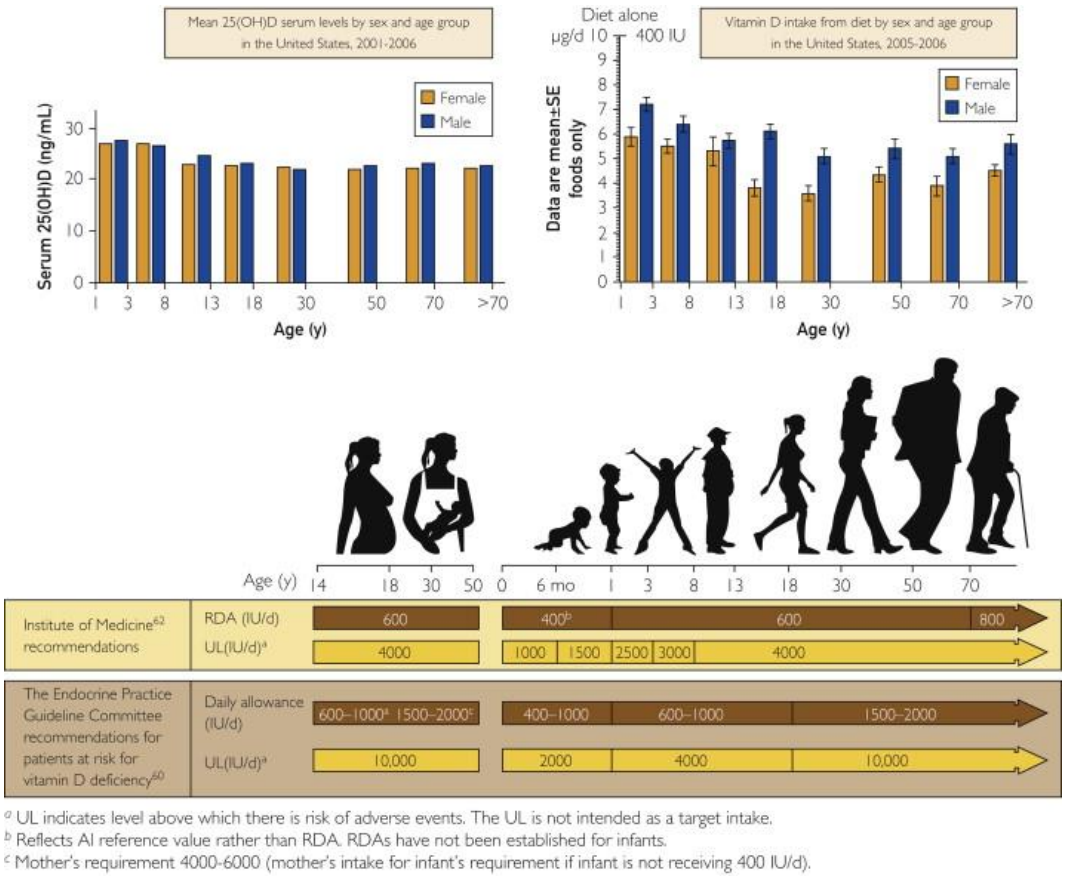
The blood level of 25(OH)D is the best method to determine vitamin D status. Although $1,25(OH)_2D$ is the biologically active form, it provides no information about vitamin D status because it is often normal or even elevated in children and adults who are vitamin D deficient. Recently, the Institute of Medicine (IOM) and the Endocrine Society released separate guidelines for vitamin D requirements. The recommended dietary allowances (RDAs) of the IOM and the Endocrine Society guidelines for vitamin D intake are summarized in Figure 5.

Table 1: Showing the RDA and Tolerable Upper Limit of Vitamin D.

AGE	VIT D (IU/DAY)	
	RECOMMENDED INTAKE	TOLERABLE UPPER LIMIT
0-6 Months	400	1000
6-12 Months	400	1500
1-3 Years	600	2500
4-8 Years	600	3000
9-18 Years	600	4000

VITAMIN D STATUS IN RELATION TO 25 (OH) D LEVELS

The revised guidelines by the IOM stress that the daily requirements for vitamin D are generally met by most of the population and are appropriate to reach the "sufficient" level of 20 ng/mL (to convert to nmol/L, multiply by 2.496). The IOM guidelines used a population model to prevent vitamin D deficiency in 97.5% of the general population. The IOM report focused only on bone health (calcium absorption, bone mineral density, and osteomalacia/rickets) and found no evidence that a serum 25(OH)D concentration greater than 20 ng/mL had beneficial effects at a population level. However, considering the available evidence on skeletal and extra skeletal effects of vitamin D, and the lack of toxicity potential of vitamin D supplementation at recommended doses, the US Endocrine Society, which used a medical model, recommended that serum 25(OH)D levels of 30 ng/mL should be attained to avoid other risks connected with an inadequate vitamin D status.[1]



[a] UL indicates level above which there is risk of adverse events. The UL is not intended as a target intake.
[b] Reflects AI reference value rather than RDA. RDAs have not been established for infants.
[c] Mother's requirement 4000-6000 (mother's intake for infant's requirement if infant is not receiving 400 IU/d).

Fig 5: Showing Vitamin D intakes recommended by the IOM and the Endocrine Practice Guidelines Committee. (IOM-Institute of Medicine)[1]. The normal vitamin D requirements and the tolerable upper limit values are as shown in Table 1[20].

Therefore, the Endocrine Society recommended that vitamin D deficiency be defined as a 25(OH)D level of 20 ng/mL or less, vitamin D insufficiency as 21 to 29 ng/mL, and vitamin D sufficiency as 30 ng/mL or greater for children. It suggested that maintenance of a 25(OH)D level of 40 to 60 ng/mL is ideal (this takes into account assay variability) and that up to 100 ng/mL is safe(Table 2A & B)[1].

Table 2A & 2B: Showing Vitamin D status in relation to 25 (OH) D LEVELS

Table 2A: US IOM CLASSIFICATION

US IOM CLASSIFICATION	
VITAMIN D STATUS	**LEVELS**
SEVERE DEFICIENCY	<5 ng/mL
DEFICIENCY	<15ng/mL
SUFFICIENCY	>20ng/mL
RISK OF TOXICITY	>50ng/mL

TABLE 2B: US ENDOCRINE SOCIETY CLASSIFICATION

US ENDOCRINE SOCIETY CLASSIFICATION	
VITAMIN D STATUS	**LEVELS**
DEFICIENCY	≤20 ng/mL (50nmol/L)
INSUFFICIENCY	21-29ng/mL(52.5-72.550nmol/L)
SUFFICIENCY	≥30ng/mL
TOXICITY	>150ng/mL

VITAMIN D DEFICIENCY

Vitamin D deficiency is common due to several factors such as – decreased dietary intake, decreased cutaneous synthesis (because of cultural and religious practices, seasonal variation, fear of cancer, and practice of not taking the child out, increase in pigmentation), increasing rate of exclusive breast feeding, and low maternal vitamin D[20].Table 3.

Table 3: Aetiology of Vitamin D deficiency

Decreased vitamin D synthesis	Skin pigmentation, physical agents blocking UVR exposure, clothing, latitude season, air pollution, cloud cover, altitude
Decreased nutritional intake of vitamin	Strict vegan diet
Age and physiology related	Elderly, obese and institutionalised
Decreased maternal vitamin D stores	Exclusive breast feeding
Malabsorption	Celiac disease, pancreatic insufficiency (cystic fibrosis), biliary obstruction (biliary atresia)
Decreased synthesis	Chronic liver disease
Increased degradation of 25 (OH) D	Drugs such as rifampicin, isoniazid, anticonvulsants, glucocorticoids.

Signs and symptoms of Vitamin D deficiency

Vitamin D deficiency is known to cause several bone diseases.

-Rickets is a childhood disease characterized by impeded growth and deformity of the long bones. The earliest sign of subclinical vitamin D deficiency is craniotabes which is an abnormal softening or thinning of the skull.

-Osteomalacia is a bone-thinning disorder that occurs exclusively in adults and is characterized by proximal muscle weakness and bone fragility.

-Osteoporosis is a condition characterized by reduced bone mineral density and increased bone fragility.

Muscle aches and weakness (in particular proximal limb girdle), non skeletal problems like diabetes, hypertension, multiple sclerosis, rheumatoid arthritis, malignancies have been associated with Vitamin D deficiency[21] - **Figure 6.**

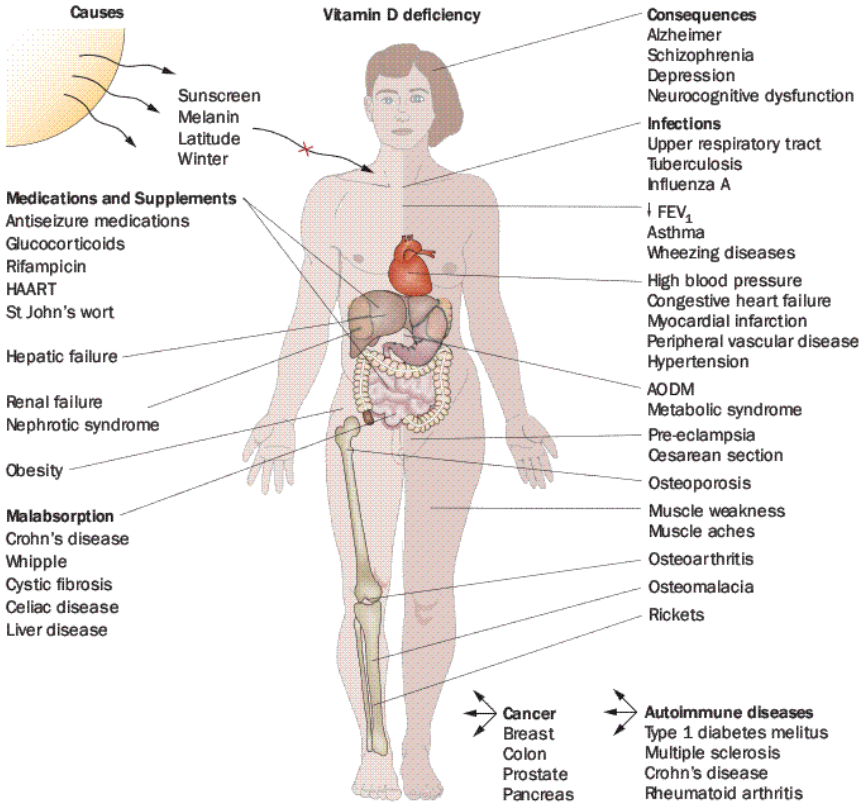


Figure6 :Showing different Consequences of Vitamin D deficiency

Vitamin D and immunity

The essential role of vitamin D in bone health and calcium homeostasis is well documented**.** However, vitamin D is now known to be involved in many cellular processes and receptors that are found in most cells in the body, suggesting that its importance extends beyond traditionally understood roles. As such, the benefits of vitamin D to other organ systems

havebecome an important area of study with recent advances describing its association with cardiovascular health, autoimmune disease and cancer[1].

Vitamin D receptors have been identified on many of the cells involved in the immune system, especially monocytes, macrophages and dendritic cells; in addition, these cells are also proved to have enzyme CYP27B1, which can locally convert the circulating 25 hydroxy vitamin D into the active form calcitriol. In addition to its endocrine functions, vitamin D may act in a paracrine or autocrine manner. Some of the more recently recognized non-classical actions of vitamin D include effects upon cell proliferation and differentiation as well immunologic effects resulting in an ability to maintain tolerance and to promote protective immunity. The antigen presenting cells (macrophages and dendritic cells), T cells and B cells also have the necessary machinery to synthesize and respond to $1,25(OH)_2$ D hence vitamin D may act in a paracrine or autocrine manner in an immune environment. Moreover, local levels of $1,25(OH)_2$ D may differ from systemic, circulating levels as local regulation of the enzymes synthesizing and inactivating vitamin D are different from the controls originating in the kidney. The extrarenal 1-α-hydroxylase enzyme in macrophages differs from the renal hydroxylase as it is not regulated by PTH. Instead, it is dependent upon circulating levels of 25 D or it may be induced by cytokines such as IFN-γ, IL-1 or TNF-α. Furthermore, the macrophage 24 hydroxylase enzyme is a non-functional splice variant, so there is no negative feedback of local $1,25(OH)_2$D production by $1,25(OH)_2$ D[22].

Vitamin D and pulmonary health

The known effects of vitamin D on immune function are described in relation to respiratory health. Vitamin D appears capable of inhibiting pulmonary inflammatory responses while enhancing innate defence mechanisms against respiratory pathogens[23]. There

hasbeenincreasing interest in the role of vitamin D in respiratory infections where it has been postulated that lower vitamin D levels may explain the seasonal variation in influenza and other viral infections[24].

Further evidence by in vitro studies support the potential role of vitamin D in pulmonary health and also found that primary lung epithelial cells express high baseline levels of 1α-hydroxylase and low levels of 24-hydroxylase resulting in active vitamin D production in the lungs[25].

The active vitamin D leads to increased expression of vitamin D regulated genes including CD14 andcathelicidin, important components of the innate immune system. In addition, study shows that in RSV-infected human airway epithelial cells, vitamin D induces Ikβα, an NF- kβ inhibitor, in airway epithelium and decreases RSV induction of inflammatory genes[26].Studies have also linked insufficient Vitamin D levels as a potential risk factor for the occurrence of asthma, acute exacerbations of asthma and also in active tuberculosis. Hence, Vitamin D promotes positive pulmonary health[27, 28,29].

Acute Lower Respiratory Tract Infections

Acute lower respiratory tract infections (ALRTI) are a group of illnesses transmitted through aerosolized droplets. ALRTI occur distal to the epiglottis and include laryngitis, tracheitis, bronchitis, bronchiolitis and pneumonia. The common etiologic agents of viral pneumonia include the respiratory syncytial virus (RSV), influenza A and B viruses, parainfluenza virus and adenoviruses.

1. While most ALRTI are non-life threatening viral infections, some such as RSV and influenza A and B viruses can result in severe disease and death.
2. The frequency of viral respiratory infections is highest during infancy and between ages 1-4 years.
3. Viral infections also hinder ciliary action in the bronchioles, which may predispose to super-infection with bacterial pathogens. Pneumonia is the most serious manifestation of ALRTI, with Streptococcus pneumoniae and Haemophilusinfluenzae type b (Hib) reported as the most common causes of bacterial pneumonia in children 2 months to 5 years of age[8].

Revised classification and treatment of childhood pneumonia under Integrated Management of Childhood Illness(IMCI)[30]:

A no pneumonia classification is made in a child 2-59 months of age with a history of cough or cold by history and no fast breathing and pneumonia as coughor chest indrawing or fast breathing with the presence of a respiratory rate that is higher than the cut-off established by WHO for infants and young children that is in 2 months up to 12 months 50 breaths per minute or more and in 12 months up to 5 years 40 breaths per minute or more. A severe pneumonia classification is made in a child 2-59 months of age with a history of cough or difficulty breathing and any one of the following: chest indrawing and/or stridor in a clam

child, or any general danger signs which include lethargy and unconsciousness, persistent vomiting, convulsions and inability to feed or drink[30].

Table 4 : Showing revised classification and treatment of childhood pneumonia of World Health Organization under IMCI strategy for children aged 2-59 months[30].

IMCI Classification	Clinical sign
No Pneumonia	Cough or cold (by history) and no fast breathing
Pneumonia	Cough or difficulty breathing (by history) and/or chest in-drawing [a]
Severe or very severe Pneumonia	cough or difficulty breathing, stridor in clam child and any of the danger signs [b]

[a] ≥50 breaths per minute in a child 2-11 months old or ≥40 breaths per minute in a child 12-59 months old

[b]Defined as the presence of any one or more of the following signs: 1) inability to breastfeed or swallow fluids; 2) persistent vomiting; 3) convulsions; and 4) unconscious or lethargic

VITAMIN D AND BREAST FEEDING

Vitamin D is proven to enhance lung development in infants and has a preservative effect on the development of wheezing and asthma that may occur later[31].Vitamin D deficiency is observed among breastfed infants at one end while dietary calcium deficiency is present in older children at the other end[20]. In a study done in India by Jain V et al[32] , it was observed that infants who were exclusively breastfed but who do not receive any supplemental vitamin D or adequate sunlight exposure were at increased risk of developing vitamin D deficiency and/or rickets. They also found a high prevalence of vitamin D deficiency in term, appropriate for gestational age breastfed infants and their mothers. The reason for this high prevalence in India may be related to decreased cutaneous synthesis owing to higher skin pigmentation. Lesser duration of exposure; less surface area of body exposed to sunlight due to greater coverage of body and lesser participation in outdoor activities were the other reasons proposed[32].

S. Balasubramanian in a review article discussed the rising incidence of vitamin D deficiency in infancy and found that potential risk factors for vitamin D deficiency in infancy include low maternal levels of vitamin D, indoor confinement during the day, living at higher altitudes, living in urban areas with tall buildings, air pollution, darker skin

pigmentation, use of sunscreen and covering much or all of the body when outside[33].

VITAMIN D AND ARTI

The association between Vitamin D status and plasma LL-37 (human cathelicidin which enhances microbial killing against a broad range of respiratory pathogens with a defined vitamin D- dependent mechanism) levels in children with pneumonia was evaluated in a case control study. It was observed that both Vitamin D and LL-37 levels were significantly lower

in children with pneumonia than in the control group. In support of the role of Vitamin D in the production of LL-37, the study further showed a highly significant positive correlation between Vitamin D and LL-37 inpatients, controls and in children with resolved pneumonia while there was a significant positive correlation in children with slowly resolved pneumonia. They concluded that inappropriate concentrations of Vitamin D decreases the ability of the immune system to defend against respiratory infections through lowering LL-37.[4]

A case control study was done by Wayse V et al[5] to observe the association of subclinical vitamin D deficiency with severe acute lower respiratory infection in 150 Indian children aged two to sixty months. The study showed that factors significantly associated with decreased risk of severe ALRI were: exclusive breastfeeding in the first 4 months, introduction of dietary liquids other than milk only after 6 months, use of liquid petroleum cooking fuel, infants not covered in swaddling clothes when exposed to sunlight before crawling and serum 25OHD3 levels >22.5 nmol/L . In a multivariate analysis, the factors associated with significantly lower odds ratio for having severe ALRI were: serum 25(OH)D3 levels >22.5 nmol/L (OR: 0.09; 95% CI 0.03-0.24; P<0.001) and exclusive breastfeeding in the first 4 months of life (OR 0.42; 95% CI 0.18-0.99; P=0.046) with age and height/age as significant covariates. It was concluded from the study that subclinical vitamin D deficiency and nonexclusive breastfeeding in the first 4 months of life were significant risk factors for severe ALRI in Indian children[5].

In a review article that examined 18 studies, it was found that vitamin D deficiency was associated with increased risk or severity of ALRI in 13 studies. The authors concluded that more research was required in context of Vitamin D and its role in ALRI and the impact of supplementation on the same. And the study also suggested that Vitamin D supplementation

is a low-cost, low risk intervention that providers should consider for children, especially those at high risk for ALRI [34].

Another study has also shown that low serum 25(OH) D was associated with increased risk of viral co-infections in wheezing children and also suggested that vitamin D might play a role in antiviral defence .The study also suggested an inverse association between 25(OH)D levels and specific types of viral infections.The study suggested that there was a link between a low serum 25(OH)D level and risk of viral co-infection, specifically the risk of RSV, rhinovirus, or both infections, which were involved in most of the co-infections. The association was demonstrated in the most severe spectrum of viral illnesses in children with acute wheezing necessitating hospitalization, which suggested that vitamin D might have a role in antiviral defence particularly in children at increased risk of moderate-to-severe viral infections, such as young infants exposed to RSV and high asthma risk children exposed to rhinovirus. The potential beneficial effects of vitamin D in the defence against respiratory tract infections were deduced to involve changes in both the innate and adaptive immune systems.third of children had low serum 25(OH)D levels, that provided additional evidence supporting a role of vitamin D in antiviral defence and suggested that it might be particularly important in wheezing children[35].

In a randomized double blinded placebo controlled trial of Mongolian school children in winter, Vitamin D3 supplementation of milk with 300 IU was assigned to the study group while the controls received unfortified milk to test the hypothesis that Vitamin D supplementation of children with Vitamin D deficiency would lower the risk of ARTI. It was observed that at the end of the trial, the median 25(OH)D levels of children in the control versus study group were significantly different and compared with the control group, children receiving vitamin D had fewer ARTI. The authors suggested that future trials were required

to examine the efficacy of different vitamin D supplementation regimens on ARTI risk in general as well as risk of ARTI caused by specific pathogens, such as respiratory syncytial virus and human rhinovirus[36].

In a systematic review and meta analysis of randomized controlled trials on Vitamin D and respiratory tract infections there was evidence from 11 trials that supplementation with vitamin D could be an effective means of preventing respiratory tract infection. Results indicated that vitamin D has a protective effect against ARTI, and dosing once-daily seems most effective[13].

A double blinded randomized controlled trial conducted by Choudhary N and Gupta P[37]in India was done to study the resolution of severe pneumonia with short term (5 days) Vitamin D supplementation.It was found that the duration of hospitalization and the time taken for resolution of tachypnea, chest retractions and inability to feed were comparable between the two groups. Hence it was concluded from the study that short-term supplementation with oral vitamin D had no beneficial effect on resolution of severe pneumonia in under-five children and it was suggested that further studies be conducted with higher dose of Vitamin D or longer duration of supplementation to corroborate the findings of the study[37].

Leis KS et al[38]conducted a study to determine if vitamin D intake was associated with ALRI in children younger than 5 years of age admitted to hospital with either bronchiolitis or pneumonia by comparing to an unmatched control group of the same age without respiratory infection. It was observed that the mean vitamin D intake of children with ALRI was less

compared to the control group. They concluded that a higher vitamin D intake than currently recommended might be needed to offer protection against diseases such as ALRI[38].

A Systematic review and meta-analysis was done to explore the role of vitamin D supplementation in prevention of respiratory tract infections. According to the review and meta-analysis, vitamin D significantly reduces the respiratory tract infection related events as compared to placebo. Beneficial effect of vitamin D was observed in children as well as adults[39].

A double-blinded individually randomised placebo-controlled trial was done in a hospital in Kabul comprising of 453 children aged 1–36 months, diagnosed with non-severe or severe pneumonia. Children with rickets, other concurrent severe diseases, very severe pneumonia or wheeze were excluded. In addition to routine pneumonia treatment, 224 children were given vitamin D3 while 229 children received placebo drops. There was no significant difference in the mean number of days to recovery between the vitamin D3 and placebo arms. The risk of a repeat episode of pneumonia within 90 days of supplementation was lower in the intervention than the placebo group. Children in the vitamin D3 group survived longer without experiencing a repeat episode. Hence the authors concluded that a single high-dose oral vitamin D3 supplementation to young children along with antibiotic treatment for pneumonia could reduce the occurrence of repeat episodes of pneumonia[40].

MATERIALS & METHODS

MATERIALS AND METHODS

Study hospital :

R L Jalappa hospital Kolar, is a tertiary level hospital catering to the local needs of the people of Kolar district.

Study population:

Children with ARTI aged between two months and five years fulfilling the inclusion criteria attending the Department of Paediatrics , during the study period from November 2014 to November 2015 were considered for the study.

Inclusion criteria:

Children aged between two months and five years with ARTI as defined by revised classification and treatment of childhood pneumonia underIntegrated management of childhood illnesses (IMCI)[30] as described below were included in the study

1.No Pneumonia: Cough or cold (by history) and no fast breathing.

2. Pneumonia :Cough or difficulty breathing (by history) and chest in-drawing (fast breathing: number of breaths in one minute for 2-12 months as $\geq$ 50 breaths per minute; 12 months -5 years fast breathing $\geq$40 breaths per minute)

3.Severe Pneumonia /Very SevereDisease: Cough or chest indrawing or stridor in a calm childor difficulty breathing and any general danger signs like inability to feed, lethargy, cyanosis)

Exclusion criteria:

1. Children already on vitamin D supplementation.
2. Children with clinical rickets.

Study design:

Across sectional observational hospital based study.

Sample size:

Sample size was estimated based on the prevalence of ARTI of 20 %[8]. Minimum sample sizeobtained was 67.

$$n = \frac{Z^2 pq}{d^2}$$

n=sample size

Z=standard deviation(which is at 95% confidence interval)

p=prevalence

q=(1-p)

d=margin of error

Where p=20, q=100-p, d=10% absolute error at 95% confidence interval, 10% non responsive.

Study tools:

Proforma (Annexure 1)

Children were evaluated with a detailed clinical history (nature and duration of symptoms) and background characteristics including feeding practices (breastfeeding history and age of introduction of complementary foods), immunization status, and socio-demographic variables such as the parental education, occupation, family income, details of cooking fuel used in the household, family history of smoking, and history of lower RTI in the past. Information was collected regarding the practice of exposure of the child to sunlight. A semi-structured proforma was prepared. Based on severity of ARTI, patients were classified according to the IMCI criteria[30].

Blood sampling:

For all cases satisfying the inclusion criteria and who had consented were included in the study. Two milliliters of venous blood sample was collected in a plain vial and stored at -80^0 C [41,42]. The samples were used for Vitamin D estimationusing Micro Vue -25-OH Vitamin D Kit under the Department of Allied Health Sciences attached to the university.

Method of Vitamin D estimation:

Principle and method of the procedure:

The MicroVue 25-OH Vitamin D kit is a solid phase Enzyme Linked Immunosorbent (EIA) Assay kit which is performed using Microtiterplate. First was the incubation step which was done at room temperature for a period of two hours. This step allows for the estimation of total 25OH Vitamin D (D2 and D3) present and also allows the dissociation of 25OH Vitamin D from binding serum proteins to fix on binding sites of a specific monoclonal antibody. It was followed by washing the Microtiter plate. After first washing step, a fixed amount of 25OH Vitamin D-labelled with biotin in presence of horseradish peroxidase (HRP) compete with unlabelled 25OH Vitamin D 2 and 25OH Vitamin D3 present on the binding sites of the specific monoclonal antibody. The Microtiterplate was left for 30 minutes of incubation period at room temperature. The Microtiter plate was then washed to stop the competition reaction. After this step, a chromogenic solution was added and the Microtiterplate incubated for 15 minutes. The reaction is stopped with the addition of Stop Solution and the Microtiter plate was then read at the appropriate wavelength. The amount of substrate turnover was determined colourimetrically by measuring the absorbance, which is inversely proportional to the total 25OH Vitamin D (D2 and D3) concentration. A calibration curve was plotted and the total 25OH Vitamin D (D2 and D 3) concentrations of the samples were determined by dose interpolation from the calibration curve[43] as shown in figure - 7.

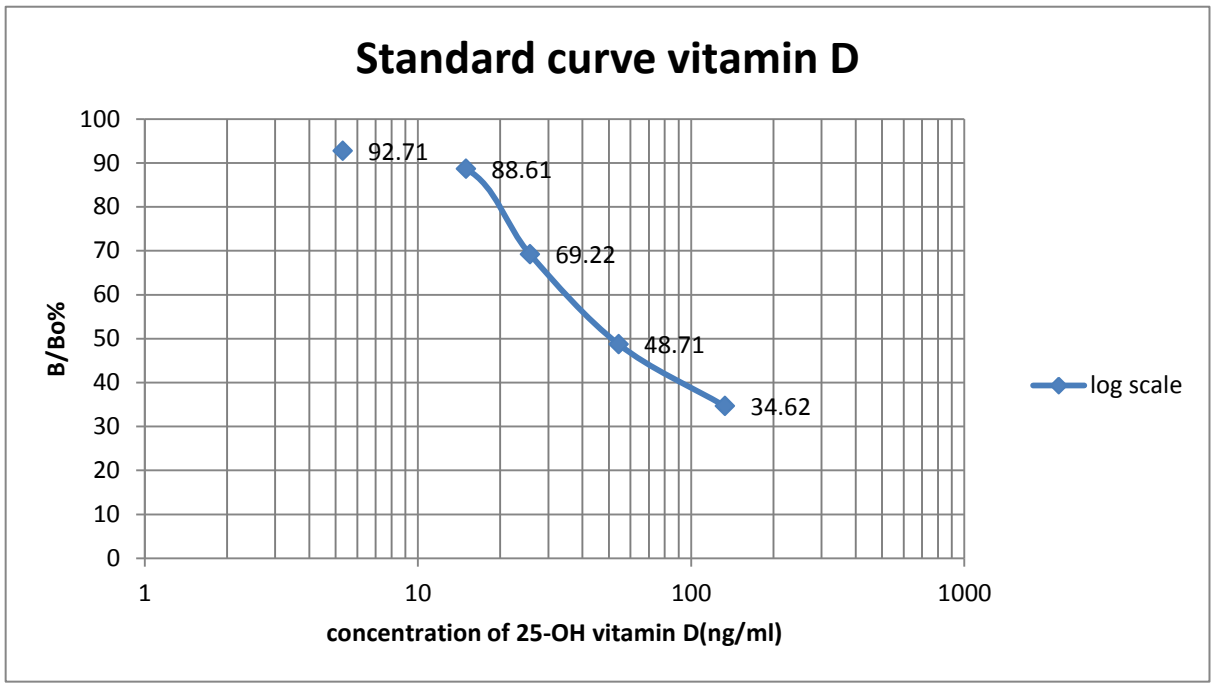


Figure 7: Showing the Calibration curve

Figure 8: Enzyme LinkedImmunosorbentAssay KIT

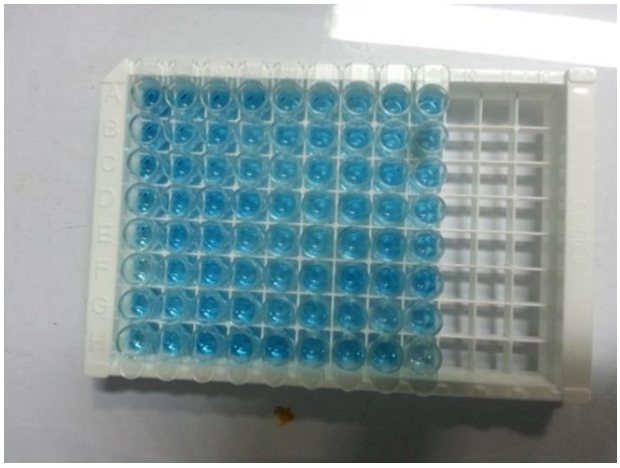


Figure 9: Microtiter with substrate

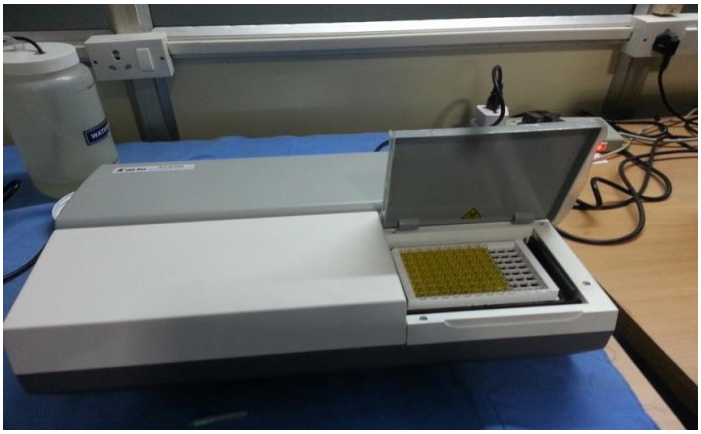


Figure 10: ELISA Microtiter reader

STUDY METHODOLOGY

A hospital-based observational cross sectional study was conducted at R L Jallappa hospital. Cases were children from 2 months to 5years of age admitted as in-patients in the department of Paediatrics with ARTI as per WHO- IMCI criteria[30]. After obtaining permission from the institutional review board and written informed consent from the parents of the patients a detailed history was taken and entered in the proforma.

Previous history of similar complaints was also taken. Breastfeeding history and the age of introduction of supplementary foods were recorded. Parents were explained the meaning of „exclusive breastfeeding" (breast milk and nothing else) and asked if their child was exclusively breastfed during the first 6 months of life. History of age of introduction of supplementary feeding was also elicited. Top feeding was defined as lack of exclusive breast feeding with receipt of any other feed other than breast feeds including water in the first 6 months of life. Mixed feeding was defined as both breast feeding and top feeding.Immunization history was asked in detail from the parents. A child was assessed to be completely immunized if he/she had received all vaccinations due for the age according to national immunization schedule. Socioeconomic status was determined using BG Prasad's Scale[44].

Socioeconomic class	Revised income categories for 2014(Rupees)
Upper class	4860 and above
Upper middle class	2406-4859
Middle class	1424-2405
Lower middle class	737-1423
Lower class	< 736

Table 5: Showing SocioeconomicStatus(BG Prasad's Scale)

Information regarding the practice of exposure of the child to sunlight was collected including the frequency and approximate duration of sun exposure. History of smoking by various members in the family and details of cooking fuel used were recorded. A detailed clinical examination was performed.Length of the child was measured on an infantometer to the nearest centimeter till the age of two years and thereafter height on a stadiometer. Weight of the child was recorded on beam type of weighing scale to the nearest 100 g. Children were examined for pallor and was labelled as anaemia if pallor was present in the conjunctiva and/or mucous membrane and/or colour of palmar creases was similar to the rest of the palm[45].

Two ml of venous blood sample was drawn for estimation of Vitamin D (25[OH] D3) levels. ELISA kit method was used for assessing vitamin D status. Vitamin D levels were classified as per the Endocrine Society recommendations in which vitamin D deficiency was defined as a 25(OH)D level of 20 ng/mL or less, 21 to 29 ng/mL as insufficient and 30 ng/mL or greater as sufficient[46].

All children with deficient Vitamin D levels (≤ 20ng/ml) received Vitamin D supplementation as per Stoss regimen[20] as shown in Table 6. All other children received the recommended Vitamin D supplements of 400 IU/day.

Group	**Stoss therapy(oral)**	**Maintenance**
1-12 months old	1 - 6 lakh units over 1-5 days	400- 1,000 IU
1- 5 years old	3-6 lakh units over 1-5 days	600-1,000 IU

Table 6: Showing treatment regimens for vitamin D deficiency

Statistical Analysis

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of frequencies and proportions. **Chi-square test** was used as test of significance for qualitative data. Yatescorrection was applied where ever applicable.

Graphical representation of data: MS Excel and MS word was used to obtain various types of graphs such as bar diagram and Pie diagram.

p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Statistical software: MS Excel**,** SPSS version 22 **(**IBM SPSS Statistics, Somers NY, USA) was used to analyze data. EPI Info (CDC Atlanta), Open Epi, Med calc and Medley‟s desktop were used to estimate sample size, odds ratio and reference management.

RESULTS

RESULTS

TABLE 7: DISTRIBUTION OF ARTI CASES ACCORDING TO AGE (N=82)

AGE IN MONTHS	FREQUENCY	PERCENTAGE
2-12	46	56%
13-24	17	20.7%
25-36	9	10.9%
37-48	4	4.8%
49-60	6	7.31%

In the study , it was observed that majority (56%) of subjects belonged to the age group of 2 months to 12 months, while 17(20.7%) were in the age group of 13 to 24 years,9 (10.9%) in the age group of 25 to 36 months, 6(7.31%) in the age group of 49 to 60months and 4 (4.8%) in the age group of 37 to 48 months- Table 7& Fig 11.

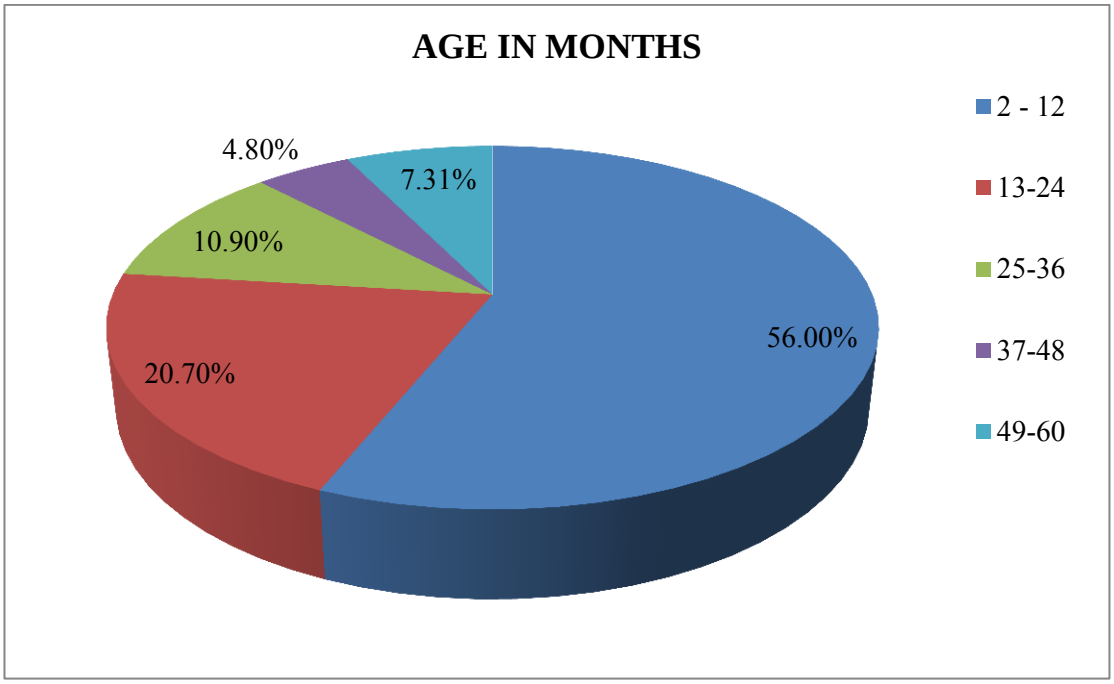


Figure 11: PIE DIAGRAM SHOWING DISTRIBUTION OF ARTI CASES ACCORDING TO AGE

TABLE 8: DISTRIBUTION OF ARTI CASES ACCORDING TO SEX (N=82)

SEX	FREQUENCY	PERCENTAGE
MALE	51	62.2%
FEMALE	31	37.8%

It was observed that 51 (62%) of subjects were males and 31 (38%) were females – Table 8& Fig 12.

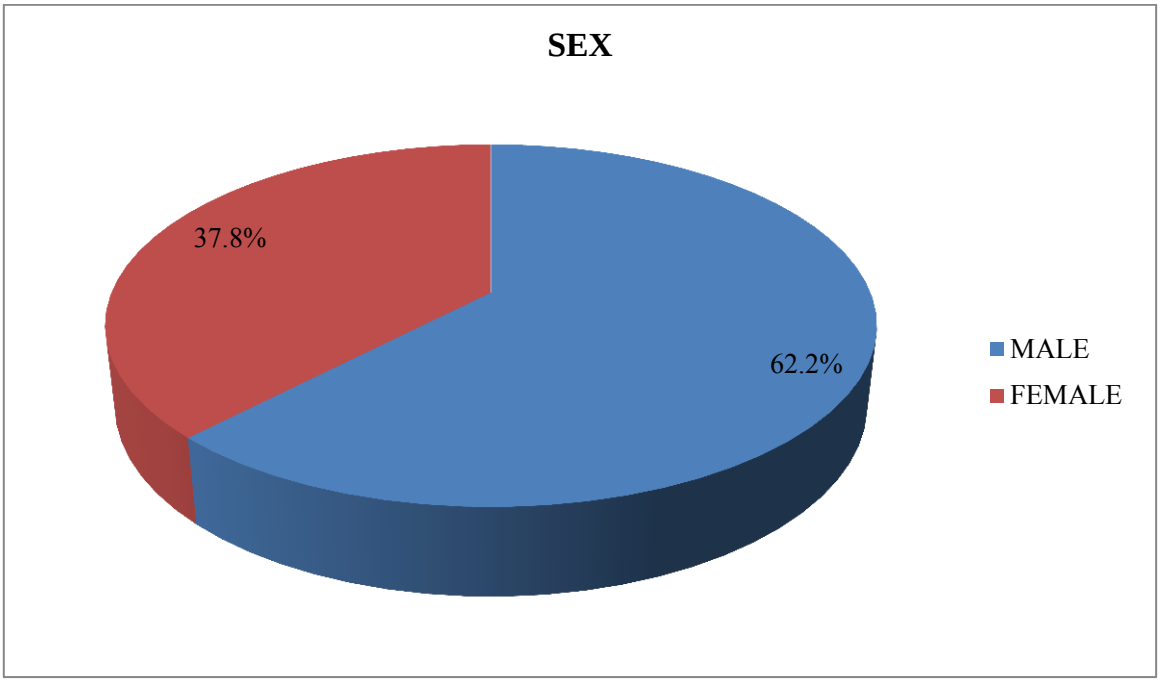


Figure 12: PIE DIAGRAM SHOWING DISTRIBUTION OF ARTI CASES ACCORDING TO SEX

TABLE 9: DISTRIBUTION OF ARTI CASES ACCORDING TO RELIGION (N=82)

RELIGION	FREQUENCY	PERCENTAGE
HINDUS	70	85%
MUSLIMS	8	9.7%
CHRISTIANS	4	5.3%

In the study,majority(85%) of the subjects belonged to Hindu religion while 8(9.7%) were Muslimsand 4 (5.3%) were Christians– Table 9& Fig 13.

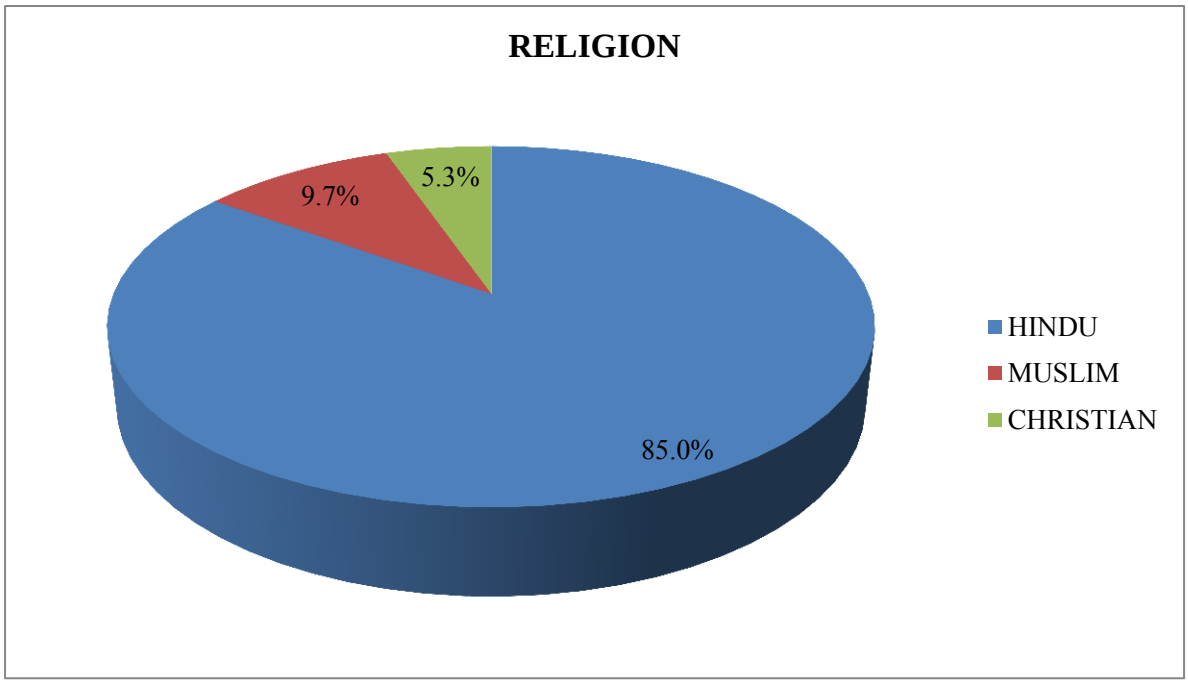


Figure 13: PIE DIAGRAM SHOWING DISTRIBUTION OF ARTI CASES ACCORDING TO RELIGION

TABLE10: DISTRIBUTION OF ARTI CASES ACCORDING TO SOCIO-ECONOMIC STATUS (N=82)

SOCIO ECONOMIC CLASS	FREQUENCY	PERCENTAGE
UPPERCLASS	3	3.6%
UPPER MIDDLE CLASS	21	25.6%
MIDDLE CLASS	30	36.5%
LOWER MIDDLE CLASS	21	25.6%
LOWER CLASS	7	8.7%

Table 10& Fig 14 show distribution of the study subject according to socio economic status where maximum (36.5%) subjects belonged to Middle Class while,21 (25.6%) belonged to Lower Middle and Upper Middle Classes each. Seven (8.7%) belonged to Lower Class and 3 (3.6%) belonged to Upper Class.

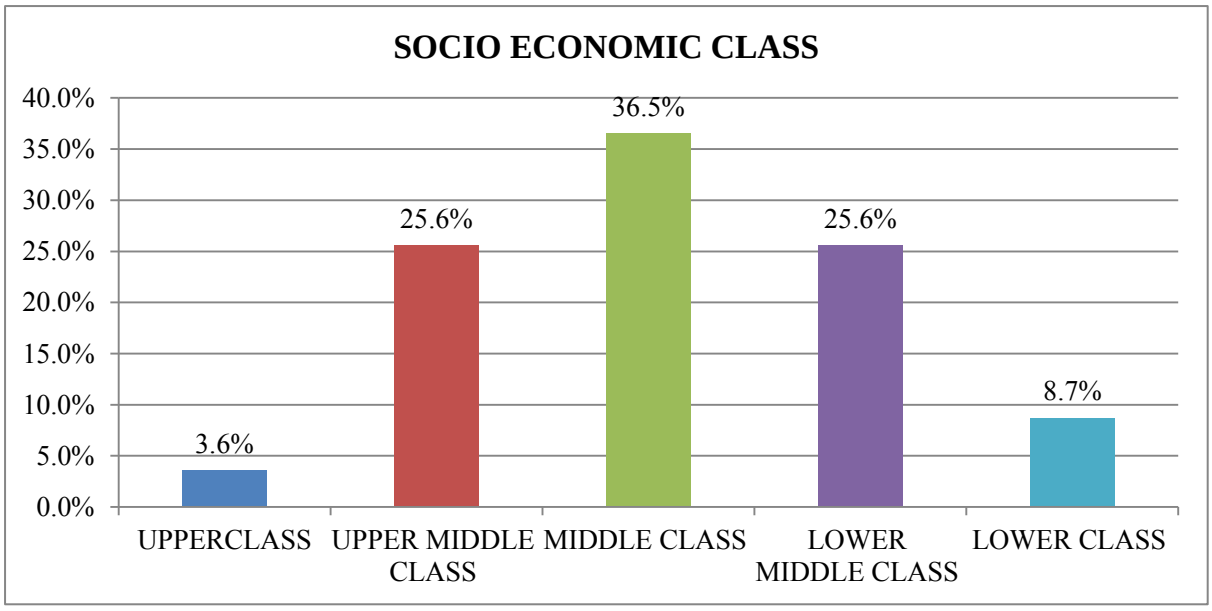


Figure 12: BAR DIAGRAM SHOWING DISTRIBUTION OF ARTI CASES ACCORDING TO SOCIO-ECONOMIC STATUS

TABLE 11: DISTRIBUTION OF ARTI CASES ACCORDING TO TYPE OF FEEDING WITHIN FIRST SIX MONTHS OF LIFE (N=82)

TYPE OF FEEDING	FREQUENCY	PERCENTAGE
EXCLUSIVE BREAST FEEDING	60	73.2%
TOP FEEDING ONLY	3	3.6%
COMBINED FEEDING	19	23.2%

In the study population it was found that 60(73.2%) children were exclusively breast fed. Three subjects (3.6%) were only on top feeds and 19 (23.2%)received both breast feeding and top feeds -Table 11& Fig 15.

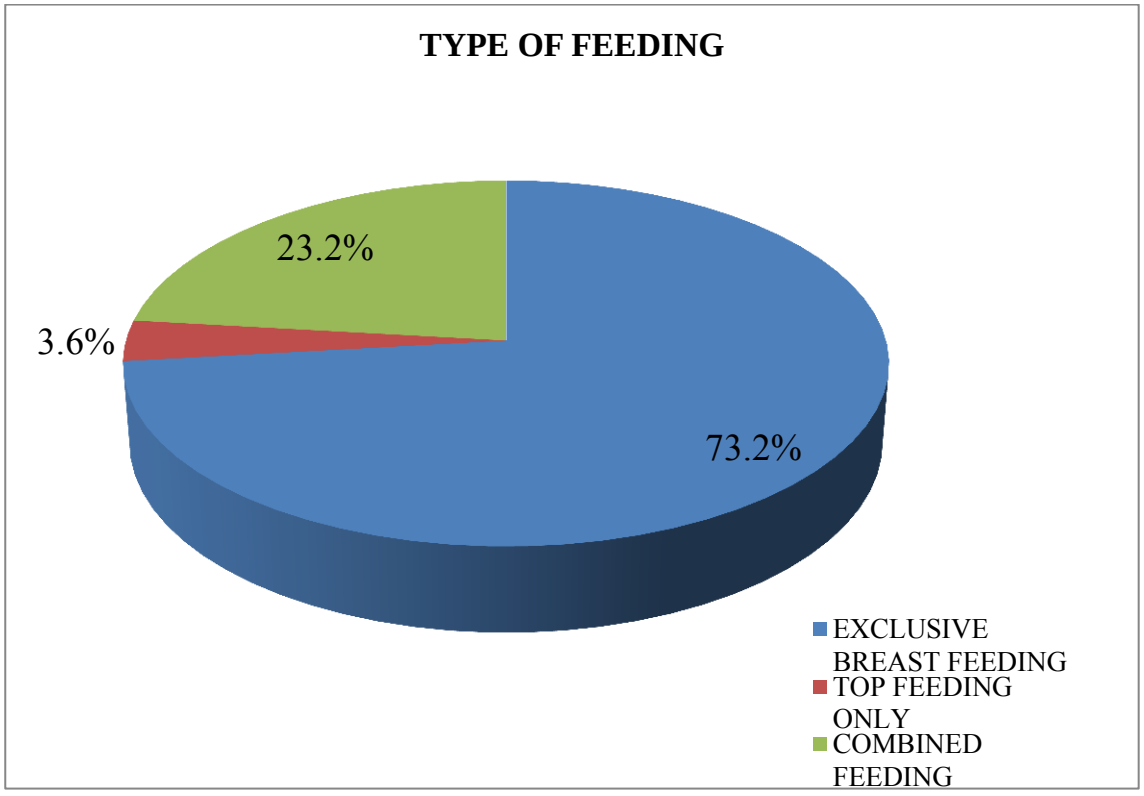


Figure 13: PIE DIAGRAM SHOWING DISTRIBUTION OF ARTI CASES ACCORDING TO TYPE OF FEEDING WITHIN FIRST SIX MONTHS OF LIFE

TABLE 12:DISTRIBUTION OF ARTI CASES ACCORDING TO IMMUNIZATION STATUS (N=82)

IMMUNIZATION HISTORY	FREQUENCY(PERCENTAGE)
UPTO DATE	34(41%)
PARTIAL	48(59%)

Among the study subjects, 34(41%) were immunized up to date and 48 (59%) subjectswere partially immunized –Table 12& Fig 16.

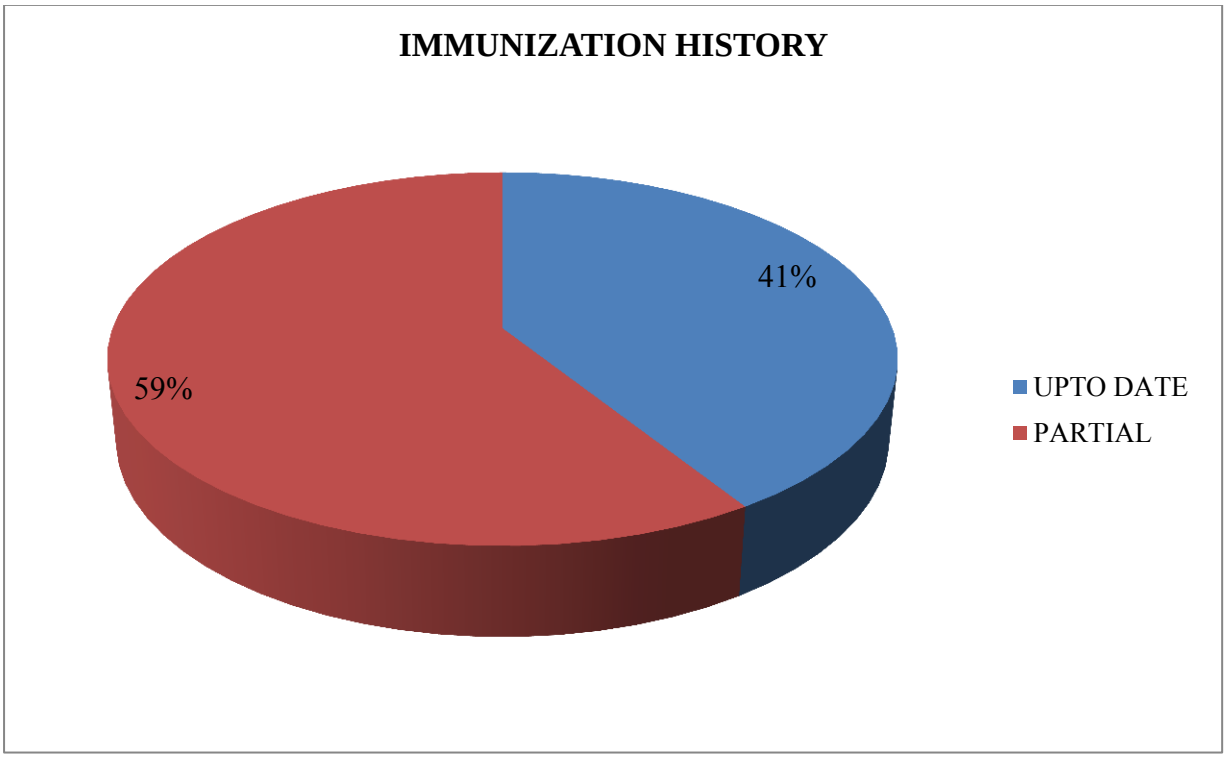


Figure 16: PIE DIAGRAM SHOWING DISTRIBUTION OF ARTI CASES ACCORDING TO IMMUNIZATION STATUS

TABLE 13: DISTRIBUTION OF ARTI CASES ACCORDING TO PAST HISTORY OF RESPIRATORY TRACT INFECTION (N=82)

PAST RESPIRATORY TRACT INFECTION	FREQUENCY(PERCENTAGE)
PRESENT	49(59.7%)
ABSENT	33(40.3%)

In the study 49 (59.7%) of subjects had past respiratory tract infection while 33(40.3%) had no history of past respiratory tract infections –Table 13& Fig 17.

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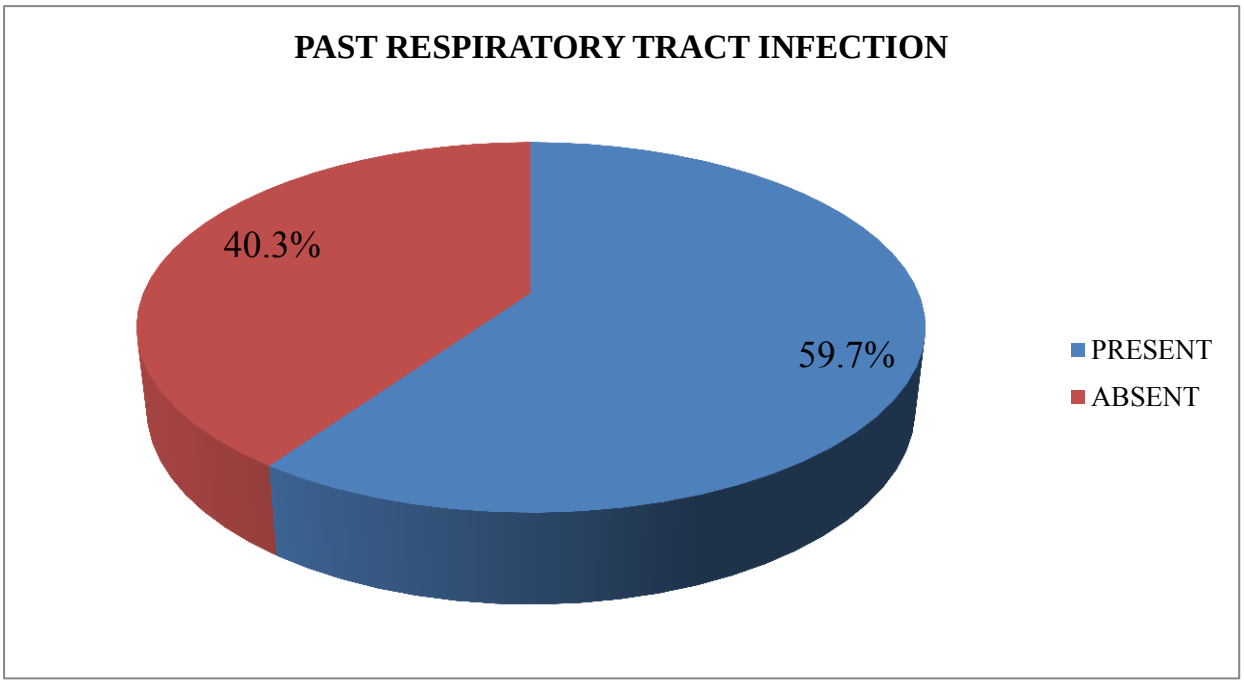


Figure 17: PIE DIAGAM SHOWING DISTRIBUTION OF ARTI CASES ACCORDING TO PAST HISTORY OF RESPIRATORY TRACT INFECTION

TABLE 14:DISTRIBUTION OF ARTI CASES ACCORDING TO FAMILY HISTORY OF SMOKING (N=82)

FAMILY HISTORY OF SMOKING	FREQUENCY(PERCENTAGE)
PRESENT	39(47.5%)
ABSENT	43(52.5%)

Family history of smoking was present in 47.5% of the subjects–Table 14& Fig 18

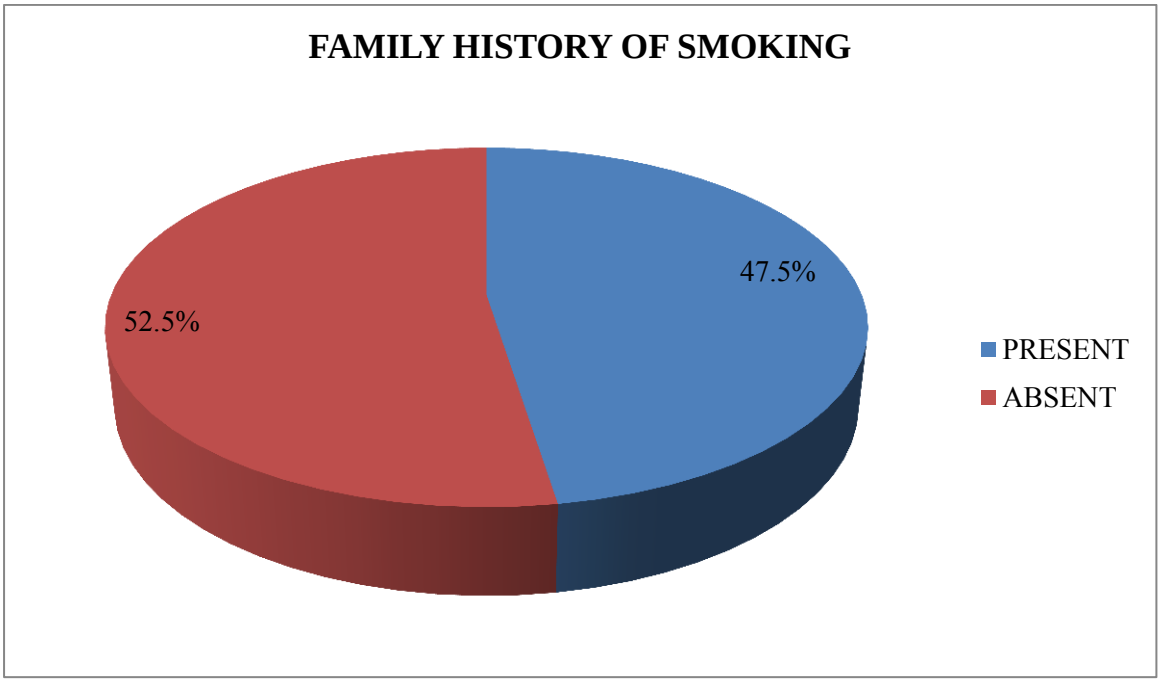


Figure 18: PIE DIAGRAM SHOWING DISTRIBUTION OF ARTI CASES ACCORDING TO FAMILY HISTORY OF SMOKING

TABLE 15:DISTRIBUTION OF ARTI CASES ACCORDING TO COOKING FUEL USED IN THE FAMILY (N=82)

FUEL USED	FREQUENCY(PERCENTAGE)
KEROSENE	5(6%)
WOOD	2(2%)
LPG	75(92%)

In the study it was observed that the commonly used fuel for cooking was LPG in92% of families, while 5(6%) were using kerosene and 2(2%) were using firewood –Table 15& Fig 19.

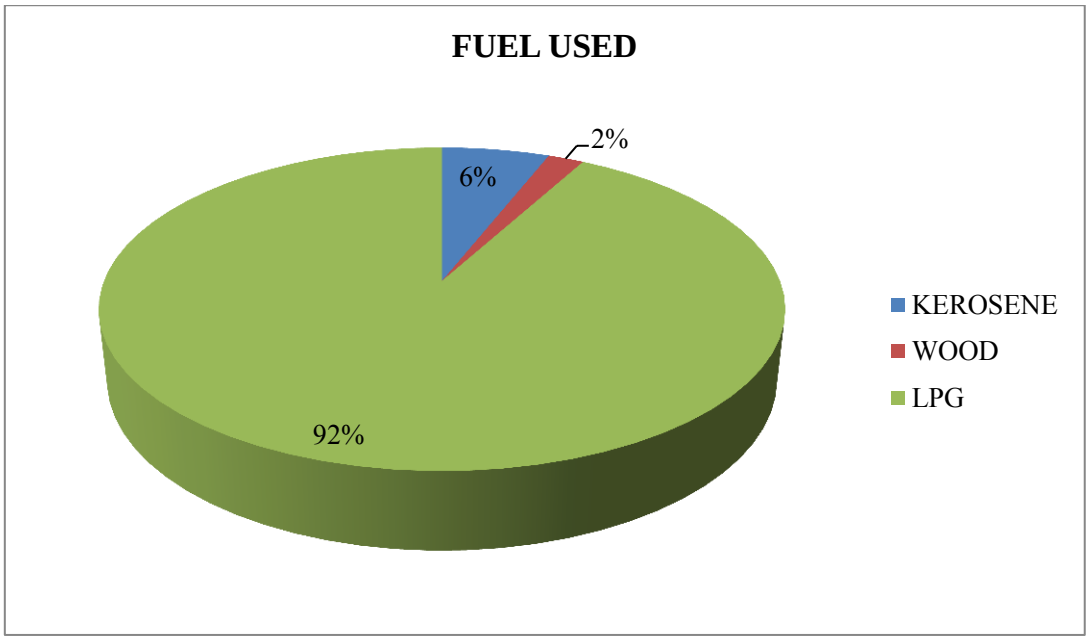


Figure 19: PIE DIAGRAM SHOWING DISTRIBUTION OF ARTI CASES ACCORDING TO COOKING FUEL USED IN THE FAMILY

TABLE 16:DISTRIBUTION OF ARTI CASES ACCORDING TO CLINICAL PALLOR (N=82):

PALLOR	FREQUENCY(PERCENTAGE)
PRESENT	60(73%)
ABSENT	22(27%)

Out of 82 subjects in the study, 60(73%) had pallor while 22 (27%) had no pallor-Table 16 & Fig 20.

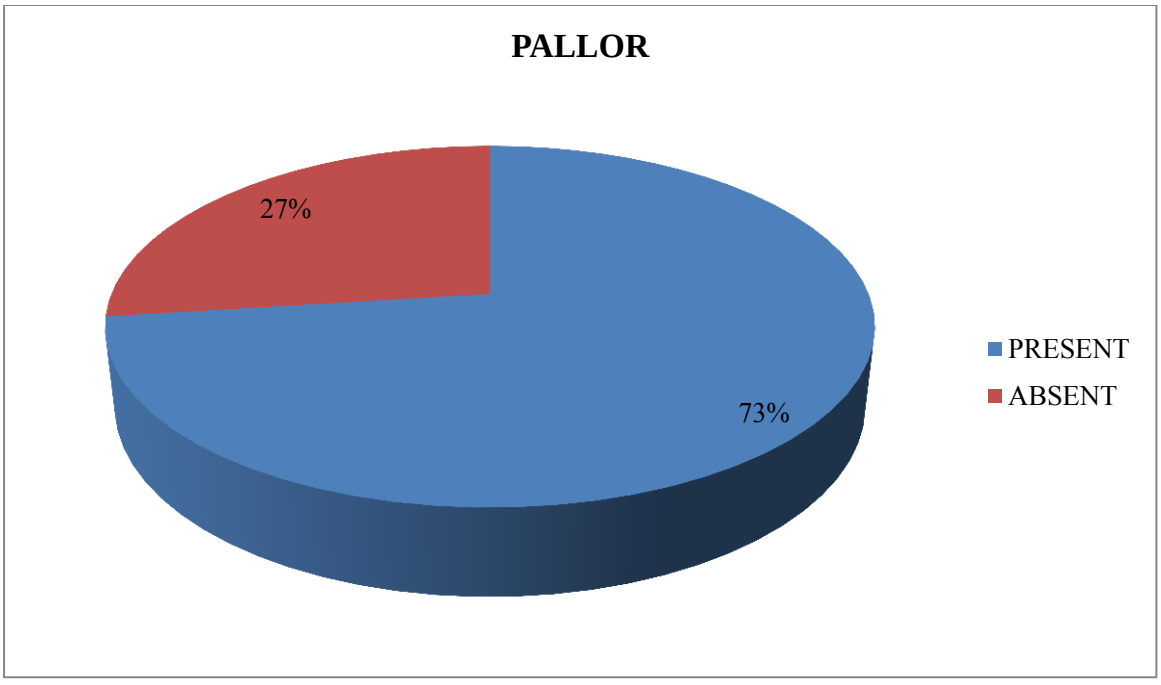


Figure 20: PIE DIAGRAM SHOWING DISTRIBUTION OF ARTI CASES ACCORDING TO CLINICAL PALLOR

TABLE 17: DISTRIBUTION OF ARTI CASES ACCORDING TO DURATION OF SUNLIGHT EXPOSURE (N=82)

EXPOSURE TO SUNLIGHT IN HOURS/DAY	FREQUENCY(PERCENTAGE)
1-2	14(15%)
3-4	32(41%)
5-6	27(33%)
>6	5(6%)
NO EXPOSURE	4(5%)

It was observed that 41% and 33% of the population were exposed to 3-4 hours and 5-6 hours ofsunlight per day respectively. Among the remaining subjects, 15% and 16% received 1-2 hours and >6 hours of sunlight exposure per day respectively. In 4(5%) children there was no exposure to sunlight at all –Table 17& Fig 21

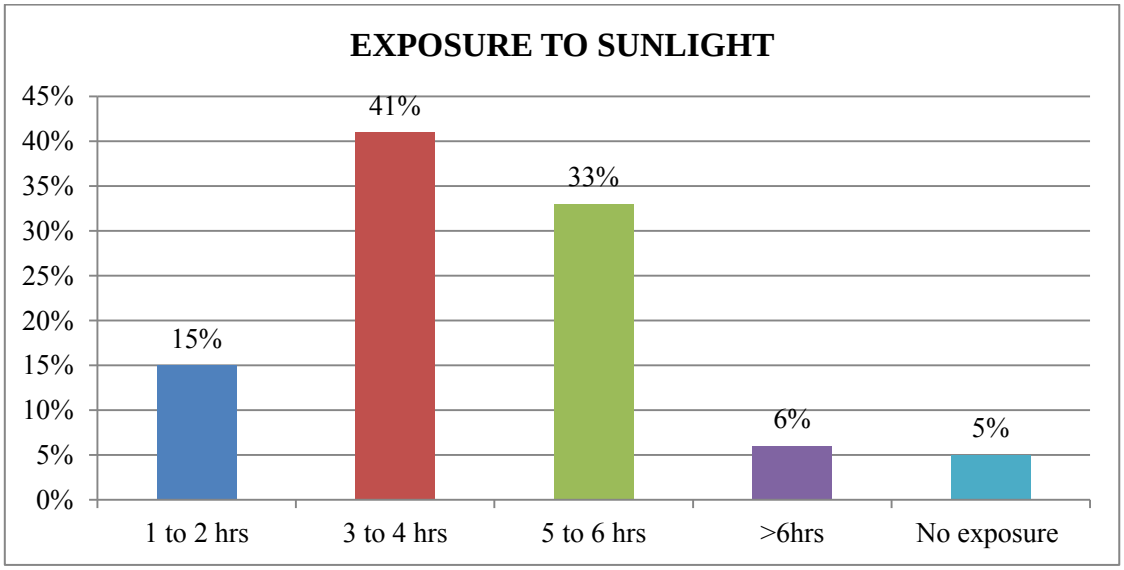


Figure 21: BAR DIAGRAM SHOWING DISTRIBUTION OF ARTI CASES ACCORDING TO DURATION OF SUNLIGHT EXPOSURE

TABLE 18: DISTRIBUTIONOF ARTI CASES ACCORDING TO SEVERITY OF PNEUMONIA (N=82)

SEVERITY OF PNEUMONIA	FREQUENCY	PERCENTAGE
NO PNEUMONIA	13	15.8%
PNEUMONIA	38	46.4%
SEVERE PNEUMONIA/VERY SEVERE DISEASE	31	37.8%

Out of 82 subjects in the study, 13 (15.8%) had no pneumonia while 38(46.4%) had pneumonia and 31 (37.8%) had severe pneumonia or very severe disease – Table 18& Fig 22.

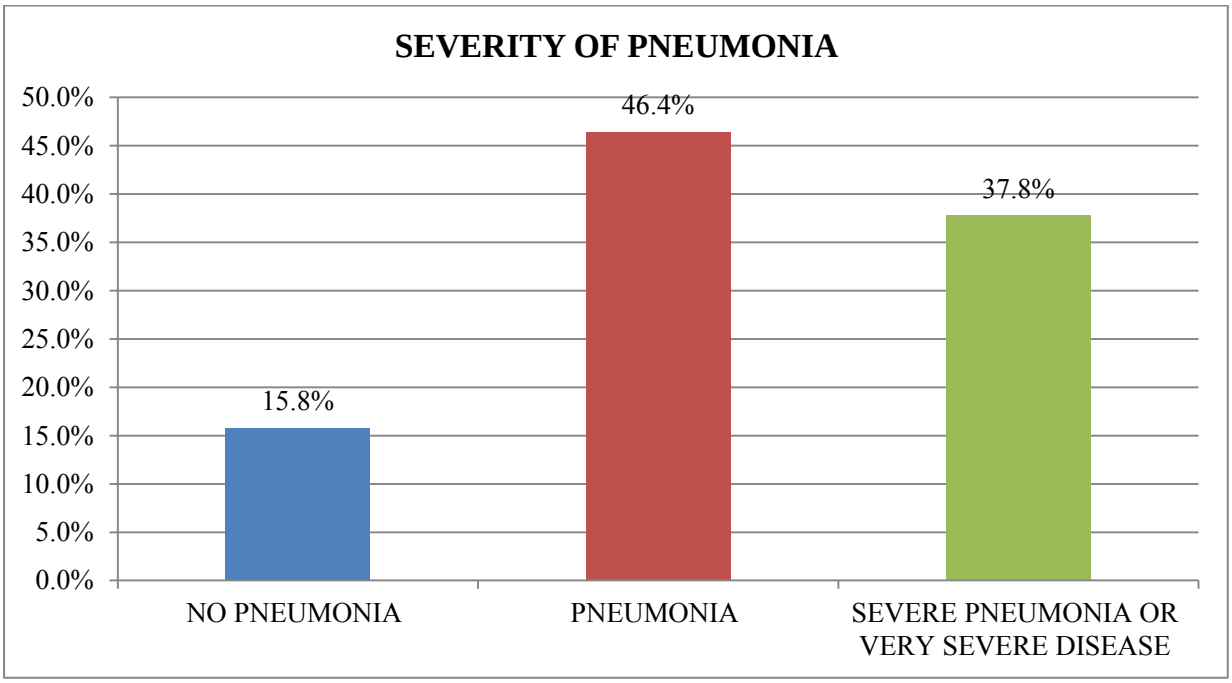


Figure 22: BAR DIAGRAM SHOWING DISTRIBUTION OF ARTI CASES ACCORDING TO SEVERITY OF PNEUMONIA

TABLE 19: DISTRIBUTION OF ARTI CASES ACCORDING TO SERUM VITAMIN D LEVELS (N=82)

SERUM VITAMIN D LEVELS	FREQUENCY(PERCENTAGE)
SUFFICIENT ≥30ng/ml	6(7.3%)
IN SUFFICIENT 21-29ng/ml	48(58.5%)
DEFICIENCT≤20ng/ml	28(34.2%)

Out of 82 subjects almost half of them (58.5%) had insufficient serum Vitamin D levels while 34.2% had deficient levels. Only 7.3% had sufficient levels Table 19& Fig 23.

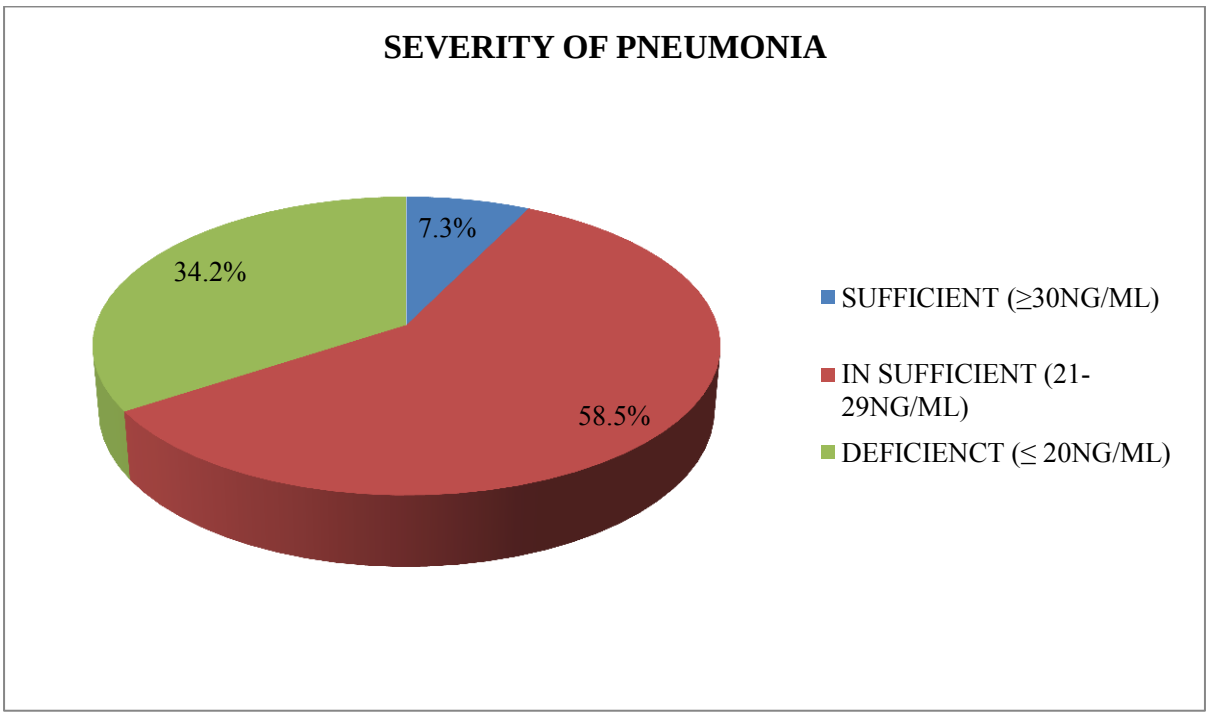


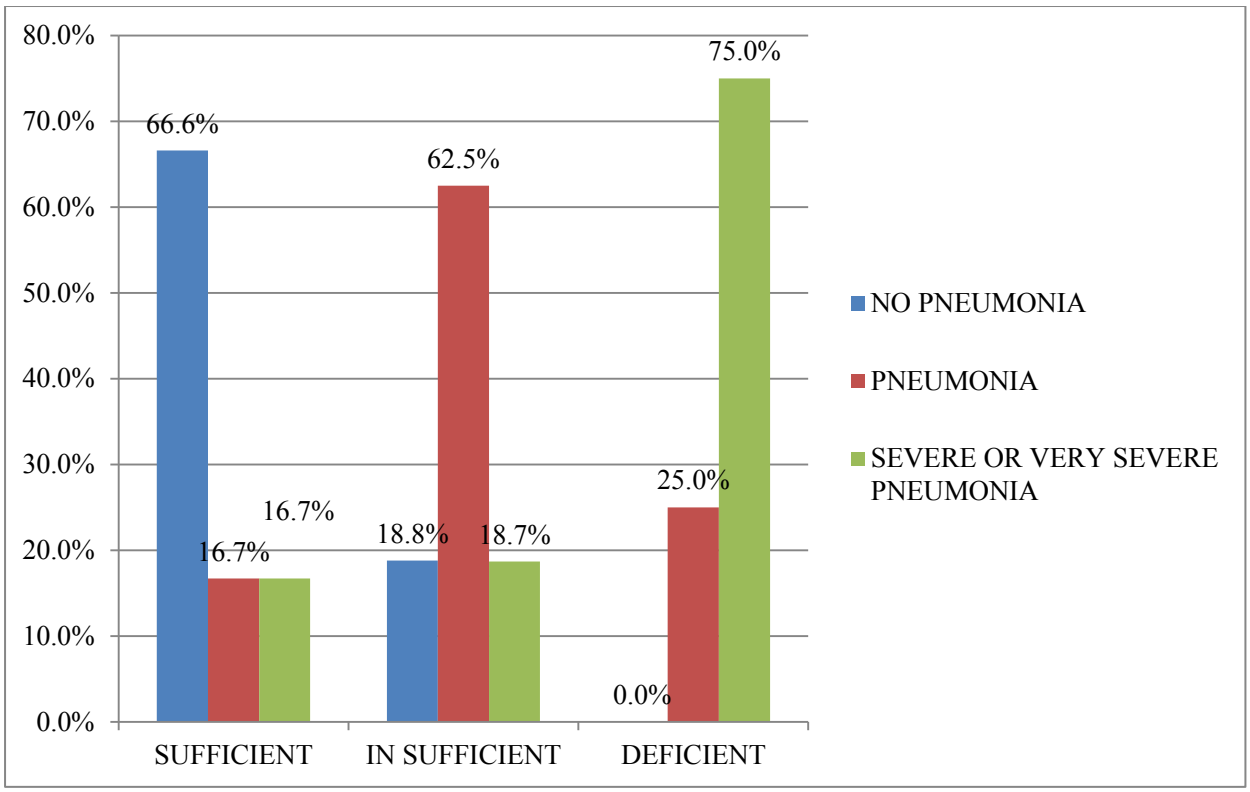
Figure 23: PIE DIAGRAM SHOWING DISTRIBUTION OF ARTI CASES ACCORDING TO SERUM VITAMIN D LEVELS

TABLE 20: ASSOCIATION OF SERUM VITAMIN D WITH SEVERITY OF PNEUMONIA

VITAMIN D LEVELS	NO PNEUMONIA	PNEUMONIA	SEVERE PNEUMONIA ORVERY SEVERE DISEASE	TOTAL	$\chi 2$ VALUE	„P" VALUE
SUFFICIENT ≥30ng/ml N=6	4(66.6%)	1(16.7%)	1(16.7%)	6	36.6	<0.001
IN SUFFICIENT 21-29ng/ml N=48	9(18.8%)	30(62.5%)	9(18.7%)	48		
DEFICIENT ≤20ng/ml N=28	-	7(25%)	21(75%)	28		
TOTAL	13	38	31	82		

Table 20 & Fig 24 depict the association of serum Vitamin D levels with severity of pneumonia. It was observed that in those subjects with sufficient serum Vitamin D levels, 66% had no pneumonia while pneumonia and severe pneumonia was present in only 16.7% each. In the group with insufficient serum Vitamin D levels, 62.5% had pneumonia while 18.7% had severe pneumonia. In the group with deficient serum Vitamin D levels, 75 % had severe pneumonia while 25% had pneumonia. Thus pneumonia and severe pneumonia was found in increasing frequency in children with insufficient and deficient serum Vitamin D levels which was statistically significant.

Figure 24: BAR DIAGRAM SHOWING ASSOCIATION OF SERUM VITAMIN D WITH SEVERITY OF PNEUMONIA



ASSOCIATION OFSERUM VITAMIN D LEVELS WITH VARIOUS RISK FACTORS OF ARTI CASES

TABLE 21: ASSOCIATION BETWEEN AGE OF ARTI CASES AND SERUM VITAMIN D LEVELS

	AGE IN MONTHS					$\chi 2$ VALUE	„P" VALUE
	2-12	13-24	25-36	37-48	49-60		
SUFFICIENT ≥30ng/ml N=6	5(83.3%)	1(16.6%)	-	-	-		
IN SUFFICIENT 21-29ng/ml N=48	27(56%)	9(18.7%)	6(12.5%)	3(6.4%)	3(6.4%)	2.51	0.867
DEFICIENT ≤20ng/ml N=28	14(50%)	7(25%)	3(11%)	1(3.5%)	3(10.5%)		

Among the group with insufficient serum vitamin D levels, majority (56%) were in the age group of 2-12months while 9(18.7%) and 6(12.5%) subjects were in the age groups of 13-24 months and 25-36 months respectively. Among the group with deficient serum vitamin D levels, half (50%) of them were in the age group of 2-12 months. The other 50% were distributed among the other age groups.

In the group with sufficient vitamin D levels, 83.3% were in the age group of 2-12 months and 16.6% were in the age group of 13-24 months. None of the children above 25 months had sufficient serum vitamin D levels. However it was not significant statistically - Table 21 & Fig 25.

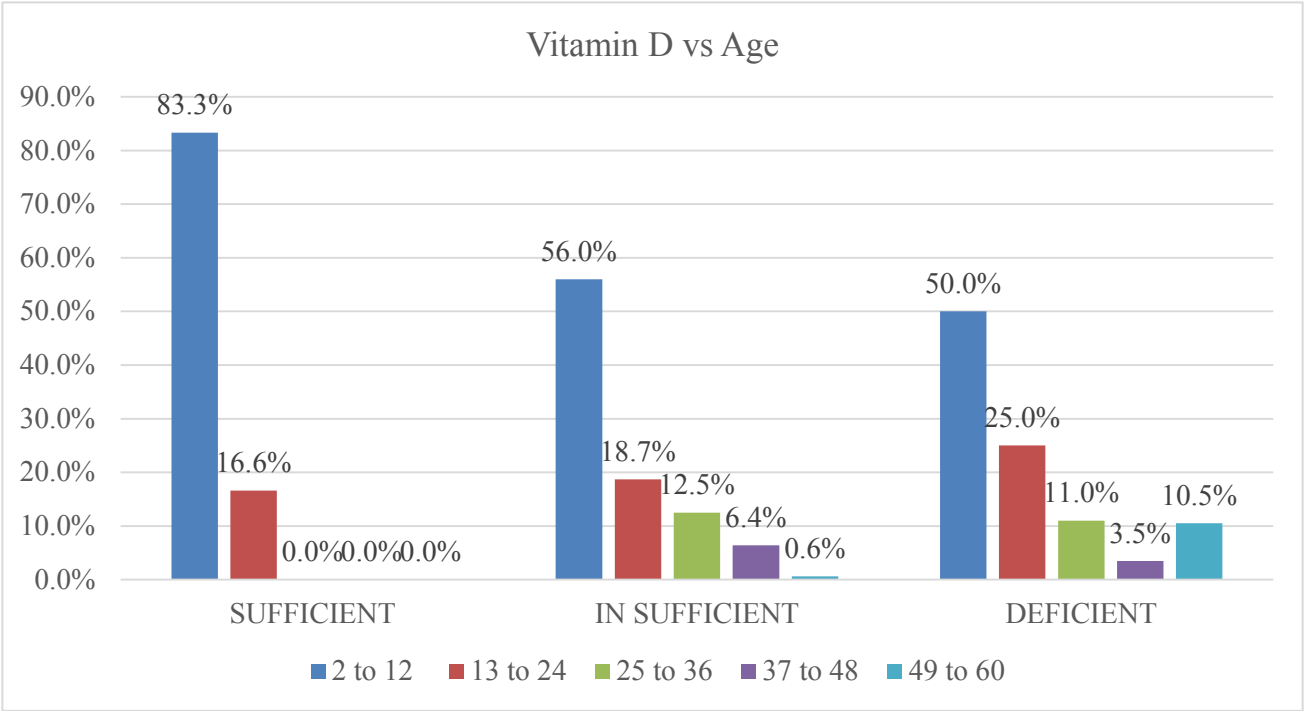


Figure 25: BAR DIAGRAM SHOWING ASSOCIATION OF ARTI CASES BETWEEN AGE AND SERUM VITAMIN D LEVELS

TABLE 22: ASSOCIATION BETWEEN SEX OF ARTI CASES AND SERUM VITAMIN D LEVELS

VITAMIN D	Gender		χ2 Value	„P“ Value
	MALE	FEMALE		
SUFFICIENT ≥30ng/ml N=6	3(50%)	3(50%)	0.522	0.770
IN SUFFICIENT 21-29ng/ml N=48	31(64%)	17(36%)		
DEFICIENT ≤20ng/ml N=28	17(60%)	11(40%)		

In the group with insufficient vitamin D levels, 64% of subjects were males while 36% were females. In the group with deficient serum vitamin D levels, majority (64%) were males. In the group with sufficient vitamin D levels there was an equal distribution among males and females.

However there was no significant association between Vitamin D status and gender distribution-Table 22& Fig 26

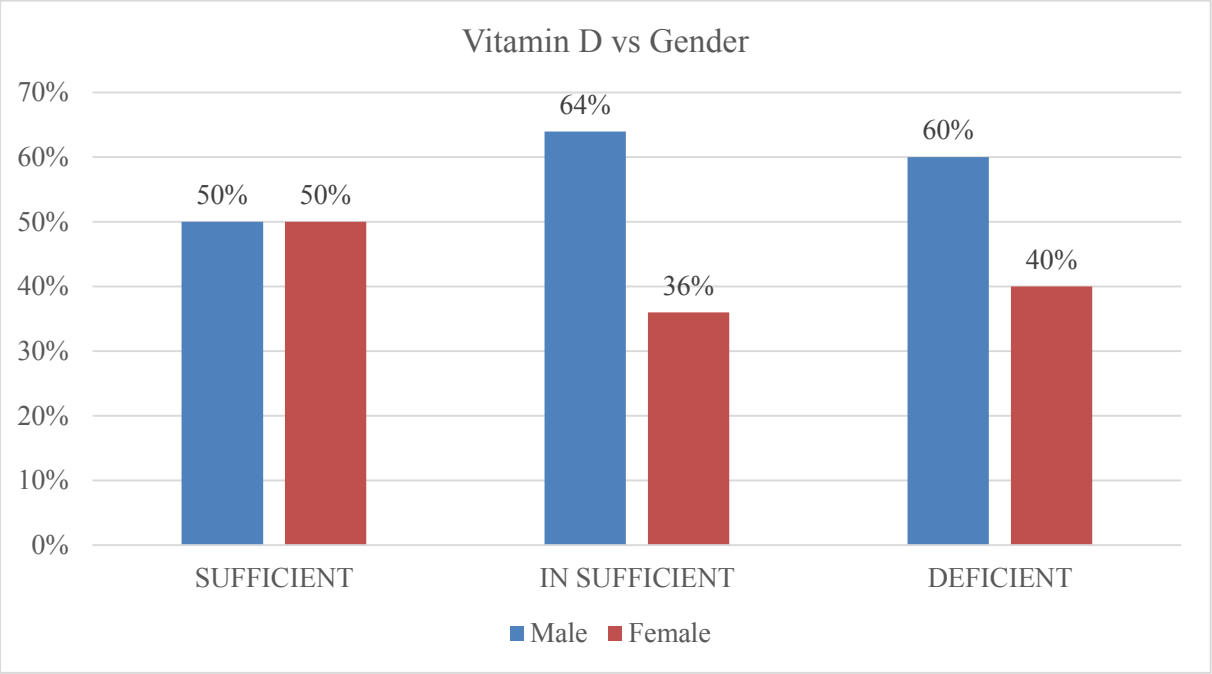


Figure 26: BAR DIAGRAM SHOWING ASSOCIATION OF ARTI CASES BETWEEN SEX AND SERUM VITAMIN D LEVELS

TABLE 23: ASSOCIATION BETWEEN RELIGION OF ARTICASES AND SERUM VITAMIN D LEVELS

	RELIGION				
	HINDU	MUSLIM	CHRISTIAN	$\chi 2$ VALUE	„P‟ VALUE
SUFFICIENT ≥30ng/ml N=6	6(100%)	-	-	2.02	0.731
IN SUFFICIENT 21-29ng/ml N=48	39(81%)	6(12.5%)	3(6.5%)		
DEFICIENT ≤20ng/ml N=28	25(89.4%)	2(7.1%)	1(3.5%)		

It was observed that among subjects with sufficient Vitamin D levels, all were Hindus. Among subjects with insufficient vitamin D levels 39(81%) were Hindus, 6 (12.5%) were Muslimsand 3 (6.5%) were Christians. Among subjects with deficient Vitamin D levels 25(89.4%) were Hindus, 2(7.1%) were Muslims and 1(3.5%) was a Christian. There was no significant difference between Vitamin D status and religion – Table23& Fig 27.

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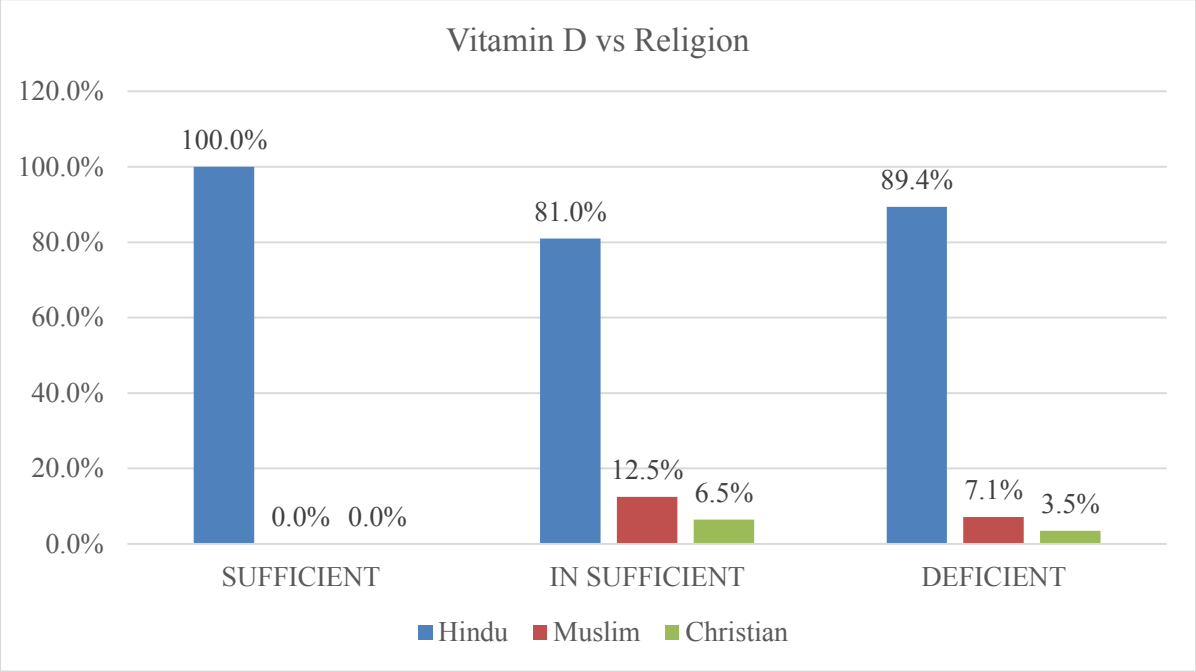

Figure 27: BAR DIAGRAM SHOWING ASSOCIATION OF ARTI CASES BETWEEN RELIGION AND SERUM VITAMIN D LEVELS

TABLE 24: ASSOCIATION BETWEEN SOCIO ECONOMIC STATUS OF ARTI CASES AND SERUM VITAMIN D LEVELS

	UPPER CLASS	UPPER MIDDLE CLASS	MIDDLE CLASS	LOWER MIDDLE CLASS	LOWER CLASS	$\chi 2$ VALUE	„P" VALUE
SUFFICIENT ≥30ng/ml N=6	1(16.66%)	3(50%)	1(16.66%)	1(16.66%)	-	23.8	0.002*
IN SUFFICIENT 21-29ng/ml N=48	1(2%)	15(31%)	10(20%)	16(33%)	6(14%)		
DEFICIENT ≤20ng/ml N=28	1(3%)	3(13%)	19(67%)	4(14%)	1(3%)		

Distribution of ARTI cases according to socio economic status and serum vitamin D levels is depicted in Table 24& Fig 28.

It was observed that, in the group with sufficient serum vitamin D levels, majority (50%) belonged to upper middle class society, while (16.6%) belonged to upper class, middle class and lower classes each. In the group with insufficient serum vitamin D levels, 33% belonged to lower middle class society while 31% belonged to upper middle class.Only 2% with insufficient levels belonged to upper class.

In the group with deficient serum vitamin D levels, majority (67%) belonged to middle class society, while 14% and 13% belonged to lower middle class and upper middle class respectively. Association of ARTI cases according to socio economic status and serum vitamin D levels was found to be statistically significant (p = 0.002).

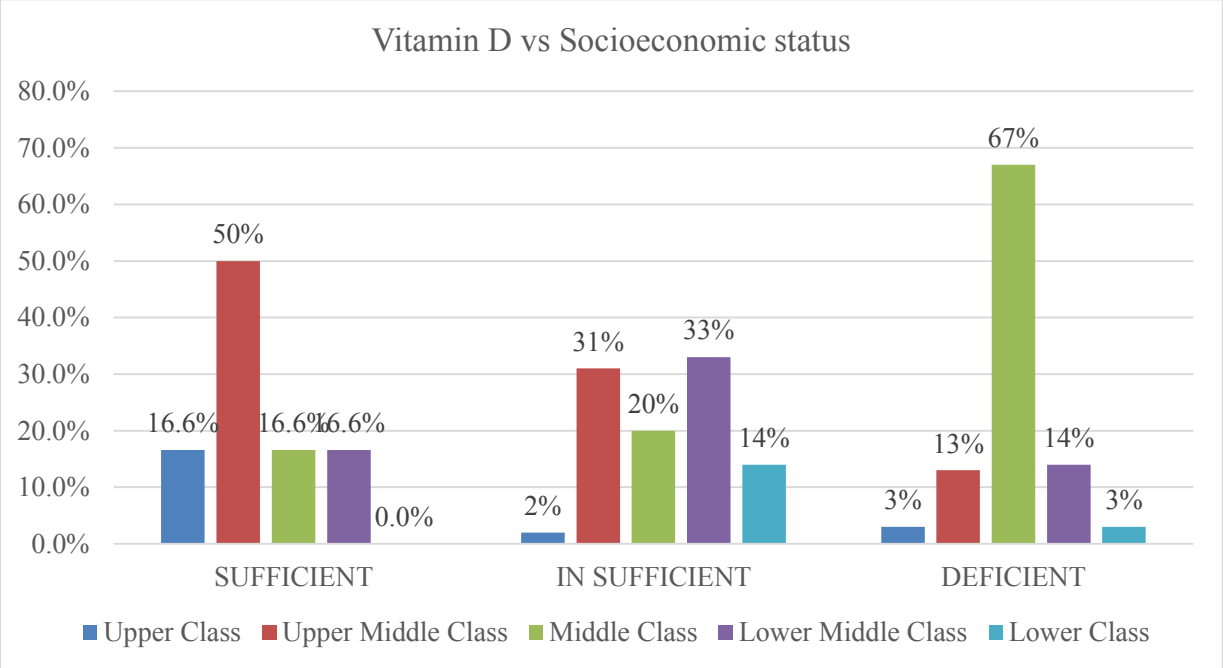

Figure 28: BAR DIAGRAM SHOWING ASSOCIATION OF ARTI CASES BETWEEN SOCIO ECONOMIC STATUS AND SERUM VITAMIN D LEVELS

TABLE 25: ASSOCIATION BETWEEN HISTORY OF FEEDING WITHIN FIRST SIX MONTHS OF LIFE OF ARTI CASES AND VITAMIND LEVELS

VITAMIN D	EXCLUSIVE BREAST FEEDING	TOP FEED ONLY	COMBINED FEEDING	$\chi 2$ VALUE	„P" VALUE
SUFFICIENT ≥30ng/ml N=6	5(83.3%)	-	1(16.7%)	5.50	0.240
IN SUFFICIENT 21-29ng/ml N=48	37(77%)	3(6.3%)	8(16.7%)		
DEFICIENT ≤20ng/ml N=28	18(64.2%)	-	10(35.8%)		

It was observed that in the group with sufficient serum vitamin D levels, majority (83.3%) were exclusively breast fed while 16.7% received combined feeding. In the group with insufficient serum vitamin D levels, majority (77%) received breast feeding while 16.7% and 6.3% received combined feeding and only top feeding respectively. In the group with deficient serum vitamin D levels, 64.2% received exclusive breast feeding while 35.8% received combined feeding - Table 25 & Fig 29.

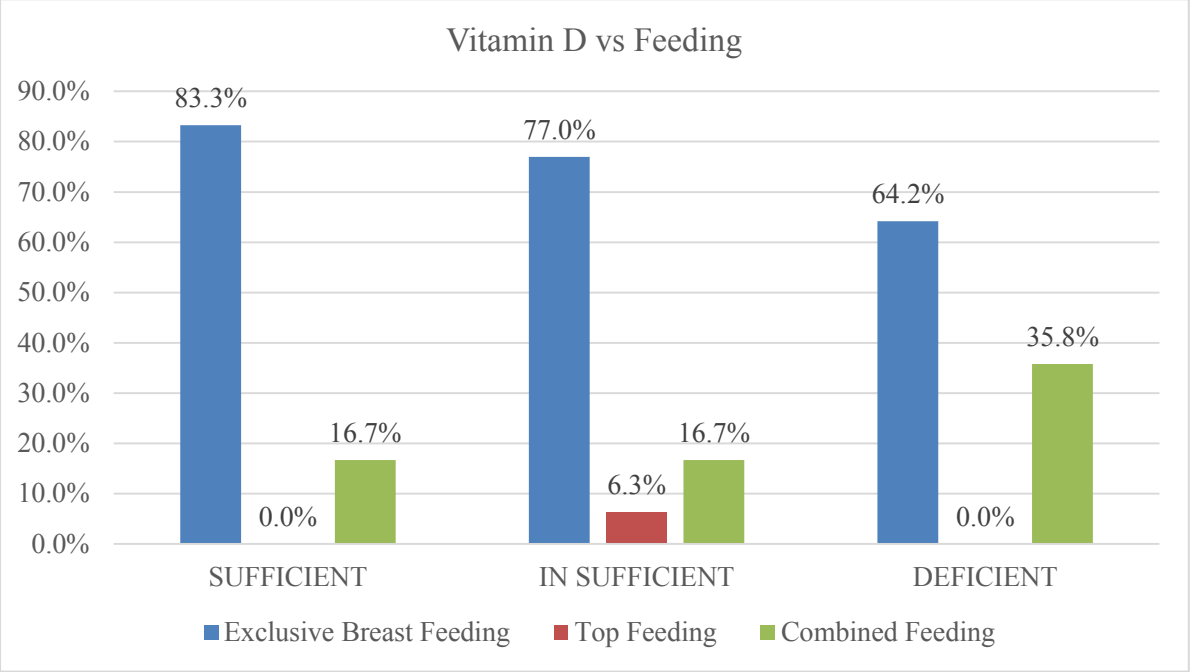

Figure 29: BAR DIAGRAM SHOWING ASSOCIATION OF ARTI CASES BETWEEN HISTORY OF FEEDING WITHIN FIRST SIX MONTHS OF LIFE AND SERUM VITAMIN D LEVELS

TABLE 26: ASSOCIATION BETWEEN CLINICAL PALLOR OF ARTI CASES AND SERUM VITAMIN D LEVELS

	PALLOR			
VITAMIN D	PRESENT	ABSENT	χ2 VALUE	„P" VALUE
SUFFICIENT ≥30ng/ml N=6	2(33.4%)	4(66.6%)	11.4	0.003*
IN SUFFICIENT 21-29ng/ml N=48	32(66.6%)	16(33.4%)		
DEFICIENT ≤20ng/ml N=28	26(92.8%)	2(7.2%)		

In the group with sufficient vitamin D levels ,clinical pallor was present in only while in the insufficient group and deficient groups clinical pallor was present in66.6% and 92.8% respectively which was found to be statistically significant – Table 26 and Fig 30.

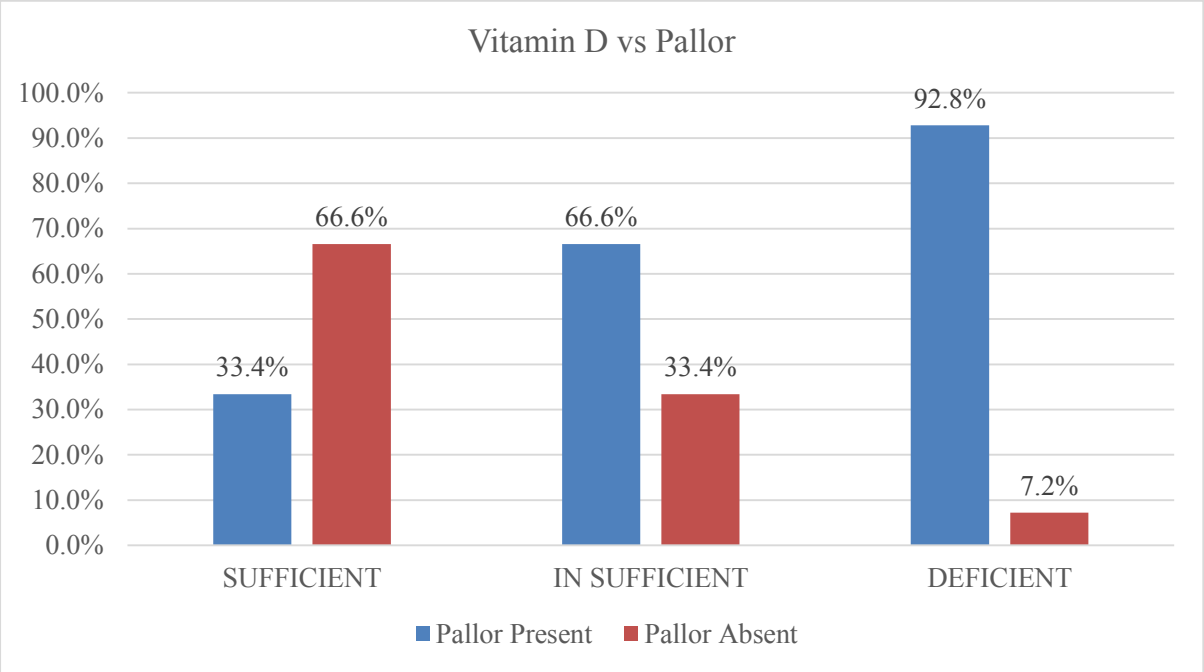

Figure 30: BAR DIAGRAM SHOWING ASSOCIATION OF ARTI CASES BETWEEN CLINICAL PALLOR AND SERUM VITAMIN D LEVELS

TABLE 27: ASSOCIATION BETWEEN DURATION OF SUN EXPOSURE AND SERUM VITAMIN D LEVELS

	SUN EXPOSURE						
	1-2HRS	3-4HRS	5-6HRS	>6HRS	NO EXPOSURE	$\chi 2$ VALUE	„P" VALUE
SUFFICIENT ≥30ng/ml N=6	3(50%)	1(16.66%)	1(16.66%)	1(16.66%)	-	20.6	0.008*
IN SUFFICIENT 21-29ng/ml N=48	10(20%)	14(30%)	21(44%)	1(2%)	2(4%)		
DEFICIENT ≤20ng/ml N=28	1(3%)	17(60%)	5(18%)	3(11%)	2(8%)		

In the group with sufficient vitamin D levels, 50% of children were exposed to 1-2hours of sunlight per day. In the same group 16.66% were exposed to 3-4 hours, 5-6hours and >6 hours of sunlight per day each. In the group with insufficient serum vitamin D levels, 44%, 30% and 20% were exposed to 5-6hours, 3-4hours and 1-2 hours of sunlight per days respectively. There was no exposure to sunlight in 4% in the same group.

In the group with deficient serum vitamin D levels,60% received 3-4 hrs exposure to sunlight per day while 18% and 11% received 5-6 hours and >6 hours of sunlight exposure

per day. On the other hand, only 8% did not receive any sunlight exposure. The association was found to be statistically significant - Table 27& Fig 31.

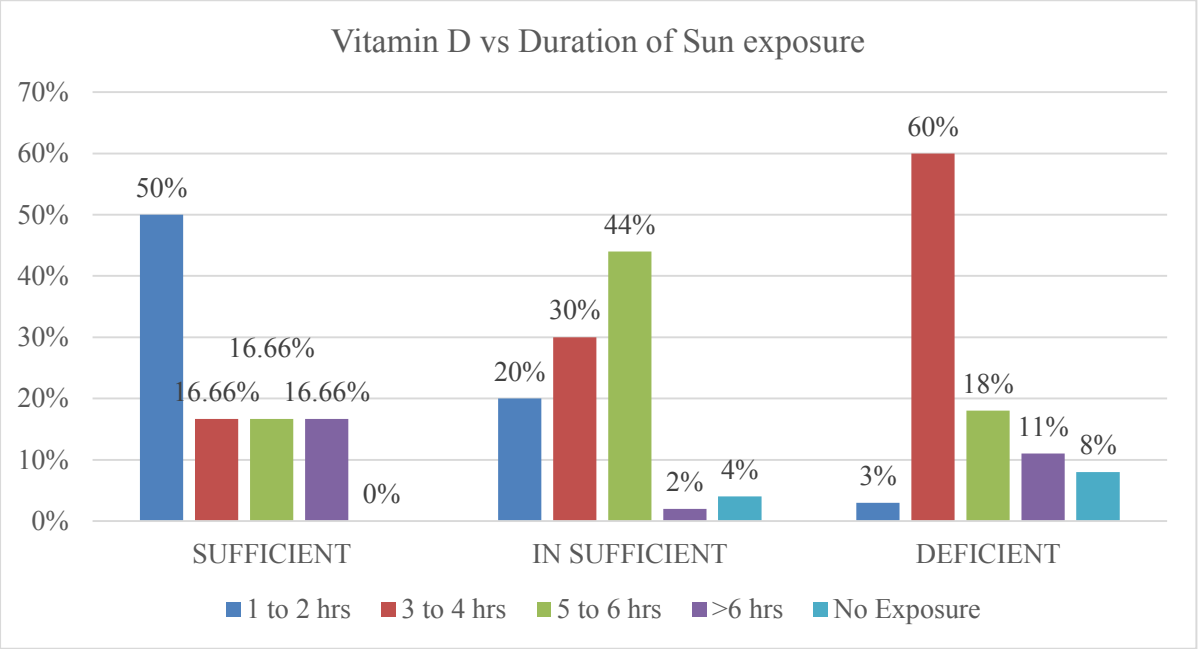

Figure 31: BAR DIAGRAM SHOWING ASSOCIATION OF ARTI CASES BETWEEN DURATION OF SUN EXPOSURE AND SERUM VITAMIN D LEVELS

RELATIONSHIP BETWEEN SEVERITY OF PNEUMONIA AND VARIOUS RISK FACTORS

TABLE 28: RELATIONSHIP BETWEEN AGE OF ARTI CASES AND SEVERITY OF PNEUMONIA

	AGE IN MONTHS						
	2-12 N=46	13-24 N=17	25-36 N=9	37-48 N=4	49-60 N=6	$\chi 2$ VALUE	„P" VALUE
NO PNEUMONIA	8(18%)	2(12%)	1(12%)	-	2(33.3%)	9.61	0.254
PNEUMONIA	17(36%)	9(53%)	6(67%)	4(100%)	2(33.3%)		
SEVERE PNEUMONIA/ VERY SEVERE DISEASE	21(46%)	6(35%)	2(21%)	-	2(33.3%)		

In the study it was observed that in the age group of 2-12months, severe pneumonia was present in 46% while 36% and 18% had pneumonia and no pneumonia. In the age group of 13-24 months, majority (53%) had pneumonia, while 35% had severe pneumonia and 12 % had no pneumonia. in the age group of 25-36 months,67% had pneumonia and 21% had severe pneumonia. In the age group of 37-48 months all the subjects (100%) had pneumonia

. In the age group of 49-60months 33.3% had pneumonia and severe pneumonia each.However there was no significant association between severity of pneumonia and age - Table 28 & Fig 32.

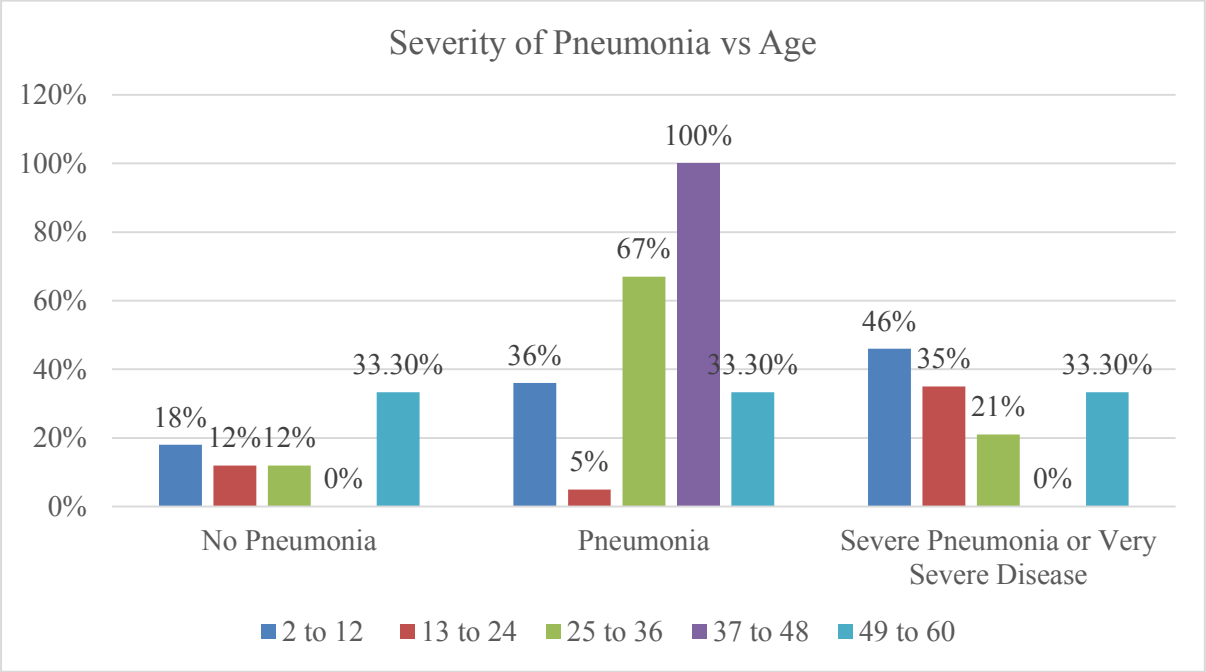

Figure 4: BAR DIAGRAM SHOWING RELATIONSHIP BETWEEN AGE OF ARTI CASES AND SEVERITY OF PNEUMONIA

TABLE 29: RELATIONSHIP BETWEEN SEX OF ARTI CASES AND SEVERITY OF PNEUMONIA

CLASSIFICATION OF PNEUMONIA	GENDER		$\chi 2$ VALUE	„P" VALUE
	MALE N=51	FEMALE N=31		
NO PNEUMONIA	10(19%)	3(10%)	1.47	0.480
PNEUMONIA	23(45%)	15(48%)		
SEVERE PNEUMONIA/VERY SEVERE DISEASE	18(36%)	13(42%)		

In the study, it was observed that among male children 45% had 36% had pneumonia and severe pneumonia or very severe disease respectively while 19% had no pneumonia. Among female children 48% and 42% had pneumonia and severe pneumonia while 10% had no pneumonia. There was no significant relationship between gender and severity of pneumonia – Table 29& Fig 33.

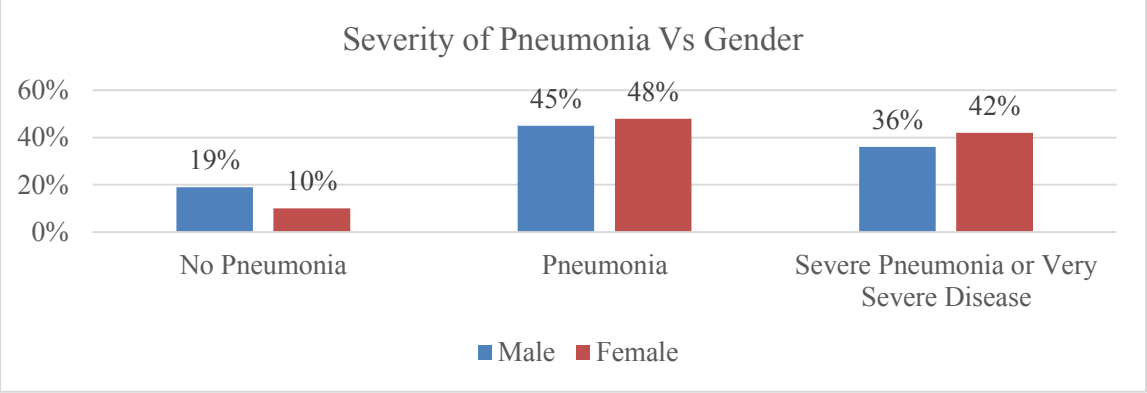

Figure 33: BAR DIAGRAM SHOWING RELATIONSHIP BETWEEN SEX OF ARTI CASES AND SEVERITY OF PNEUMONIA

TABLE 30:RELATIONSHIP BETWEEN RELIGION OF ARTI CASES AND SEVERITY OF PNEUMONIA

	RELIGION				
RELIGION	HINDUS N=70	MUSLIMS N=8	CHRISTIANS N=4	$\chi 2$ VALUE	„P" VALUE
NO PNEUMONIA	11(15%)	-	2(50%)	6.72	0.152
PNEUMONIA	34(48%)	4(50%)	-		
SEVERE PNEUMONIA/VERY SEVERE DISEASE	25(37%)	4(50%)	2(50%)		

Among the Hindu children, only 15% had no pneumonia while 48% and 37% had pneumonia and severe pneumonia respectively.Among the Muslim children, pneumonia and severe pneumonia was present in 50% each. Among Christian children, 50% had severe pneumonia while the remaining 50% had no pneumonia. There was no significant relationship between religion and severity of pneumonia - Table 30& Fig 34.

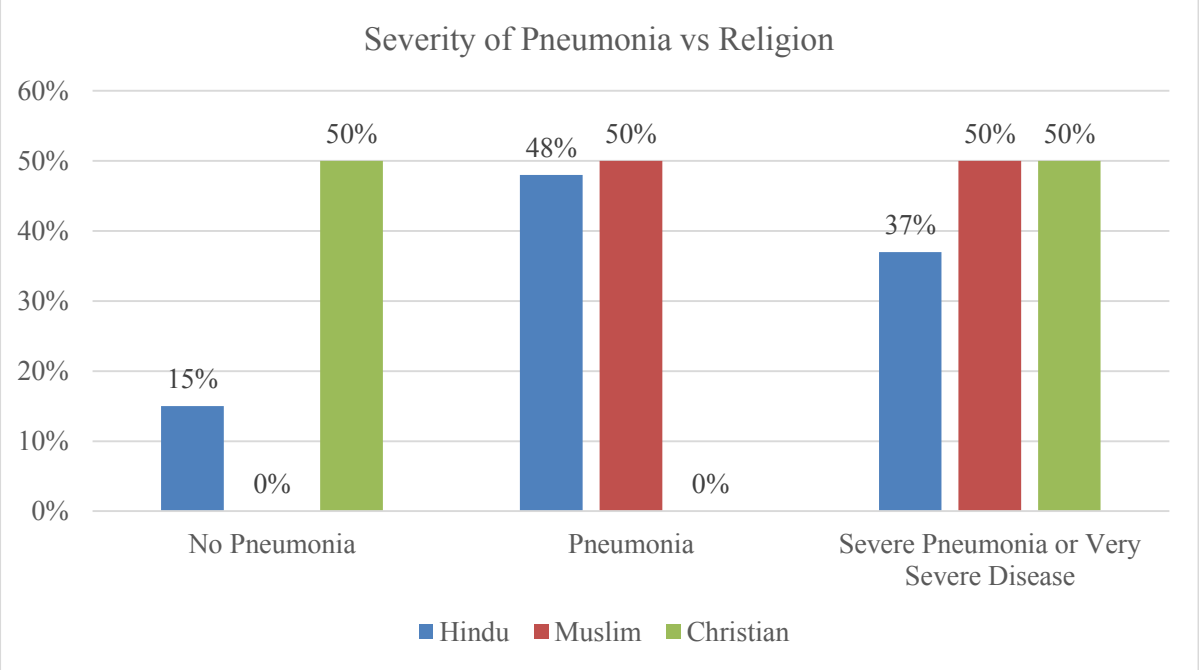

Figure 34: BAR DIAGRAM SHOWING RELATIONSHIP BETWEEN RELIGION OF ARTI CASES AND SEVERITY OF PNEUMONIA

TABLE 31: RELATIONSHIP BETWEEN SOCIO ECONOMIC STATUS OF ARTI CASES AND SEVERITY OF PNEUMONIA

	UPPER CLASS N=3	UPPER MIDDLE CLASS N=21	MIDDLE CLASS N=30	LOWER MIDDLE CLASS N=21	LOWER CLASS N=7	$\chi 2$ VALUE	„P" VALUE
NO PNEUMONIA	1(33.4%)	3(14%)	6(20%)	3(14.3%)	-	10.5	0.235
PNEUMONIA	2(66.6%)	12(57%)	14(46.6%)	6(28.5%)	3(42.8%)		
SEVERE PNEUMONIA/VERY SEVERE DISEASE	-	6(29%)	8(33.4%)	13(57.2%)	4(57.2%)		

In the study, it was observed that among children belonging to upper class, 66.6% had pneumonia while 33.3% had no pneumonia. In the upper middle class group, 57% and 29% had pneumonia and severe pneumonia respectively while 14% had no pneumonia. In the middle class group, 46.6% had 33.4% had pneumonia and severe pneumonia respectively while 20% had no pneumonia.In the lower middle class group, 57.2% and 28.5% had severe pneumonia and pneumonia respectively while 14.3% had no pneumonia. In the lower class group severe pneumonia and pneumonia was present in 57.2% and 42.8% respectively. However there was no significant relationship – Table 31& Fig 35.

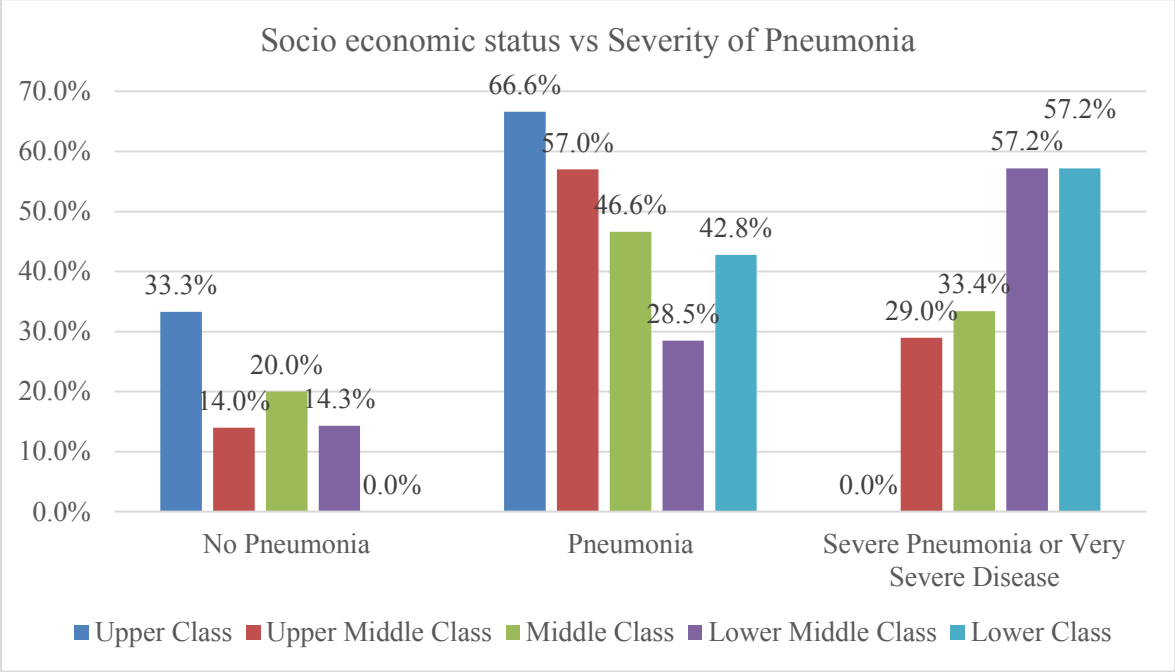

Figure 35: BAR DIAGRAM SHOWING RELATIONSHIP BETWEEN SOCIO ECONOMIC STATUS AND SEVERITY OF PNEUMONIA

TABLE 32: RELATIONSHIP BETWEEN HISTORY OF FEEDING WITHIN FIRST SIX MONTHS OF LIFE OF ARTI CASES AND SEVERITY OF PNEUMONIA

CLASSIFICATION OF PNEUMONIA	EXCULSIVE BREAST FEED N=60	TOP FEED ONLY N=3	COMBINED FEEDING N=19	$\chi 2$ VALUE	„P" VALUE
NO PNEUMONIA	11(18%)	1(33%)	1(5%)	10.4	*0.034**
PNEUMONIA	32(53%)	-	6(31%)		
SEVERE PNEUMONIA/VERY SEVERE DISEASE	17(29%)	2(67%)	12(64%)		

It was observed that among children exclusively breastfed, 11(18%) had no pneumonia, 32(53%) had pneumonia and 17(29%) had severe pneumonia. Among children who were onlytop fed, 33% had no pneumonia while 67% had severe pneumonia. Among subjects with combined feeding 1(5%) had no pneumoniawhile, 6(31%) had pneumonia and 12(64%) had severe pneumonia. It was found that children fed with top milk and combined feeding had higher incidence of severe pneumonia. This observation was statistically significant –Table 32& Fig 36.

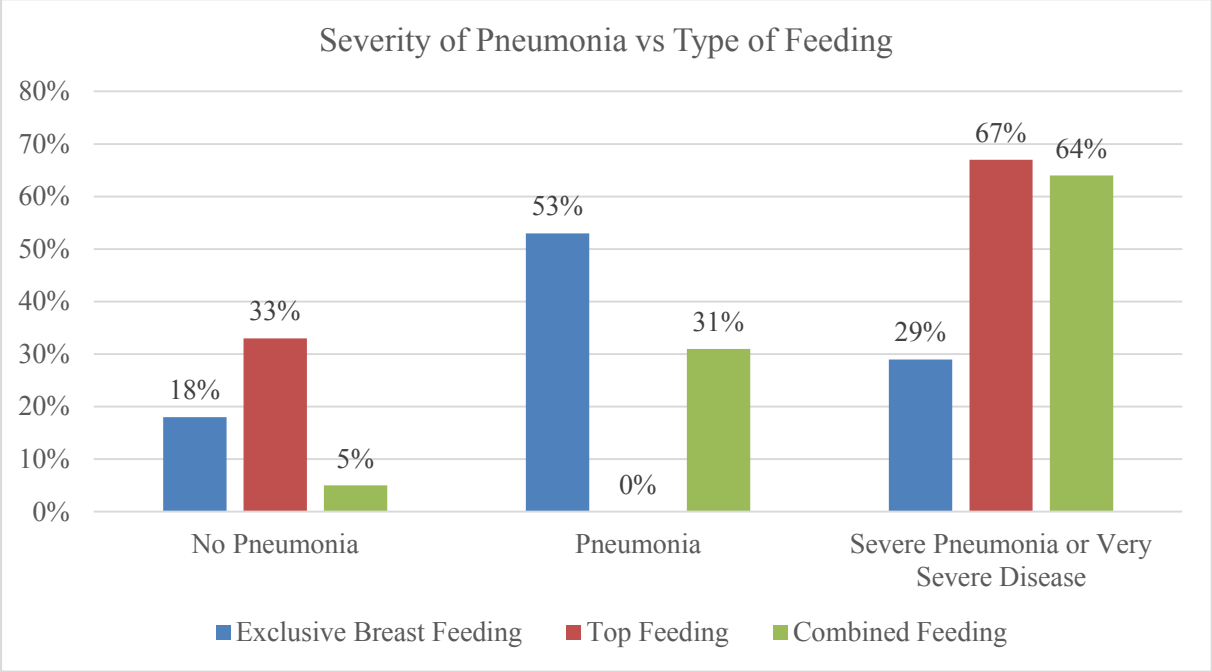

Figure 36: BAR DIAGRAM SHOWING RELATIONSHIP BETWEEN HISTORY OF FEEDING WITHIN FIRST SIX MONTHS OF LIFE AND SEVERITY OF PNEUMONIA.

TABLE 33:RELATIONSHIP BETWEEN IMMUNIZATION STATUS OF ARTI CASES AND SEVERITY OF PNEUMONIA:

	IMMUNIZATION STATUS			
CLASSIFICATION OF PNEUMONIA	UPTO DATE N=34	PARTIAL N=48	χ^2 VALUE	„P" VALUE
NO PNEUMONIA	6(17.7%)	7(14.5%)	1.55	0.460
PNEUMONIA	13(38%)	25(52%)		
SEVERE PNEUMONIA /VERY SEVERE DISEASE	15(44.3%)	16(33.5%)		

It was observed that among children who were fully vaccinated 6 (17.7%) had no pneumonia, while 13(38%) had pneumonia and 15(44.3%) had severe pneumonia. Among subjects with partial immunization status, 7(14.5%) had no pneumonia, 25(52%) had pneumonia and 16 (33.5%) had severe pneumonia or very severe disease. However it was found that there was no significant association between severity of pneumonia and immunization status – Table 33&Fig 37.

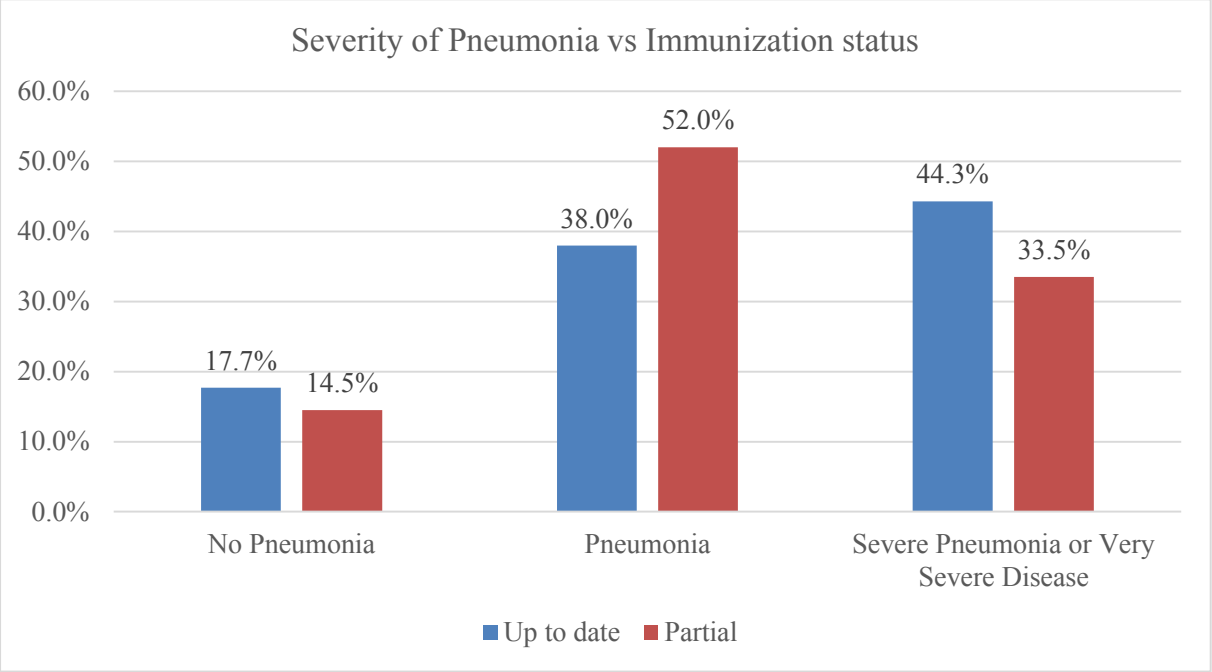

Figure 37: Bar diagram showing relationship between Immunization Status and Severity of Pneumonia

TABLE 34: RELATIONSHIP BETWEEN PAST HISTORY OF RESPIRATORY TRACT INFECTIONS OF ARTI CASES AND SEVERITY OF PNEUMONIA

	PAST HISTROY RTI			
CLASSIFICATION OF PNEUMONIA	PRESENT N=49	ABSENT N=33	$\chi 2$ VALUE	„P" VALUE
NO PNEUMONIA	7(14%)	6(18%)	0.229	0.892
PNEUMONIA	23(47%)	15(45%)		
SEVERE PNEUMONIA / VERY SEVERE DISEASE	19(39%)	12(37%)		

In the study, it was found that 49(59.7%) had past history of ARTI. Out of the 49 cases, 47% and 39% had pneumonia and severe pneumonia respectively while 14% had no pneumonia. However there was no significant relationship between past history of ARTI and severity of pneumonia – Table 34&Fig 38.

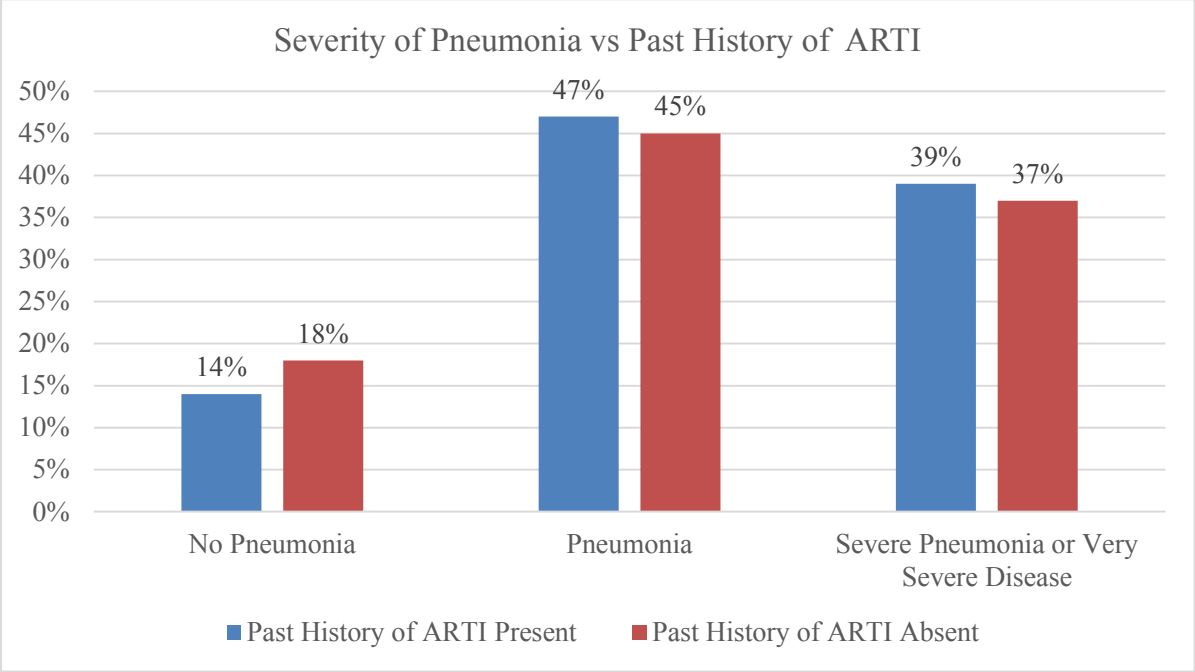

Figure 38: BAR DIAGRAM SHOWING RELATIONSHIP BETWEEN PAST HISTORY OF RESPIRATORY TRACT INFECTIONS AND SEVERITY OF PNEUMONIA

TABLE 35: RELATIONSHIP BETWEEN FAMILY HISTORY OF SMOKING AND SEVERITY OF PNEUMONIA

	FAMILY HISTORY OF SMOKING			
CLASSIFICATION OF PNEUMONIA	PRESENT N=39	ABSENT N=43	$\chi 2$ VALUE	„P" VALUE
NO PNEUMONIA	3(8%)	10(23%)	10.7	*0.005**
PNEUMONIA	28(71.7%)	10(23%)		
SEVERE PNEUMONIA / VERY SEVERE DISEASE	20(20.3%)	11(54%)		

It was observed that among subjects with family history of smoking, 71.7% had pneumonia and 20.3% had severe pneumonia or very severe disease and only 8% had no pneumonia. Among subjects without family history of smoking 54% had severe pneumonia or very severe diseaseand 23% each had nopneumonia and pneumonia.

There was a significant relationship between severity of pneumonia and family history of smoking – Table 35&Fig 39.

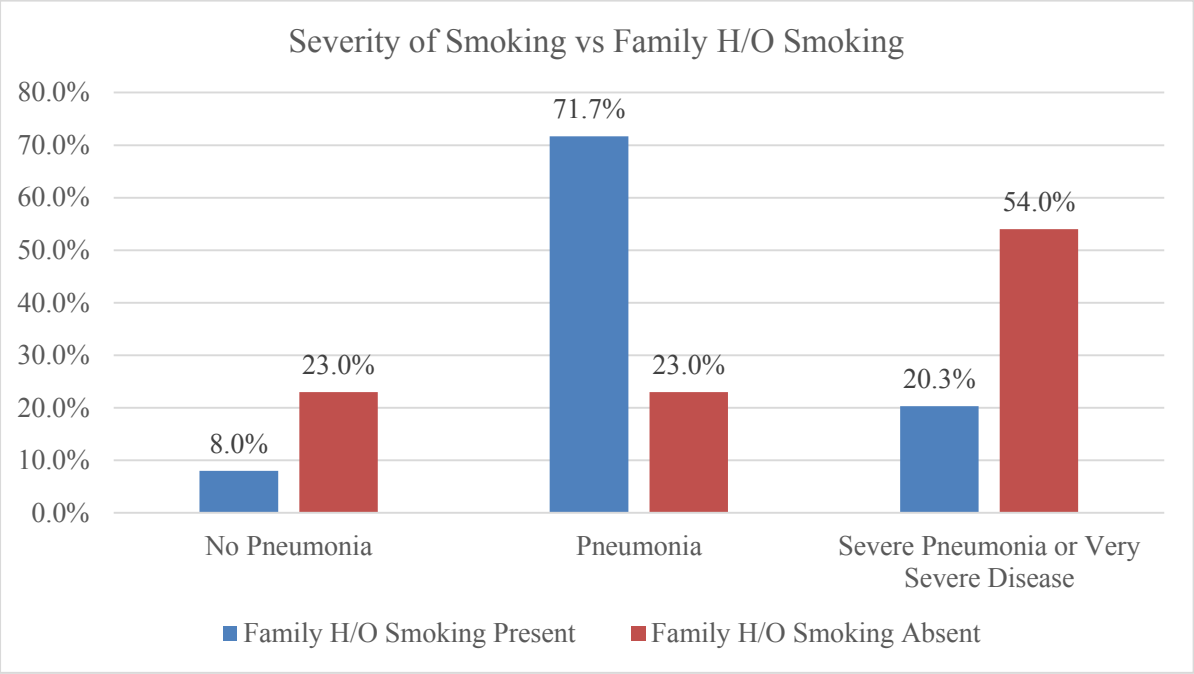

Figure 5: BAR DIAGRAM SHOWING RELATIONSHIP BETWEEN FAMILY HISTORY OF SMOKING AND SEVERITY OF PNEUMONIA

TABLE 36: RELATIONSHIP BETWEEN TYPE OF FUEL USED IN FAMILIES OF ARTI CASES AND SEVERITY OF PNEUMONIA

CLASSIFICATION OF PNEUMONIA	KEROSENE N=5	WOOD N=2	LPG N=75	$\chi 2$ VALUE	„P“ VALUE
NO PNEUMONIA	-	-	13(17%)	2.52	0.641
PNEUMONIA	2(40%)	2(100%)	34(45%)		
SEVERE PNEUMONIA / VERY SEVERE DISEASE	3(60%)	-	28(38%)		

In this study, it was observed that in those families using kerosene as cooking fuel, 60% had severe pneumonia, while remaining 40% had pneumonia. In those families using fire wood as cooking fuel all 100% had pneumonia. On the other hand, those families using LPG as cooking fuel, 45% and 38% had pneumonia and severe pneumonia respectively while 17% had no pneumonia. However there was no significant relationship- Table 36 & Fig 40.

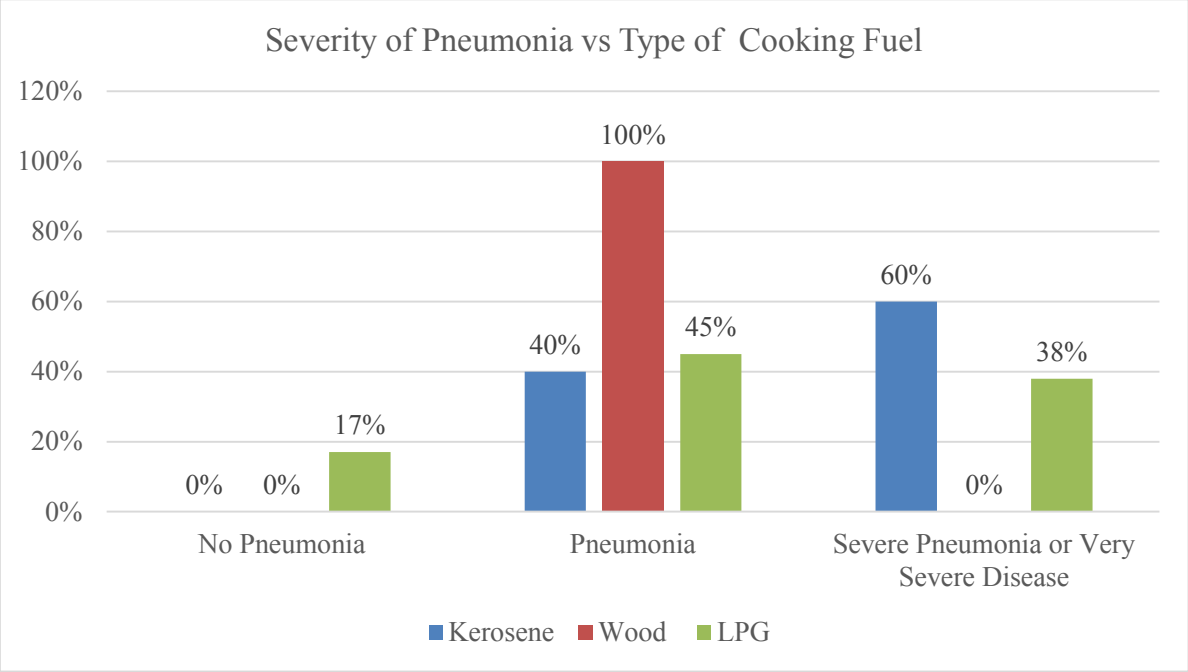

Figure 6: BAR DIAGRAM SHOWING RELATIONSHIP BETWEEN TYPE OF COOKING FUEL USED AND SEVERITY OF PNEUMONIA

TABLE37 : RELATIONSHIP BETWEEN CLINICAL PALLOR OF ARTI AND SEVERITY OF PNEUMONIA

	PALLOR			
CLASSIFICATION OF PNEUMONIA	PRESENT N=60	ABSENT N=22	$\chi 2$ VALUE	„P" VALUE
NO PNEUMONIA	5(8%)	8(36%)		
PNEUMONIA	26(44%)	12(55%)		
SEVERE PNEUMONIA / VERY SEVERE DISEASE	29(48%)	2(9%)	15.0	0.001*

In the study , it was observed that among children with clinical pallor, 48% and 44% had severe pneumonia and pneumonia respectively while 8% had no pneumonia. Among children without pallor 55% had pneumonia while 36% and 9% had no pneumonia and severe pneumonia respectively. There was significant relationship between clinical pallor and severity of pneumonia – Table 37&Fig 41.

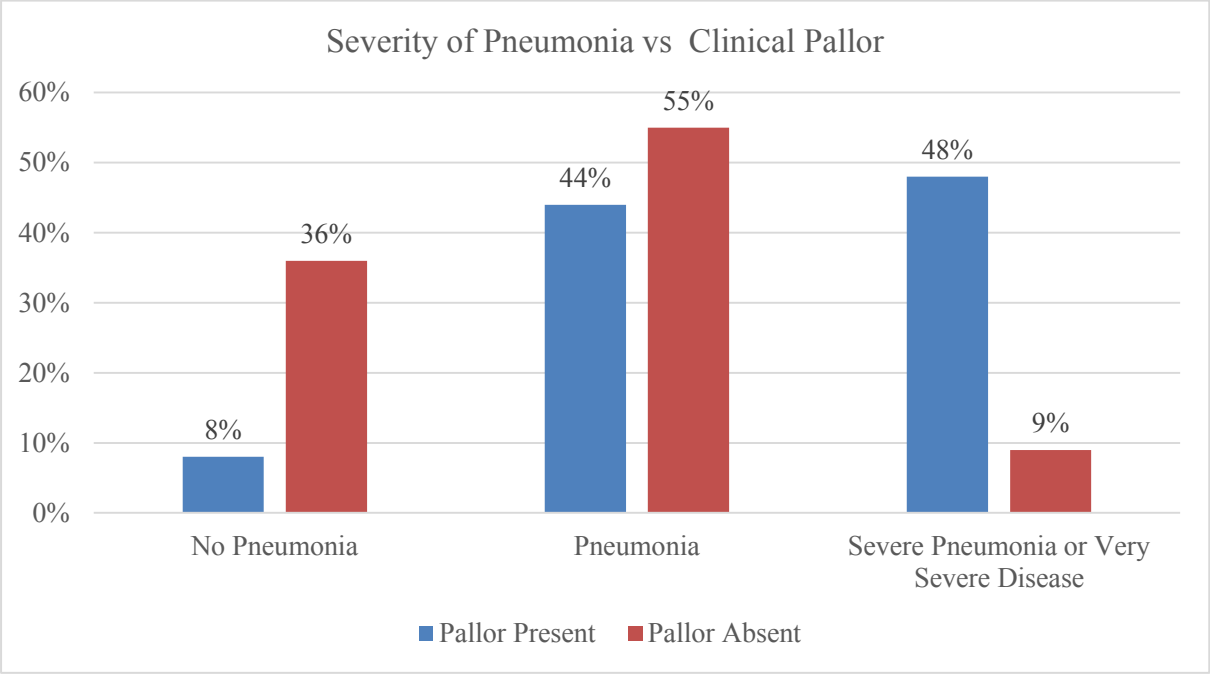

Figure 41: BAR DIAGRAM SHOWING RELATIONSHIP BETWEEN CLINICAL PALLOR AND SEVERITY OF PNEUMONIA

DISCUSSION

DISCUSSION

Vitamin D (D_2, D_3, or both) is a secosterol produced endogenously in the skin from sun exposure and also obtained from foods that naturally contain vitamin D, foods fortified with vitamin D and supplements[47]. Vitamin D has long been known to play a role in the skeletal system and calcium homeostasis; the deficiency of which causes rickets and osteoporosis[47]**.** There is growing evidence that vitamin D also contributes positively to pulmonary health. Clinical vitamin D deficiency (rickets) has been associated with a 13-foldincreased risk of pneumonia[12].Vitamin D deficiency is a common and important nutritional deficiency in children in India. Clinical and subclinical vitamin D deficiency in children has been reported to be a significant risk factor for severe acute respiratory tract infection[48].There is evidence to suggest that subclinical vitamin D deficiency is common in India despite lying in low latitude and having sunshine in plenty[5].

Vitamin D and ARTI

In the present study, out of 82 children with ARTI, serum Vitamin D was significantly less in majority (92.7%) of subjects. Vitamin D insufficiency was present in 48(58.5%) and deficiency in 28(34.2%). Pneumonia and severe pneumonia or very severe disease was present in 69(84.2%) of the study subjects collectively of whom 38(46.4%) had pneumonia and 31(37.8%) had severe pneumonia or very severe disease. This clearly indicates that majority (92.7%)of study subjects having insufficient or deficient serum Vitamin D levels had a higher incidence of pneumonia and severe pneumonia or very severe disease – Table 20. **Wayse V et al[5]** observed that sub clinical vitamin D deficiency was a significant risk factor for ALRI in children below 5 years of age which is in conformity with our study. **Roth et al[49]** reported similar results in children 1 to 18 months of age who were hospitalized with ALRI. In a study comprising of 152 children younger than 59 months of age with pneumonia

at Yemen, Vitamin D deficiency was found to be an independent predictor of persistent hypoxemia for children admitted with pneumonia[50]. These studies suggest that Vitamin D deficiency might increase the severity of a respiratory infection in children and that infants and children with vitamin D deficiency and ARTI might require higher levels of care than in children with sufficient Vitamin D levels.

Vitamin D levels and age

Out of 63 study subjects below 24 months of age, only 6(9.5%) had sufficient Vitamin D levels while none of the subjects above 24 months of age had sufficient serum Vitamin D – Table 21. Overall serum Vitamin D levels were low in the subjects below 5 years of age however; there was no significant association between age and serum Vitamin D levels. High prevalence rates of Vitamin D deficiency are reported in otherwise healthy infants, children and adolescents from India and abroad[1]. **Roth et al[49]** reported that 25(OH)D levels were significantly lower in children aged 1-18 months with ALRI than in control subjects which is in conformity with our study. In contrast, **Wayse et al** [5] observed a significant increase of serum Vitamin D levels with age in children below 5 years with ARTI which is not in conformity with our study.

Vitamin D and Gender

In our study, there was a male predominance (62.2%) among the subjects with ARTI. Out of 51 male children, only 3(5.8%) had sufficient Vitamin D levels. Likewise out of 31 female children only 3(9.7%) had sufficient Vitamin D levels- Tables 8&22.However there was no significant association between Vitamin D status and gender in our study. **Rabbani A et al**. [51] however reported that low serum Vitamin D levels were five times more prevalent in girls than in boys among healthy school children in Teheran. This finding can possibly be explained by the prevailing cultural practices, skin pigmentation,more clothing of the body

and lesser participation in outdoor activities leading to decreased cutaneous vitamin D synthesis.

Vitamin D and Religion

In our study, out of 82 subjects only 8(9.7%) children were Muslims and 4(5.3%) were Christians. The remaining 70(85%) study subjects were Hindus. All the 6 children with sufficient Vitamin D levels were Hindus – Tables 9&23. We could not find any association between religion and Vitamin D levels as majority (85%) of study subjects were Hindus.

Vitamin D and socioeconomic status

In the present study, it was observed that out of 6 children with sufficient serum Vitamin D levels, 3(50%) hailed from upper middle class families while none of the children with sufficient Vitamin D levels hailed from lower class families. In children with deficient Vitamin D levels, majority (67%) belonged to middle class families while only 3% belonged to upper class families. Similarly, only 2% of subjects in the insufficient group hailed from upper class families-Table 24 & Fig 28. There was a significant association between socio economic status and serum vitamin D levels in our study. In a review article, it was reported that individuals with hypovitaminosis D were mostly of low socio economic status with low daily intake of calcium[52] while another study by **Vasudevan J et al**[53] found that children from the higher socio economic group were at greater risk of hypovitaminosis D probably due to less sun exposure. However, **Wayse Vet al**[5] found no relationship between Vitamin D levels and socio- economic status of the children with ALRI.

Vitamin D and type of feeding

In our study, we observed that majority (73.2%) of children were exclusively breast fed. Out of 6 children with sufficient vitamin D levels, 5 (83.3%) received exclusive breast feeding.

Out of 48 children with insufficient vitamin D, majority (77%) were exclusively breast fed. Likewise, out of 28 children with deficient vitamin D levels, 64.2% were breast fed exclusively- Table 25 & Fig 29. However, there was no significant association between type of feeding and Vitamin D levels in our study (p value =2.40). Exclusive breast feeding in the first 4 months of life was significantly associated with decreased risk of severe ALRI in the study conducted by **Wayse V et al**[5]. And **Leis Ks et al** [38].On the other hand, **Abdul Razzak et al**[54] reported that, infants who were exclusively breast fed had a higher risk of Vitamin d deficiency and insufficiency than those who were bottle fed. The vitamin D stores of the newborn depend entirely on the vitamin D stores of the mother. Hence, if the mother is vitamin D-deficient, the infant will be deficient because of decreased materno-foetal transfer of vitamin D[55].The risk factors associated with low maternal 25-OHD include low educational level, insufficient intake of vitamin D in diet and dressing habits[33].Hence exclusively breast fed infants may be predisposed to hypovitaminosis D secondary to decreased vitamin D levels in mothers which may in turn predispose the infants to ARTI.

Vitamin D and duration of exposure to sunlight

In our study with sufficient vitamin D levels, 50% of children were exposed to 1-2hours of sunlight per day. In the group with deficient serum vitamin D levels,60% received 3-4 hours exposure to sunlight per day while 18% and 11% received 5-6 hours and >6 hours of sunlight exposure per day respectively - Table 27 & Fig 31. The study shows that vitamin D deficiency was significantly more in children receiving less hours of sunlight exposure($p<0.008$) . Cultural and health practices can contribute to vitamin D insufficiency preventing infants from acquiring vitamin D from sun exposure. In some cultures infants are swaddled when outdoors, minimizing their sun exposure[56]**.**Application of sunscreen lotions and creams to limit the sun‟s damage to skin cansuppress cutaneous synthesis of vitaminD3 by blocking the

absorption of UV B radiation[7]. In addition, atmospheric pollution may decrease the UV rays reaching the children exposed to sunlight in spite of belonging to area with plenty of sunshine as explained in study by **Agarwalet al[57].**

Vitamin D and clinical pallor

In the group with sufficient vitamin D levels, clinical pallor was present in only 33.4% while in the insufficient group and deficient groups clinical pallor was present in 66.6% and 92.8% respectively showing a significant association between serum Vitamin D deficiency and clinical pallor– Table 26 and Fig 30. In a study done in South Korean children aged ≤ 2 years, the authors showed a significant association between coexisting iron deficiency and vitamin D deficiency[58]. Several mechanisms have been proposed to explain the association of vitamin D deficiency and anaemia. Erythroid precursors are believed to be directly stimulated by vitamin d suggesting the latter‟s role in erythropoiesis. Another explanation offered is that absorption of vitamin D may be impaired due to iron deficiency. However there is a controversy as to which deficiency causes the other.[59]

Risk factors for ARTI:

In the present study, presence of anaemia was a significant risk factor for developing ARTI which was similar to a study by **Savitha MR et al** [60] The proposed pathophysiologic basis for increased risk of infection isthat neutrophils have a decreased capacity to kill organisms due to decreased myelo peroxidase activity. It was also proposed that both the proportion and absolute number of circulating 'T' cellsare also reduced and also have defective DNA synthesis.It is known that partially immunized children are more prone to pneumonia. A significant association was found between immunization status and ARTI in a study done by

Broor S et al [61]but no such association was demonstrated in our study. In our study, **Murray et al**[62] in their study found significant association between type of fuel used as a risk factor for pneumonia but no such association was found in the present study. A significant association between type of feeding in first six months and severity of pneumonia was observed in the present study. It was found that those children receiving top milk were associated with pneumonia. Colostrum is known to possess antibodies against various pathogens, higher concentration of C3, Ig A and lactoferrin which protect the breast fed children against infection[60]**.**In the present study it was also found that there was an association between the passive smoking and severity of pneumonia which was similar to another study by **Broor S et al** [61].

In the present, the significant risk factors for ARTI were presence of clinical pallor, passive smoking and inadequate breastfeeding in first six months of life.

CONCLUSION

CONCULSION

- Serum vitamin D levels were insufficient in 58.5% of children with ARTI. Deficient levels of serum Vitamin D was present in 34.2% of children with ARTI whereas only 7.3% of children with ARTI had normal levels of serum Vitamin D levels.
- In children with insufficient levels of serum Vitamin D, pneumonia was more prevalent (62.5%) while those with deficient levels of serum Vitamin D had a high prevalence (75%) of severe pneumonia/very severe disease. Variables from this study showed statistically significant associations between severity of ARTI and serum vitamin D levels.
- Results from this study conclude that deficiency of vitamin D is a modifiable risk factor in prevention of ARTI. Education regarding the importance of sunlight exposure of young children should be reinforced to mothers and the general community. Also, foods rich in vitamin D-rich should be advocated in order to prevent the morbidity and mortality secondary to ARTI, which globally contribute to morbidity and mortality worldwide.
- The study demonstrates significant association between levels of serum Vitamin D and presence of clinical pallor. Hence it can be concluded that decreased levels of serum vitamin D levels can predispose children to anaemia. Hence in patient with anaemia correction of underlying vitamin D deficiency should be emphasised.
- From this study, it was found that there was a significance association ($p<0.002$) between serum vitamin D levels and socioeconomic status. All the children belonging to lower socio economic class had significantly decreased levels of Vitamin D and none had sufficient levels.
- Our study also demonstrates significant association between duration of exposure to sunlight and levels of serum vitamin D. Vitamin D deficiency was significantly more

in children receiving less hours of sunlight exposure($p<0.008$). Hence, the importance of longer duration of sunlight exposure in prevention of vitamin D deficiency and its co morbidities like ARTI needs to be made aware among the population.

- The study also demonstrated that inadequate exclusive breast feeding in first six months of life, presence of pallor and exposure to passive smoking were other modifiable risk factors for pneumonia. Hence, steps for correction of these factors can help in prevention of morbidities secondary to ARTI worldwide.

LIMITATION OF STUDY

- Small sample size
- No comparison done with healthy subjects

SUMMARY

SUMMARY

- The study was a hospital-based observational cross sectional study conducted at R L Jallappa hospital.
- Cases were children from 2 months to 5years of age attending the department of Paediatrics with ARTI as per revised classification and treatment of childhood pneumonia under IMCI.
- After obtaining written informed consent from the parents of the patient detailed history was taken, clinical examination was done and entered in a semi-structured proforma. Serum vitamin D levels were measured using Micro Vue EIA Kit.
- Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software.
- A total of 82 children with ARTI comprised the study group.
- In the study, majority (56%) of patients belonged to 2 to 12 months age group with a male predominance (62.2%).
- Majority (85%) of the subjects belonged to Hindu religion .
- Study of distribution according to socioeconomic status showed maximum (36.5%) subjects belonged to Middle Class and minority belonging to Upper Class(3.6%).
- In the study group 34 subjects (41%) were fully immunized for the age.
- In our study, 50% of children were exposed to 1-2 hours of sunlight per day and 4(5%) had no history of exposure to sunlight.
- In the study, 49 (59.7%) subjects had past history of respiratory tract infection; commonly used fuel for cooking was LPG in 92% and family history of smoking was present in 47.5% of the subjects.
- Out of 82 subjects in the study, 60(73%) had clinical pallor.
- In the study, 13 (15.8%) had no pneumonia while 38(46.4%) had pneumonia and 31 (37.8%) had severe pneumonia or very severe disease.
- Out of 82 subjects almost half of them (58.5%) had insufficient serum Vitamin D levels while 34.2% had deficient levels. Only 7.3% had sufficient levels.
- In the present study serum Vitamin D was significantly less in majority (92.7%) of subjects and those having insufficient or deficient serum Vitamin D levels had a higher incidence of pneumonia and severe pneumonia or very severe disease.

Significant association was found between severity of pneumonia and serum levels of vitamin D ($p<0.001$) and that deficiency of vitamin D is a modifiable risk factor in prevention of ARTI.

- Analysis of serum vitamin D levels and socio-economic status was found that in children with sufficient vitamin D levels none belonged to the lower class group which was found to be statistically significant.
- In the study, significant association was found between presence of clinical pallor and serum vitamin D levels.
- Vitamin D deficiency was significantly more in children receiving less hours of sunlight exposure($p<0.008$) which might be due to cultural practices.

- Relationship between various risk factors and pneumonia showed that presence of pallor, type of feeding in the first six months of life and family history of smoking were significant risk factors for developing ARTI.
- No significant association was found in the study between cases of ARTI and past history of RTI, type of fuel used and immunization status.
- Hence from the study we conclude that in addition to decreased serum vitamin D levels; inadequate exclusive breast feeding in first six months of life; presence of pallor and exposure to passive smoking were other modifiable risk factors for pneumonia. Hence, steps for correction of these factors can help in prevention of morbidities secondary to ARTI worldwide.

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ANNEXURES

ANNEXURE 1

PROFORMA FOR THE STUDY:

1) Name:

2) Age/Sex:

3) Hospital number:

Date of admission:

Date of discharge:

4) Address and Phone number:

5) Religion: Hindu / Muslim / Christian / others

6) SOCIO ECONOMIC STATUS:

a) EDUCATIONAL STATUS

FATHER: Illiterate / Primary / Secondary / High school / PUC/

graduate / Post graduate

MOTHER: Illiterate / Primary / Secondary / High school / PUC / Graduate / Post graduate

b) OCCUPATION

FATHER: Agriculture / Labourer / Service / Business / others

MOTHER: House wife / Labourer / Service / Others

c) Total number of members in the family:

d) Total income of the family:

e) Per – capita income:

f) Socioeconomic classification (ACCORDING TO BG PRASAD CLASSIFICATION)

7) Personal history:

i) Diet: Veg / Non veg / Mixed diet

ii) Nutritional:Breast-feeding given: Yes / no

Duration of breast feeding (in months):

Exclusive breast-feeding given: Yes / no, if yes then duration.

If not then type of top feed (cereal / milk based):

Duration when complementary feeding were started:

iii)**Immunization**

Complete	
Partial	
Unimmunized	

8) History of exposure to sunlight:

a) Yes b) No

If yes, how many hours per day?:

If no, reason why ?:

9) i) History of smoking in family: a) YES b) NO

ii) Fuel used for cooking / lightening: Kerosene / coal / wood / electricity.

10) H/o Vitamin D supplementation: a) YES b) NO

11) Past history of ALRI: a) YES b) NO

12) History of TB contact: a) YES b) NO

General physical examination:

Any danger signs : Convulsion/ Lethargy/ Refusal of feeds/ Vomiting

Signs of rickets: Any skeletal deformity(Genu varum/Genu valgum/Carniotabes/Spinal or pelvic deformity/Costochondral swelling/Harrison s groove) : Present / Absent

Oedema: Present/ Absent

Pallour: Present/ Absent (Hb %)

Height : cm Height for age

Weight : kg Weight for length

Vital signs: PR …… RR …… TEMP…….

11) Systemic examination

CVS

RS

RESPIRATORY RATE	
CHEST INDRAWING	PRESENT / ABSENT
STRIDOR	PRESENT / ABSENT
WARNING SIGN	PRESENT / ABSENT

P/A

CNS

CLINICAL DIAGNOSIS ACCORDING TO IMCI CRITERIA-

Vitamin D (25 hydroxycalciferol) level in the blood: ng/dl

CONSENT FORM

I/we,have been told to participate in "**ASSOCIATION OF SERUM VITAMIN D LEVELS WITH SEVERITY OF ACUTE RESPIRATORY TRACT INFECTIONS IN CHILDREN** " I have been told in language best understood by me/us and completely understood. I have been informed that no additional expenditure will be incurred for this study, and my personal info and of my ward will not be revealed and I can withdraw from the study at any point of time without reason.

I, voluntarily give consent to participate in this study and allow to draw 2ml of venous blood from my ward for the purpose of the study.

SIGNATURE

Date:

WITNESS

1.

Date:

2.

Date

ಒಪ್ಪಿಗೆಪತ್ರ

ನಾನು / ನಾವು,

"ತೀವ್ರಶ್ವಾಸನಾಳದಸೋಂಕುಗಳುಮಕ್ಕಳಲ್ಲಿಜೊತಿಸೀರಮ್ಸಂಘಟನೆಯಿಂದಡಿಜೀವಸತ್ವಮಟ್ಟವನ್ನು"

ಭಾಗವಹಿಸಲುಹೇಳಿದರುಮಾಡಲಾಗಿದೆನಾನು /

ನಮಗೆನನ್ನಿಂದಅತ್ಯುತ್ತಮಅರ್ಥಮತ್ತುಸಂಪೂರ್ಣವಾಗಿಅರ್ಥಭಾಷೆಯಲ್ಲಿಹೇಳಿದರುಮಾಡಲಾಗಿದೆ.

ನಾನುಯಾವುದೇಹೆಚ್ಚುವರಿವೆಚ್ಚಈಅಧ್ಯಯನಕ್ಕೆಉಂಟಾದಎಂದುಮಾಹಿತಿಮಾಡಲಾಗಿದೆ,

ಮತ್ತುನನ್ನವೈಯಕ್ತಿಕಮಾಹಿತಿಯನ್ನುಮತ್ತುನನ್ನವಾರ್ಡಹಿರಂಗಮಾಡುವುದಿಲ್ಲಮತ್ತುನಾನುಕಾರಣವಿಲ್ಲದೆಸಮಯ

ಯಾವುದೇಹಂತದಲ್ಲಿಅಧ್ಯಯನದಿಂದಹಿಂದಕ್ಕೆ.

ನಾನುಸ್ವಯಂಪ್ರೇರಣೆಯಿಂದಈಅಧ್ಯಯನದಲ್ಲಿಭಾಗವಹಿಸಲುಮತ್ತುಅಧ್ಯಯನದಉದ್ದೇಶನನ್ನವಾರ್ಡಿರೆಯರಕ್ತವ

ನ್ನು 2 ಮಿಲಿಸೆಳೆಯಲುಅವಕಾಶಒಪ್ಪಿಗೆನೀಡಿ.

ಸಹಿ

ದಿನಾಂಕ:

ಸಾಕ್ಷಿ

1.

ದಿನಾಂಕ:

2.

ದಿನಾಂಕ

INFORMATION SHEET

I Dr Jyothi.A Post Graduate in Department of Paediatrics am conducting a study on "**ASSOCIATION OF SERUM VITAMIN D LEVELS WITH SEVERITY OF ACUTE RESPIRATORY TRACT INFECTIONS IN CHILDREN "** this is a observational study to measure the serum levels of Vitamin D levels in children and to associate the severity of acute respiratory tract infections with serum Vitamin D levels. This study would be beneficial to establish association between subclinical Vitamin D levels and acute respiratory tract infections to prevent recurrence. There will not be any additional expenditure other than routine care incurred because of this study other than 2ml of venous blood collected. Personal information will not be revealed and the scientific data obtained through the study will be communicated to other Pediatricians.

(Principle investigator)

Date:

ಮಾಹಿತಿನಮೂನೆ

ನಾನುಪೀಡಿಯಾಟ್ರಿಕ್ಸ್ಇಲಾಖೆಡಾಜ್ಯೋತಿ .ಎಸ್ನಾತಕೋತ್ತರ

"ತೀವ್ರಶ್ವಾಸನಾಳದಸೋಂಕುಗಳುಮಕ್ಕಳುತೀವ್ರತೆಸೀರಮ್ಸಂಘಟನೆಯಿಂದ D ಜೀವಸತ್ವಮಟ್ಟವನ್ನು"

ಮೇಲೆಅಧ್ಯಯನನಡೆಸುವುದುನಾನುಈಮಕ್ಕಳಲ್ಲಿವಿಟಮಿನ್ದಿಮಟ್ಟದಸೀರಮ್ಮಟ್ಟವನ್ನುಅಳೆಯಲುಒಂದುಸರ್ವೇಕ್ಷಣೆ

ಯಅಧ್ಯಯನವುಮತ್ತುಡಿಸೀರಮ್ವಿಟಮಿನ್ಮಟ್ಟದತೀವ್ರಉಸಿರಾಟದಪ್ರದೇಶದಸೋಂಕುಗಳುತೀವ್ರತೆಯನ್ನುಸಂಯೋ

ಜಿಸಲು. ಈಅಧ್ಯಯನವು,

ಸಬ್ಕ್ಲಿನಿಕಲ್ದಿಜೀವಸತ್ವಮಟ್ಟವನ್ನುಮತ್ತುಅದರಪುನರಾವರ್ತನೆತಪ್ಪಿಸಲುತೀವ್ರಉಸಿರಾಟದಪ್ರದೇಶದಸೋಂಕುಗಳು

ನಡುವೆಸಂಬಂಧವನ್ನುಸಹಾಯಕವಾಗಬಲ್ಲ. ವಾಡಿಕೆಯಕಾಳಜಿಏಕೆಂದರೆಸಂಗ್ರಹಿಸಿದಸಿರೆಯರಕ್ತವನ್ನು 2

ಮಿಲಿಬೇರೆಈಅಧ್ಯಯನದಉಂಟಾದಬೇರೆಯಾವುದೇಹೆಚ್ಚುವರಿವೆಚ್ಚಇರುವುದಿಲ್ಲ.

ವೈಯಕ್ತಿಕಮಾಹಿತಿಬಹಿರಂಗಆಗುವುದಿಲ್ಲಮತ್ತುಅಧ್ಯಯನದಮೂಲಕಪಡೆದವೈಜ್ಞಾನಿಕದಶಮಾಂಶಇತರಮಕ್ಕಳ

ಸಂವಹನನಡೆಯಲಿದೆ.

(ಪ್ರಿನ್ಸಿಪಲ್ಸಂಶೋಧಕ)

ದಿನಾಂಕ:

	SL NO	AGE	SEX	RELIGION	ADDRESS	SOCIO ECONOMIC	DIET	H/O EXPOSURE SUNLIGHT	YES	NO	HOURS	IF NO REASON??	HEIGHT	WEIGHT	PR	RR	RESPIRATORY FINDINGS	WARNING SIGN	IMNCI CLASS	VITAMIN D LEVELS		CLASSIFICATION	DURATION OF HOSPITAL STAY	FEEDING IN FIRST SIX MONTHS OF LIFE	IMMUNIZATION	PAST HISTORY OF ARTI	FAMILY HISTORY OF SMOKING	TYPE OF FUEL USED	PALLOR
85203	1	2YR	MALE	MUSLIM	MULBAGAL,KOLAR	MIDDLE CLASS	MIXED		YES		2HRS		82CM	11KG	150	38	BL CREPS,BL SCR	PRESENT	SEVERE PNEUMONIA		19	INSUFFICIENCY	5	EXCULSIVE BREAST FEEDING	UPTODATE	ABSENT	PRESENT	KEROSENE	ABSENT
86221	2	IYR	MALE	HINDU	MULBAGAL,KOLAR	UPPER MIDDLE CLASS	VEG		YES		4 HRS		74cm	8.9KG	130	58	BLCREPS,BLSCR	ABSENT	PNEUMONIA		27	SUFFICIENCY	4	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	ABSENT	LPG	PRESENT
85360	3	2M15DYS	MALE	HINDU	MULBAGAL,KOLAR	MIDDLE CLASS	VEG			NO		NOT TAKEN OUTSIDE	55 CM	3.9KG	120	62	BLCREPS,BLSCR	PRESENT	SEVERE PNEUMONIA		19	INSUFFICIENCY	6	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	ABSENT	LPG	PRESENT
2184	4	8 M10DYS	MALE	MUSLIM	MULBAGAL,KOLAR	UPPER CLASS	MIXED		YES		2HRS		72CM	11KG	100	53	BLCREPS,BLSCR	ABSENT	PNEUMONIA		22	SUFFICIENCY	4	EXCULSIVE BREAST FEEDING	UPTODATE	PRESENT	PRESENT	LPG	PRESENT
70779	5	5YR	MALE	HINDU	GULPET,KOLAR	MIDDLE CLASS	MIXED		YES		6HRS		130CM	50KG	80	22	OCCASIONAL CREPS	ABSENT	NO PNEUMONIA		18	SUFFICIENCY	4	EXCULSIVE BREAST FEEDING	UPTODATE	ABSENT	ABSENT	LPG	PRESENT
97009	6	5YR	MALE	HINDU	MULBAGAL,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		8HRS		110CM	38KG	88	27	OCCASIONAL CREPS	ABSENT	NO PNEUMONIA		22	SUFFICIENCY	10	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	PRESENT	LPG	ABSENT
98577	7	2YR	MALE	HINDU	KAPALMAD,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		4HRS		86CM	11KG	79	38	BLCREPS,BLSCR	ABSENT	PNEUMONIA		28	SUFFICIENCY	4	EXCULSIVE BREAST FEEDING	UPTODATE	PRESENT	ABSENT	LPG	PRESENT
96380	8	11M	MALE	MUSLIM	NOORVLLA,KOLAR	LOWER CLASS	MIXED		YES		2HRS		70CM	8KG	100	52	BL CREPS	ABSENT	PNEUMONIA		21	SUFFICIENCY	5	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
98356	9	1 YR	MALE	HINDU	NELAVAGILLU,KOLAR	MIDDLE CLASS	MIXED		YES		4HRS		78CM	12KG	100	48	BL CREPS LETARGY+	PRESENT	SEVERE PNEUMONIA		16	INSUFFICIENCY	6	EXCULSIVE BREAST FEEDING	UPTODATE	ABSENT	ABSENT	LPG	PRESENT
98209	10	1YR 3M	MALE	HINDU	SRINIVASPURA KOLAR	UPPER CLASS	MIXED		YES		5 HRS		78.5 CM	10KG	88	49	BL CREPS	ABSENT	PNEUMONIA		25	SUFFICIENCY	5	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	PRESENT	LPG	ABSENT
97725	11	1YR	MALE	HINDU	THMASANDRA,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		10HRS		73CM	9.8KG	92	38	BL CREPS	ABSENT	NO PNEUMONIA		25	SUFFICIENCY	4	EXCULSIVE BREAST FEEDING	UPTODATE	PRESENT	ABSENT	LPG	PRESENT
97764	12	10M	MALE	MUSLIM	RAHAMATHNAGAR,KOLAR	MIDDLE CLASS	MIXED		YES		4HRS		69CM	9KG	100	54	BL CREPS LETARGY+	PRESENT	SEVERE PNEUMONIA		19	INSUFFICIENCY	6	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
97722	13	7M	FEMALE	MUSLIM	GOWRIPET,KOLAR	LOWER CLASS	MIXED		YES		2HRS		66CM	7.8KG	110	45	BL CREPS	ABSENT	PNEUMONIA		22	SUFFICIENCY	5	EXCULSIVE BREAST FEEDING	UPTODATE	ABSENT	ABSENT	LPG	PRESENT
98296	14	4YR	MALE	HINDU	MADERAHALLI,KOLAR	UPPER MIDDLE CLASS	VEG		YES		10HRS		149CM	18KG	90	28	BL CREPS	ABSENT	PNEUMONIA		20	SUFFICIENCY	4	COMBINED FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
99943	15	1YR5M	MALE	HINDU	KGF,KOLAR	MIDDLE CLASS	MIXED		YES		6HRS		79CM	10.5KG	100	38	BL CREPS	ABSENT	PNEUMONIA		19	INSUFFICIENCY	10	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	ABSENT	LPG	PRESENT
99729	16	3YR	MALE	HINDU	BANGARPET,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		5HRS		106CM	14KG	89	30	NO ADDED SOUNDS	ABSENT	NO PNEUMONIA		22	SUFFICIENCY	1	EXCULSIVE BREAST FEEDING	UPTODATE	ABSENT	PRESENT	LPG	ABSENT
981234	17	1YR	FEMALE	MUSLIM	MULBAGAL,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		4HRS		73CM	10.5KG	100	39	BL CREPS	ABSENT	PNEUMONIA		23	SUFFICIENCY	7	COMBINED FEEDING	PARTIAL	PRESENT	ABSENT	LPG	PRESENT
101123	18	5M	MALE	HINDU	MALUR,KOLAR	UPPER CLASS	VEG		YES		1HRS		64CM	7KG	189	54	BL CREPS LETARGY+	PRESENT	SEVERE PNEUMONIA		14	INSUFFICIENCY	8	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
78029	19	2.5M	MALE	HINDU	GIKAHALLI,KOLAR	LOWER CLASS	VEG		YES		2HRS		53CM	4.3KG	100	45	NO ADDED SOUNDS	ABSENT	NO PNEUMONIA		28	SUFFICIENCY	5	EXCULSIVE BREAST FEEDING	UPTODATE	PRESENT	ABSENT	LPG	PRESENT
10065	20	5YR	MALE	HINDU	JANAPANAHALLI,KOLAR	MIDDLE CLASS	MIXED		YES		8HRS		130CM	25KG	100	29	BL CREPS	ABSENT	PNEUMONIA		23	SUFFICIENCY	2	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	PRESENT	LPG	PRESENT
96203	21	5YR	MALE	HINDU	KALAHASTHIPURA,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		6HRS		111CM	19KG	100	42	BL CREPS LETARGY+	PRESENT	SEVERE PNEUMONIA		17	INSUFFICIENCY	6	COMBINED FEEDING	PARTIAL	PRESENT	ABSENT	LPG	ABSENT
103273	22	5YR	MALE	HINDU	SRINIVASPURA KOLAR	UPPER MIDDLE CLASS	MIXED		YES		5HRS		112CM	22KG	90	19	NO ADDED SOUNDS	ABSENT	NO PNEUMONIA		29	SUFFICIENCY	1	EXCULSIVE BREAST FEEDING	UPTODATE	PRESENT	PRESENT	LPG	PRESENT
105304	23	5M	FEMALE	HINDU	CHINTMANI,KOLAR	LOWER CLASS	VEG		YES		3HRS		65CM	5.5KG	160	56	BL CREPS LETARGY+	PRESENT	SEVERE PNEUMONIA		19	INSUFFICIENCY	5	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	ABSENT	LPG	PRESENT

60847	24	7M	FEMALE	HINDU	SIDDHALAGATA,KOLAR	MIDDLE CLASS	VEG		YES		3HRS		64.5CM	7KG	162	52	BL CREPS LETARGY+	PRESENT	SEVERE PNEUMONIA		20	SUFFICIENCY	4	COMBINED FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
106859	25	1YR	MALE	HINDU	MALUR,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		4HRS		79.5CM	10KG	122	32	BL CREPS	ABSENT	NO PNEUMONIA		26	SUFFICIENCY	5	EXCULSIVE BREAST FEEDING	UPTODATE	PRESENT	ABSENT	LPG	PRESENT
107288	26	9M	MALE	HINDU	CHINTMANI,KOLAR	LOWER CLASS	VEG		YES		3HRS		63CM	8KG	130	48	NO ADDED SOUNDS	ABSENT	NO PNEUMONIA		25	SUFFICIENCY	3	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	PRESENT	KEROSENE	ABSENT
107838	27	3YR	FEMALE	HINDU	KEMADAGAN,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		4HRS		96CM	12KG	98	52	BL CREPS LETARGY+	PRESENT	SEVERE PNEUMONIA		17	INSUFFICIENCY	7	COMBINED FEEDING	UPTODATE	PRESENT	ABSENT	LPG	PRESENT
107299	28	4M	MALE	CHRISTIAN	HULTUR,KOLAR	MIDDLE CLASS	MIXED		YES		1HRS		56CM	6KG	120	54	BL CREPS LETARGY+	PRESENT	SEVERE PNEUMONIA		25	SUFFICIENCY	3	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
107387	29	1.8YR	MALE	HINDU	HUTTANUR,KOLAR	LOWER CLASS	MIXED		YES		5HRS		78CM	11KG	160	59	BL CREPS LETARGY+	PRESENT	SEVERE PNEUMONIA		12	DEFICIENCY	7	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	ABSENT	LPG	PRESENT
108110	30	1YR	MALE	HINDU	MULBAGAL,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		5HRS		70CM	12KG	80	49	BL CREPS	ABSENT	PNEUMONIA		43	SUFFICIENCY	3	EXCULSIVE BREAST FEEDING	UPTODATE	PRESENT	PRESENT	LPG	ABSENT
1020444	31	1YR	FEMALE	HINDU	SRINIVASPURA KOLAR	LOWER MIDDLE CLASS	VEG		YES		3HRS		72CM	5.6KG	100	52	BL CREPS	ABSENT	PNEUMONIA		32	SUFFICIENCY	4	COMBINED FEEDING	PARTIAL	ABSENT	ABSENT	LPG	PRESENT
11014	32	2YR	FEMALE	HINDU	MALUR,KOLAR	LOWER CLASS	MIXED		YES		5HRS		80CM	9KG	120	59	BL CREPS LETARGY+	PRESENT	SEVERE PNEUMONIA		20	SUFFICIENCY	4	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
117355	33	8M	FEMALE	MUSLIM	MULBAGAL,KOLAR	MIDDLE CLASS	MIXED		YES		2HRS		69CM	6KG	150	69	BL CREPS LETARGY+	PRESENT	SEVERE PNEUMONIA		15	INSUFFICIENCY	5	EXCULSIVE BREAST FEEDING	UPTODATE	PRESENT	PRESENT	LPG	ABSENT
111897	34	2YR	FEMALE	HINDU	BAGPELLE,KOLAR	LOWER MIDDLE CLASS	MIXED		YES		6HRS		87CM	10KG	130	50	BL CREPS	ABSENT	PNEUMONIA		24	SUFFICIENCY	4	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	ABSENT	LPG	PRESENT
111914	35	1YR	MALE	HINDU	NARASAPUR,KOLAR	LOWER MIDDLE CLASS	VEG		YES		5HRS		75CM	7.5KG	88	48	BL CREPS	ABSENT	NO PNEUMONIA		22	SUFFICIENCY	3	COMBINED FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
113388	36	1YR	MALE	HINDU	SB HALLI,KOLAR	MIDDLE CLASS	MIXED		YES		6HRS		72CM	9.5KG	150	68	BL CREPS LETARGY+	PRESENT	SEVERE PNEUMONIA		16	INSUFFICIENCY	7	EXCULSIVE BREAST FEEDING	UPTODATE	PRESENT	ABSENT	LPG	ABSENT
113613	37	5YR	FEMALE	HINDU	GATAHALLI,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		4HRS		98CM	15KG	98	41	BL CREPS LETARGY+	PRESENT	SEVERE PNEUMONIA		19	INSUFFICIENCY	5	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	PRESENT	LPG	PRESENT
108906	38	3YR	FEMALE	HINDU	ARAVAPALLI,KOLAR	LOWER MIDDLE CLASS	VEG		YES		6HRS		86CM	13KG	90	38	BL CREPS+	ABSENT	PNEUMONIA		26	SUFFICIENCY	4	COMBINED FEEDING	UPTODATE	PRESENT	ABSENT	LPG	ABSENT
1020517	39	3YR	MALE	HINDU	MULBAGAL,KOLAR	MIDDLE CLASS	VEG		YES		6HRS		92CM	13KG	68	32	BL CREPS+	ABSENT	PNEUMONIA		24	SUFFICIENCY	4	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
11891	40	3YR	MALE	CHRISTIAN	GOLIPETE,KOLAR	LOWER MIDDLE CLASS	MIXED		YES		6HRS		94CM	14KG	86	40	BL CREPS+	ABSENT	PNEUMONIA		25	SUFFICIENCY	4	EXCULSIVE BREAST FEEDING	UPTODATE	ABSENT	ABSENT	KEROSENE	ABSENT
116801	41	2.6YR	MALE	HINDU	MULBAGAL,KOLAR	LOWER MIDDLE CLASS	MIXED		YES		6HRS		88CM	12.4KG	90	32	BL CREPS+	ABSENT	PNEUMONIA		27	SUFFICIENCY	4	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
117313	42	7M	FEMALE	HINDU	MULBAGAL,KOLAR	MIDDLE CLASS	MIXED		YES		3HRS		67CM	7KG	120	30	BL NVBS	ABSENT	NO PNEUMONIA		24	SUFFICIENCY	4	COMBINED FEEDING	UPTODATE	PRESENT	ABSENT	LPG	PRESENT
117235	43	4YR	MALE	CHRISTIAN	SHILANGIRI,KOLAR	LOWER MIDDLE CLASS	MIXED		YES		5HRS		96CM	14KG	130	48	BL CREPS+ SCR+	ABSENT	PNEUMONIA		22	SUFFICIENCY	6	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	PRESENT	LPG	ABSENT
119101	44	5M	MALE	HINDU	SRINIVASPURA KOLAR	LOWER MIDDLE CLASS	MIXED		YES		3HRS		63CM	7KG	110	53	BL CREPS+BLS CR+ICR+	PRESENT	SEVERE PNEUMONIA		24	SUFFICIENCY	6	EXCULSIVE BREAST FEEDING	UPTODATE	PRESENT	ABSENT	LPG	PRESENT
119021	45	1.5YR	FEMALE	HINDU	CHINTMANI,KOLAR	MIDDLE CLASS	MIXED		YES		4HRS		79CM	9KG	140	53	BL CREPS+BLS CR+ICR+	PRESENT	SEVERE PNEUMONIA		20	INSUFFICIENCY	7	COMBINED FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
119094	46	4YR	FEMALE	HINDU	BANDAHALLI,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		3HRS		99CM	13.5KG	90	48	BL CREPS+BLS CR+ICR+	PRESENT	SEVERE PNEUMONIA		19	INSUFFICIENCY	6	EXCULSIVE BREAST FEEDING	UPTODATE	ABSENT	ABSENT	LPG	ABSENT
130713	47	11M	MALE	HINDU	BAGEPALLI,KOLAR	LOWER MIDDLE CLASS	MIXED		YES		2HRS		70CM	9.5KG	120	53	BL CREPS+	ABSENT	PNEUMONIA		27	SUFFICIENCY	5	COMBINED FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
130819	48	1YR	MALE	HINDU	ALANGI,KOLAR	MIDDLE CLASS	VEG		YES		3HRS		73CM	9.5KG	110	68	BL CREPS+BLS CR+ICR+	PRESENT	SEVERE PNEUMONIA		16	INSUFFICIENCY	8	EXCULSIVE BREAST FEEDING	UPTODATE	ABSENT	ABSENT	LPG	PRESENT

131776	49	2YR	MALE	HINDU	MALUR,KOLAR	LOWER MIDDLE CLASS	VEG		YES		4HRS		85CM	11KG	120	58	BL CREPS+	ABSENT	PNEUMONIA		21	SUFFICIENCY	4	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	PRESENT	LPG	ABSENT
124466	50	3M	FEMALE	HINDU	MULBAGAL,KOLAR	LOWER MIDDLE CLASS	MIXED		NO			NOT TAKEN OUTSIDE	55CM	5.8KG	140	54	BL CREPS+ SCR+	ABSENT	PNEUMONIA		24	SUFFICIENCY	4	EXCULSIVE BREAST FEEDING	UPTODATE	ABSENT	ABSENT	LPG	PRESENT
130780	51	9M	MALE	HINDU	HUTHUR,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		3HRS		75CM	11.5KG	130	63	BL CREPS+BLS CR+ICR+	PRESENT	SEVERE PNEUMONIA		19	INSUFFICIENCY	7	TOP FEED ONLY	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
131143	52	10M	FEMALE	HINDU	MALUR,KOLAR	MIDDLE CLASS	MIXED		YES		4HRS		82CM	13KG	150	50	BL CREPS+	ABSENT	PNEUMONIA		25	SUFFICIENCY	4	COMBINED FEEDING	UPTODATE	ABSENT	ABSENT	KEROSENE	ABSENT
132585	53	7M	MALE	HINDU	SIDDHALAGATA,KOLAR	LOWER MIDDLE CLASS	MIXED		YES		3HRS		69CM	10.5KG	130	53	BL CREPS+	ABSENT	PNEUMONIA		22	SUFFICIENCY	3	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
132668	54	2M15DYS	FEMALE	HINDU	SRINIVASPURA KOLAR	LOWER MIDDLE CLASS	MIXED		YES		2HRS		56CM	6.9KG	120	67	BL CREPS+BLS CR+ICR+	PRESENT	SEVERE PNEUMONIA		19	INSUFFICIENCY	7	COMBINED FEEDING	UPTODATE	ABSENT	ABSENT	LPG	PRESENT
134002	55	2YR	FEMALE	HINDU	SRINIVASPURA KOLAR	MIDDLE CLASS	MIXED		YES		4HRS		89CM	15KG	110	50	BL CREPS+	ABSENT	PNEUMONIA		20	INSUFFICIENCY	6	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	PRESENT	LPG	ABSENT
13338	56	1YR	MALE	HINDU	DODABALAPURA,KOLAR	LOWER MIDDLE CLASS	MIXED		YES		4HRS		77CM	11KG	100	50	BL ADDED SOUNDS	ABSENT	NO PNEUMONIA		21	SUFFICIENCY	5	EXCULSIVE BREAST FEEDING	UPTODATE	ABSENT	ABSENT	LPG	PRESENT
1020987	57	3M	MALE	HINDU	CHINTMANI,KOLAR	LOWER MIDDLE CLASS	MIXED		YES		1HRS		56CM	5.8KG	150	49	BL CREPS+	ABSENT	PNEUMONIA		22	SUFFICIENCY	3	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
131359	58	1.5YR	FEMALE	HINDU	BANGERPETE,KOLAR	MIDDLE CLASS	MIXED		YES		4HRS		86CM	14KG	98	40	BL CREPS+BLS CR+ICR+	PRESENT	SEVERE PNEUMONIA		15	DEFICIENCY	6	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	ABSENT	LPG	ABSENT
136018	59	3M	MALE	HINDU	SRINIVASPURA KOLAR	UPPER MIDDLE CLASS	VEG		YES		1HRS		62CM	7KG	160	58	BL CREPS+BLS CR+ICR+	ABSENT	PNEUMONIA		20	INSUFFICIENCY	7	EXCULSIVE BREAST FEEDING	UPTODATE	PRESENT	PRESENT	LPG	PRESENT
113866	60	7M	MALE	HINDU	MULBAGAL,KOLAR	LOWER MIDDLE CLASS	MIXED		YES		3HRS		67CM	8.9KG	140	56	BL CREPS+ SCR+	PRESENT	SEVERE PNEUMONIA		19	INSUFFICIENCY	7	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	PRESENT	LPG	PRESENT
142967	61	1YR9M	FEMALE	HINDU	SRINIVASPURA KOLAR	MIDDLE CLASS	MIXED		YES		5HRS		88CM	12.6KG	110	49	BL CREPS+ SCR+	ABSENT	PNEUMONIA		24	INSUFFICIENCY	3	EXCULSIVE BREAST FEEDING	UPTODATE	PRESENT	ABSENT	LPG	ABSENT
143134	62	6M	FEMALE	HINDU	GALLAPET,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		2HRS		71CM	8.8KG	152	68	BL CREPS+ SCR+	PRESENT	SEVERE PNEUMONIA		20	DEFICIENCY	4	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	PRESENT	KEROSENE	PRESENT
144095	63	8M	MALE	HINDU	URIGIL,KOLAR	LOWER MIDDLE CLASS	VEG		YES		2HRS		71CM	9.4KG	132	58	BL CREPS+ SCR+	ABSENT	PNEUMONIA		25	INSUFFICIENCY	2	COMBINED FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
171670	64	2M	FEMALE	HINDU	ACHNAPALLI,KOLAR	MIDDLE CLASS	VEG		NO			NOT TAKEN OUTSIDE	63CM	6.2KG	142	56	BL CREPS+	ABSENT	PNEUMONIA		26	INSUFFICIENCY	5	EXCULSIVE BREAST FEEDING	UPTODATE	ABSENT	ABSENT	WOOD	ABSENT
154773	65	5M	FEMALE	HINDU	MULBAGAL,KOLAR	LOWER MIDDLE CLASS	MIXED		YES		2HRS		67CM	8.5KG	130	59	BL CREPS+	PRESENT	SEVERE PNEUMONIA		18	DEFICIENCY	4	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
171599	66	5M	MALE	HINDU	TEKAL,KOLAR	MIDDLE CLASS	VEG		YES		4HRS		65CM	8KG	132	48	BL NVBS	ABSENT	PNEUMONIA		21	INSUFFICIENCY	3	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	ABSENT	LPG	ABSENT
171679	67	2YR	MALE	HINDU	SRINIVASPURA KOLAR	UPPER MIDDLE CLASS	MIXED		YES		4HRS		91.1CM	13.2KG	110	56	BL CREPS+	ABSENT	PNEUMONIA		20	DEFICIENCY	6	COMBINED FEEDING	UPTODATE	PRESENT	PRESENT	LPG	PRESENT
175579	68	1YR6M	FEMALE	MUSLIM	CHINTMANI,KOLAR	LOWER MIDDLE CLASS	MIXED		YES		3HRS		85CM	13KG	120	68	BL CREPS+	PRESENT	SEVERE PNEUMONIA		21	INSUFFICIENCY	5	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	ABSENT	LPG	PRESENT
164670	69	1YR6M	FEMALE	HINDU	SRINIVASPURA KOLAR	MIDDLE CLASS	MIXED		YES		4HRS		84.2CM	11.2KG	122	48	BL CREPS+	PRESENT	SEVERE PNEUMONIA		21	INSUFFICIENCY	4	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
180769	70	13M	FEMALE	HINDU	HOSAHALLI,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		4HRS		76CM	10.9KG	150	48	BL CREPS+	PRESENT	SEVERE PNEUMONIA		20	DEFICIENCY	3	COMBINED FEEDING	UPTODATE	ABSENT	ABSENT	LPG	ABSENT
179065	71	6M	MALE	HINDU	HOSAHALLI,KOLAR	MIDDLE CLASS	MIXED		YES		5HRS		67CM	8.8KG	110	52	BL CREPS+	ABSENT	PNEUMONIA		22	INSUFFICIENCY	3	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	PRESENT	LPG	PRESENT
176633	72	3YR	FEMALE	HINDU	PAPRAJANHALLI,KOLAR	MIDDLE CLASS	VEG		YES		6HRS		99CM	17KG	140	52	BL CREPS+	ABSENT	PNEUMONIA		24	INSUFFICIENCY	4	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	ABSENT	LPG	PRESENT
174370	73	1YR6M	FEMALE	HINDU	GUTTAHALLI,KOLAR	LOWER MIDDLE CLASS	MIXED		YES		5HRS		84CM	12KG	100	32	BL CREPS+	ABSENT	NO PNEUMONIA		22	INSUFFICIENCY	3	EXCULSIVE BREAST FEEDING	UPTODATE	PRESENT	PRESENT	LPG	PRESENT

178327	74	2M10D	FEMALE	HINDU	CHINTMANI,KOLAR	MIDDLE CLASS	MIXED		NO			NOT TAKEN OUTSIDE	58CM	7.1KG	130	62	BL CREPS+	PRESENT	SEVERE PNEUMONIA		33	SUFFICIENCY	5	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	ABSENT	WOOD	PRESENT
177869	75	11M	MALE	HINDU	CHINTMANI,KOLAR	MIDDLE CLASS	MIXED		YES		4HRS		75.8CM	10.8KG	133	52	BL CREPS+	ABSENT	PNEUMONIA		26	INSUFFICIENCY	4	TOP FEED ONLY	UPTODATE	PRESENT	PRESENT	LPG	PRESENT
182165	76	11M	MALE	HINDU	MULBAGAL,KOLAR	LOWER MIDDLE CLASS	MIXED		YES		5HRS		76CM	11KG	114	58	BL CREPS+BLS CR+ICR+	PRESENT	SEVERE PNEUMONIA		23	INSUFFICIENCY	3	COMBINED FEEDING	PARTIAL	ABSENT	ABSENT	LPG	PRESENT
182490	77	2YEAR	MALE	HINDU	CHINTMANI,KOLAR	MIDDLE CLASS	VEG		YES		6HRS		93CM	12.9KG	98	32	BL CREPS+	ABSENT	NO PNEUMONIA		30	SUFFICIENCY	4	EXCULSIVE BREAST FEEDING	UPTODATE	PRESENT	ABSENT	LPG	PRESENT
186585	78	1 YEAR	MALE	HINDU	BANGERPETE,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		5HRS		78CM	11KG	110	56	BL CREPS+	PRESENT	SEVERE PNEUMONIA		22	INSUFFICIENCY	5	EXCULSIVE BREAST FEEDING	PARTIAL	ABSENT	ABSENT	LPG	PRESENT
120070	79	1YEAR	FEMALE	HINDU	DOROLIPALI,KOLAR	MIDDLE CLASS	VEG		YES		7HRS		79CM	10.9KG	92	32	BL CREPS+	ABSENT	NO PNEUMONIA		32	SUFFICIENCY	3	COMBINED FEEDING	UPTODATE	PRESENT	ABSENT	LPG	PRESENT
186479	80	2YEAR	FEMALE	HINDU	NARASAPUR,KOLAR	UPPER MIDDLE CLASS	MIXED		YES		5HRS		92.5CM	12KG	120	48	BL CREPS+BLS CR+ICR+	ABSENT	PNEUMONIA		25	INSUFFICIENCY	4	EXCULSIVE BREAST FEEDING	PARTIAL	PRESENT	ABSENT	LPG	PRESENT
186360	81	11M	FEMALE	HINDU	TAMAKA,KOLAR	MIDDLE CLASS	MIXED		YES		3HRS		76.1CM	12KG	150	66	BL CREPS+	PRESENT	SEVERE PNEUMONIA		20	DEFICIENCY	3	TOP FEED ONLY	PARTIAL	PRESENT	ABSENT	LPG	PRESENT
186156	82	1.8YR	MALE	HINDU	GARDUNAHALLI,KOLAR	MIDDLE CLASS	MIXED		YES		4HRS		92CM	11KG	130	49	BL CREPS+	ABSENT	PNEUMONIA		20	DEFICIENCY	4	COMBINED FEEDING	PARTIAL	PRESENT	ABSENT	LPG	PRESENT