Vol 4 Issue 12 Jan 2015

ISSN No : 2230-7850

International Multidisciplinary Research Journal

# *Indian Streams Research Journal*

**Welcome to ISRJ**

**RNI MAHMUL/2011/38595** **ISSN No.2230-7850**

Indian Streams Research Journal is a multidisciplinary research journal, published monthly in English, Hindi & Marathi Language. All research papers submitted to the journal will be double - blind peer reviewed referred by members of the editorial board.Readers will include investigator in universities, research institutes government and industry with research interest in the general subjects.



**Address:-Ashok Yakkaldevi 258/34, Raviwar Peth, Solapur - 413 005 Maharashtra, India**
**Cell : 9595 359 435, Ph No: 02172372010 Email: ayisrj@yahoo.in Website: www.isrj.org**

Indian Streams Research Journal
ISSN 2230-7850
Impact Factor : 3.1560(UIF)
Volume-4 | Issue-12 | Jan-2015
Available online at www.isrj.org

# EFFECT OF GEOPHAGY ON THE NUTRITIONAL STATUS OF CHILDREN UNDER FIVE YEARS OF AGE

**Anil Gupta**
Reader, Department of Biochemistry, Eklavya Dental College & Hospital, Kotputli, Rajasthan.

**Abstract:-**Health of children is dependent on nutritious food, proper weaning, good hygiene practices. Inadequate calories upshots into malnutrition. Few children adopt inappropriate behavior and start eating soil. This habit untowardly effects health of children. Study was done to assess the effect of geophagy on health of children. It involved children under five year old, selected from schools (240/440), anganwadi (127/440) and slum areas (73/440). Children with habit of geophagy were seen to be under-weight, (O R = 15.7, p<0.0001)). Also, wasting was more prevalent in soil eating children, (O R = 22.89, p<0.0001).

**Keywords:** Geophagy ,Health of children , inappropriate behavior ,literature survey .

## INTRODUCTION

Geophagia has been the type of Pica, which has its root in Latin. Pica word is used in Latin for the bird, Magpie, with its haphazard eating habits. According to American Psychiatric Association, Pica is the insistent urge in an individual to eat non-nutritive substances.

Geophagy is associated with iron deficiency in most of the individuals. In a literature survey by Lacey, iron deficiency anemia was three times more observed in clay eaters. It is a well established fact that geophagy is practiced in different sections of society throughout the world. However, the scientists are not unanimous about the ill effects of pica.

Radiologists, Maravilla and Berk, (1978), studied the clay eating habit in nine radiographic technologists. Both of them, concluded that it was the constituents and volume of pica, that matter and the consumption of a small amount of pica is usually, harmless. Further, they stated that pica habit is of concern due to four important sequels as: (1) toxicity of the substance eaten, (2) obstruction, (3) calorific deficiency, (4) excessive calories.

Soil particles damage the intestinal mucosa. Soil contains heavy metals, cysts of helminthes and other harmful substances. Rawlins et al., (1991), observed the helminthic infestation in the gastrointestinal tract of those children who consumed soil. Predominant, helminthes reported were, Trichuris trichiura, Ascaris lumbricoides,hookworm, Strongyloides stercoralis, Giardia lamblia and Entamoeba coli.

Health of children is determined by multiple factors. According to (FAO, 2005), Nutritional status is the physiological level of nourishment as definied by energy, protein and minerals status.functioning".

Further, it can be assessed by child's anthropometric parameters, dietary factors, environmental factors, clinical signs and symptoms and social history, (Hammond, 2008: 383).

Anthropometric status of children, according to Hammond, (2008), it is the science of measuring size, weight and proportions of the human body.

## ANTHROPOMETRIC PARAMETERS:

### 1. Weight for Height status

Weight for height reflects the weight of body in proportion to attained growth in height (WHO,1995).

Wasting is defined as a weight for height of below -2SD of the reference population.

**2. Weight for Age status**

Weight for age reflects the child's weight in proportion to his age (WHO, 1995).Under-weight is the weight for age below -2SD of the reference population,

**3. Height for Age status**

Height for age reflects the growth in height in proportion to age of child.(WHO, 1995). Stunting is the height for age of child below -2SD of the reference population.

**Dietary factors**

According to Smolin & Grosvenor, (2008), Dietary factors determine the amount of food that an individual ingests through food intake, which is essential for proper growth and development of children.

The inter-relationship amongst multiple factors and health, has been depicted in the fig. 1.

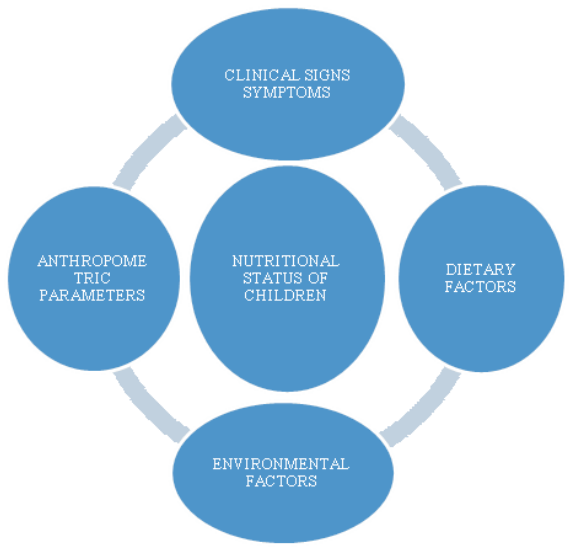



**FIG. 1. CONCEPTUAL FRAMEWORK DEPICTING RELATIONSHIP OF DIFFERENT FACTORS WITH NUTRITIONAL STATUS OF CHILDREN**

## 2. RATIONALE

Health status of child depends on the dietary habits adopted during the formative years of a child. Abnormal habits in children like geophagy, below the age of five years, influences the overall health of children.

Enough data is not available regarding Geophagy and its impact on nutritional status of children, either at national level and or at regional level.

Therefore, the present study was performed to assess prevalence of geophagy and its effect on health of children.

## 3. AIM & OBJECTIVES

**Aim**

This work was aimed at observing the effect of geophagy on the health of children those who were between two years to below five years of age.

**Objectives**

1. To observe prevalence of geophagy in children.
2. To assess prevalence of under-weight in children eating soil.
3. To observe wasting in children with habit of geophagy.
4. To explore association between habit of geophagy with under-weight and wasting in children.

## 4. RESEARCH METHODOLOGY

1 Research Design

Cohort, Descriptive and Cross-sectional research design.

### 4.2 Sampling Design

**A. Study Area**

Study was done in city, Fazilka in Punjab. This city is situated on Indo-Pak border in Punjab. According to census report of 2001, it has population of 67,424, with 52% males and 48% females. Children below 6 years of age, constitutes 13% population of Fazilka.

**B. Sample Frame and Sampling Units**

Children between two years to below the age of five years, residing in and around Fazilka, formed sample frame. Sampling units were children, illustrated by sample selection criteria, mentioned below.

**C. Sample Selection Criteria**

**Inclusion Criteria**

1. Children between 2 years to below 5 years of age.
2. Children who were physically and mentally fit to participate in physical examination & anthropometric measurements.

**Exclusion Criteria**

1. Children who were critically ill.
2. Obstinate children, who did not participate in anthropometric measurement procedure.

**D. Sampling Methods**

Random, Multi-stage sampling technique was followed.

In the first stage, the city was divided into three strata, as below:

1. Elementary schools
2. Anganwadi (child care centres)
3. Slum Areas.

In the second stage, schools, anganwadi and slum areas were selected randomly from the sample frame.

In the third stage, all the children between two years to below five years of age, were selected as per the above stated selection criteria.

**E. Sample Size Determination**

Sample size was determined according to the following formula:

Sample size (n) = $Z2 \times p \times q / d 2$

Z= value of 1.96 was used at 95% of confidence interval
p= 47% prevalence of malnutrition in india
q= ( 1- p)

d= 5% margin of error

Sample size of 382 was calculated by the above formula. To this sample size, non response rate of 15% was added, hence, after final adjustment, sample size of 440 was determined.

**4.3 Data Collection Design**

The study was based on Primary data, collected and recorded, as follows:

**A. Instruments for data collection**

1. Demographic data and anthropometric parameters were recorded with help of observation and interview schedules.

**B. Methods for data collection**

1. Direct observation and interview methods
To assess the General physical appearance.
To collect information regarding age, abnormal habit.
2. Anthropometric measurements

**A. Height measurement**

Height of children were measured using a vertical wooden height board by placing the child on the measuring board, and child standing upright in the middle of board. The child's head, shoulders, buttocks, knees and heels touching the board.

**B. Weight measurement**

Weight was measured by electronic digital weight scale with lightl clothing and no shoes. Calibration was done before weighing every child by setting it to zero.

**C. Data Collection Scales**

1. Interval scale
Age, number of participants, height and weight.
2.Nominal scale
Binary variables, Geophagy, Under-weight, Wasting were recorded, as (Y) & (N).

**4.4 Statistical Design**

A. Descriptive analysis of geophagy and other characterictics was performed and expressed in percentage, as:
Percentage (Prevalence) = number of participants affected / total number of participants × 100
B. Odd ratio with 95% C.I. was computed.
C. Hypothesis was tested by non-parametric, Chi square test of independence.
D. p value of $\leq 0.05$ was implied as statistically significant.

**5. RESULTS**

1. Descriptive and cohort study was conducted. It involved children under five year of age, selected from schools (240/440), anganwadi (127/440) and slum areas (73/440), respectively, as described in table 1.

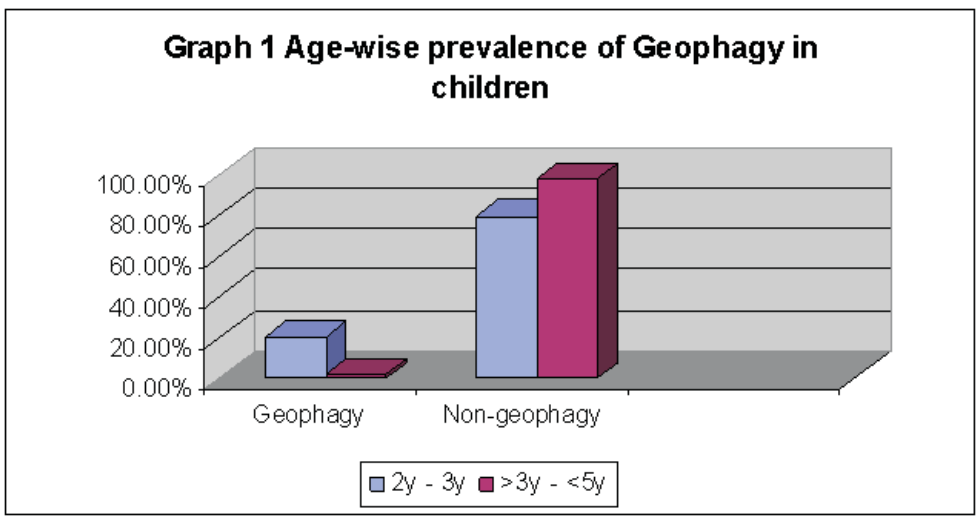
**Table 1. Distribution of participants**

| Strata | Participants (n/N) |
|---|---|
| Schools | 240/440 |
| Anganwadi(child care centre) | 127/440 |
| Slum residents | 73/440 |

2. Descriptive analysis of geophagy was performed. It showed over all prevalence of Geophagy, 9.4% (41/440), in the children below five year of age. Prevalence of Geophagy showed variation in different age groups. In the age group, (2y – 3y), prevalence was 20.2% (34/169) and in another the age group, (>3y-<5y), prevalence was 1.6% (7/271), as represented in table 2 and graph 1.

**Table 2. Age –wise prevalence of Geophagy in children**

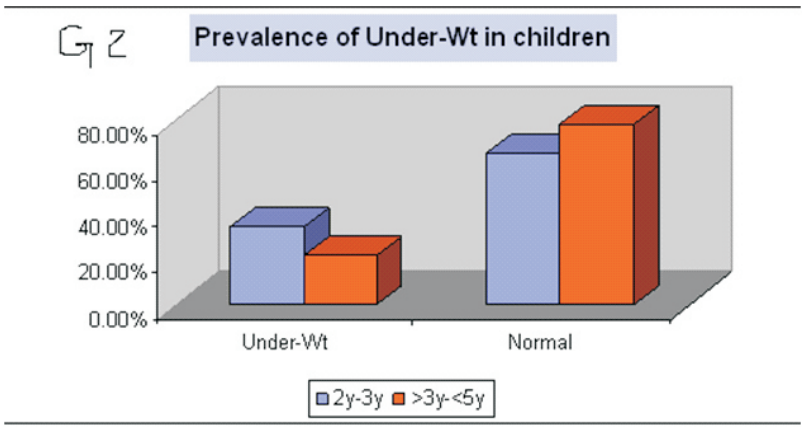
| Age | Geophagy (n%) | Normal (n%) |
|---|---|---|
| 2 years to 3 years | 20.2% (34/169) | 79.8% (135/169 |
| >3 years to < 5 years | 1.6% (7/271) | 98.4% (264/271) |




3. Descriptive analysis of the another variable, Under-weight, was done. It reflected the prevalence of underweight, 34% (58/169) in the age group, (2y to 3y) and in another age group, ( >3y to below 5y), prevalence was 21.4% (58/271), as depicted in table 3 and graph 2.

**Table 3. Prevalence of Under-weight in children**

| Age | Under-weight (n%) | Normal (n%) |
|---|---|---|
| 2 years to 3 years | 34% (58/169) | 66% (111/169) |
| >3 years to < 5 years | 21.4% (58/271) | 78.6% (213/271) |



4. Data points between categorical variables, Geophagy and Age group, were tested by non-parametric, Chi square test for independence. It provided value, ($\chi^2$= 37.8, df=1), between geophagy and age group, at a significance level,( $p < 0.0001$). This value, when compared with table value ( $\chi^2$=3.84, df=1 at p=0.05), was much higher. Thus, null hypothesis was rejected at 5% level of significance, as shown in table 4.

**Table 4. Inferential analysis of Geophagy and Age in children**

| Characteristics | Geophagy | Non-geophagy | Chi square value $\chi^2$ | P value |
|---|---|---|---|---|
| (2 y – 3 y) | 34 | 135 | 37.8 | <0.0001<br>Highly significant |
| (> 3 y – < 5 y) | 7 | 264 | | |

5. Bivariate analysis between two categorical variables, Geophagy and Under-weight was conducted to find out the probability of under-weight children, those who had habit of soil eating in comparison to those who did not consume soil.

Odd Ratio between Geophagy and Under-weight
Odd ratio =( 4.125/0.2627)
O R = (15.7)
95% C.I. ( 6.99-35.3)

Inferential analysis was performed by Chi square test for independence. It provided value, ($\chi^2$= 68.2, df=1), at significance level, ($p<0.0001$). This value was compared with the table value, ( $\chi^2$= 3.84 at df=1 and p=0.05). Calculated value was greater than table value, hence, null hypothesis was rejected at 5% level of significance, as shown in table 5.

**Table 5. Inferential analysis of Geophagy and Under-weight in children**

| Characteristics | Geophagy | Non-Geophagy | Chi square value $\chi^2$ | P value |
|---|---|---|---|---|
| Under-weight | 33 | 83 | 68.2 | <0.0001<br>Highly significant |
| Normal | 8 | 316 | | |

Additionally, the odd ratio was calculated to find out probability of wasting in children with habit of geophagy in comparison to those who did not eat soil.

Odd Ratio between Geophagy and Wasting
Odd ratio = ( 0.0871/0.038)
O R = ( 22.89)
95% C.I. ( 10.89-48.09)

The hypothesis was verified by Chi square test of independence. Value obtained was ($\chi^2$= 109.6, df=1), at significance level, ($p<0.0001$), as shown in table 6. This value was matched with table value, ( $\chi^2$= 3.84 at df=1 and p=0.05), both had wide difference. Therefore, Null hypothesis was rejected at 5% significance level.

**Table 6. Inferential analysis of Geophagy and Wasting in children**

| Characteristics | Geophagy | Non-Geophagy | Chi square value $\chi^2$ | P value |
|---|---|---|---|---|
| Wasting | 27 | 31 | 109.6 | <0.0001<br>Highly significant |
| Normal | 14 | 368 | | |

**Table 7. Association among Age, Nutritional status and Geophagy in children**

| Characteristic | Geophagy | Non-Geophagy | (2y -3y) | (>3y - <5y) | $\chi^2 = 77.2$ D.F=3 |
|---|---|---|---|---|---|
| Under-weight | 33 | 83 | 58 | 58 | P = <0.0001 H.S. |
| Normal | 8 | 316 | 111 | 213 | |

6. Further, analysis was performed by chi square test of independence among Age, Nutritional status and Geophagy in children. It resulted in a value, ($\chi^2 = 77.2$ at d.f.=3 ), highly significant, ($p<0.0001$), as shown in table 6.

## 6. DISCUSSION

1. Geophagy is the insistent eating of soil by children in a particular age group. In the present study, prevalence of geophagy was 9.4% in under five year old children in city, Fazilka in Punjab. The age of children is associated with the habit of geophagy, as it had been proved by highly significan,t ($p<0.0001$), chi square value ($\chi^2= 37.8$, df=1), in the present work. Rise in age of children leads to decline in the habit of geophagy, as, shown by high,(20.2%) prevalence of geophagy in (2y-3y), age group in comparison to its low, (1.6%) prevalence in (>3y <5y), age group.

The above facts about Age and Geophagy, in present study, have been substantiated by earlier work of Hagopian et al., (2011). It was observed that there is negative and linear relation between geophagy and age of children. It is considered normal in age between 18 months to two years, thereafter, habit of eating non-nutritive substances is taken as abnormal. In an earlier study by Hagopian et al., (2011), incidence of pica is 25-33% in children in younger age group, whereas, in present work, its prevalence is 20.2% in 2y to 3y age group.

2. The cause of geophagy is still, controversial. But the ill effects of geophagy are tremendous. In this study, highly significant ($p< 0.0001$), association was observed between under-weight and geophagy in children.

In a previous study by Diouf et al., (2000), it was established that geophagy, intestinal parasites and anemia are closely associated with chronic malnutrition. Hence, these findings support the present work.

3. Age is an important predisposing factor for the occurrence of malnutrition and the tendency of soil eating in children. In the present study, children in age group of (2y -3y), had higher proportion of malnutrition (58/169) than children, (58/271) in age group of (>3y to <5y). Further, the habit of soil eating was more prevalent, (34/135) in tender age of (2y to 3y) than its prevalence, (7/271) in age between (>3y to <5y).

A significant, ($p<0.0001$) association had been observed among age, under-weight and geophagy, in this research work. Improper & inadequate weaning, poverty are the important factors in the tender age of two to three years that the children start soil eating. These findings are supplemented by work of Karoui & Karoui (1993).

Children who are provided scarce food or food with poor calorific value, begin eating clay and soil to pacify their hunger. According to Prasad et al., (1983), Components of soil damage the intestinal mucosa. Absorptive capability of mucosa is deteriorated.

On the whole, a child in the period of growth and development, endures wasting and under-weight due to lack of proper nutrition. Further, according to Geissler et al., (1998), soil eating predisposes a child to helmenthic infestation that again terminates into malnutrition, anemia and diarrhoea.

## 8. CONCLUSION

Soil eating habit, although, an adaptive response, ruins the health of child. Population should be educated and motivated towards seeking medical help to curtail habit of geophagy.

## 9. REFERENCES

1. Abrahams, P., (2003). Human Geophagy: A Review of Its Distribution, Causes, and Implications. In: Geology and health: closing the gap. Editors, Catherine, H., Skinner, W., Berger, A. R. Oxford University Press, USA.
2. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, 4th ed. Washington DC: American Psychiatric Association, 199.

3. Cynthia, R.E., (2014). Practice Essentials. In: Pica. Editors, Pataki C., Giardino, A.P., available at http://emedicine.medscape.com/article/914765-overview.
4. Diouf, S., Camara, B., Sall, M.G., Diagne, I., Ndiaye, O., Diallo, A., Tall, A., Signate, H.S., Moreire, C., Sarr, M., Fall, M., (2000). Protein-energy malnutrition in children less than five years old in a rural zone in Senegal. Dakar Med., 45(1): pp 48-50.
5. FAO, (2005). Protecting and promoting good nutrition in crisis and recovery. Resource guide, FAO United Nations, Rome.
6. Geissler, A.W., Mwaniki, D.L., Thiongo, F., Friis, H., (1998). Geophagy as a risk factor for geohelminth infections: a longitudinal study of Kenyan primary school children. Trans. R. Soc. Trop. Med. Hyg., 92: pp7-11.
7. Hagopian, L.P., Rooker, G.W., Rolider, N.U., (2011). Identifying Empirically supported treatments for Pica in individuals with intellectual disabilities. Res Dev Disabil., 32(6): pp 2114-20.
8. Hammond, (2008). Assessment: Dietary and clinical data. In: Krause's food, nutrition, and diet therapy. Editor Mahan, K.L., Escott-Stump, S., 12th ed. Philadelphia: W.B. Saunders Company: pp383 – 406.
9. Karoui, A., Karoui, H., (1993). Pica in Tunisian children: Results of a survey performed in a polyclinic of the Tunisian Social Security National Administration. Paed., 48: pp 565-569.
10. Khan, Y., Tisman, G., (2010). Pica in iron deficiency: a case series. J Med Case Reports.,4: pp 86.
11. lacey, E. P., Broadening the Perspective of Pica: Literature Review.
Available at http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1579989/pdf/pubhealthrep00198-0031.pdf
12. Maravilla, A. M., Berk, R. N., (1978). The Radiographic diagnosis of pica. Am. J. Gastroenterol.,70:pp 94-99.
13. Prasad, A., Halsted, J., Nadimi, M., (1983). Syndrome of iron deficiency anemia, hepatosplenomegaly, hypogonadism, dwarfism, and geophagia. Nutrition Reviews, 41: pp 220-223.
14. Rawlins, S. C., Campbell, M., Fox, K., Benett, F., Gibbs, W. N., Greene, M., (1991). Parasitic infections in young Jamaicans in different ecological zones of the island. Trop. Geogr. Med., 43(1-2): pp 136-41.
15. World Health Organization, (1995). Physical status: The use and interpretation of anthropometry. WHO technical report series No. 854, WHO, Geneva.
16. Smolin, L.A., Grosvenor, M.B., (2008). Nutrition: Science and applications. USA: John Wiley and Sons. Inc.)