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DEVELOP AND STANDARDIZE PEARL MILLET BASED SUPPLEMENTARY FOOD PREMIX AND THE PRODUCTS AND FIND OUT IMPACT OF FEEDING ON THE NUTRITIONAL STATUS OF YOUNG CHILDREN

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The present investigation was performed to explore the potentialities of pearl millet by developing pearl millet based supplementary food premix and its impact on the nutritional status of young children studying in government primary school of Bikaner city. The mean weight, height and hemoglobin status of subjects was noted to be only 15.67 kg, 44.66 and 7.5 respectively indicating wide prevalence of malnutrition among them. Clinical 95% of the subjects showed different signs of malnutrition investigation brings out the fact that 95% of the subjects showed the different signs of malnutrition. The processed pearl millet flour and moth bean flour was used to develop a supplementary food premix for young children in the ratio of 5:1 along with other ingredients. The premix was provided one third of daily nutrient requirement of young children (4-6 years). During an intervention programme fifty subjects comprising of control (n = 25) and experimental (25) pearl millet-based biscuits were fed to the experimental group for 75 days. In comparison to the control group, the experimental subjects showed the mean increment of 1.20 g/dl hemoglobin, 1.16 kg of weight at the end of the programme along with improvement in clinical signs of subjects.

Keywords: Pearl millet, Malnutrition, Premix, Hemoglobin, Clinical signs

INTRODUCTION

School going children who are our future citizen form an important segment of Indian population. Better the nutritional status of children, higher will be nation's rise. Therefore, their nutritional status is of great significance. Nutrition is an indispensable component of healthy life as it is a determinant of healthy growth of mind and body. The child needs food not only in quantity according to his age but also food of considerably higher quality. School age is a dynamic period of growth and development as children undergo physical, mental, emotional and social changes. These children are at a stage of life when growth is rapid and nutrient requirement is high. In spite of all achievements of green revolution, serious food problem exists in the world. The health and nutrition situation in India even after several years of independence is quite unsatisfactory and unacceptable. It is estimated that majority of the undernourished people in the world live in Indian subcontinent and most of them are children (Joseph, 2005). According to NFHS-3 (2005-06) every second child in India is malnourished and therefore they severely suffer from retardation in their growth. Poverty, ignorance and illiteracy are identified as major causes responsible for this situation. Malnutrition not only affects physical appearance and

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energy levels, but also directly affects many aspects of the children's mental functions, growth and development which have adverse effects on children's ability to learn and possess information and grow into adults that are able to be productive and contributing members of society. The best strategy to correct the nutritional deficiencies is the food-based approach, where nutrient rich food supplements are formulated with nutrient rich familiar foods. Therefore, in an attempt to address with the problems, Government launched nutrition intervention programmes.

One of the programme running by government is mid-day meal programme. In Rajasthan this programme was initiated on 15th August 1995 by Rural Development and Panchayati Raj Department. The mid-day meal programme was initiated to provide basic nutrition to children and encourage parents to send their children to school. Studies have shown that these food items become very monotonous for children and thereby they are reluctant to accept these foods. Moreover, school authorities invariably also express difficulty in preparing and serving such meal plans. In spite of well-planned and implemented mid-day meal programme the nutritional status of school children is not improving remarkably. This indicates the need of supplementary food for these children in addition to what they are already receiving. However, such supplementary food should be locally available, low in cost, nutritious, palatable, easy to cook, store and distribute. Hence the concept of developing pearl millet based supplementary food for young children was conceived for present study. Pearl millet is basically the major crop of Rajasthan state, which is low in cost and mostly consumed by economically weaker section of the state. Pearl millet is good in its nutrient composition. It is nutritionally comparable and even superior to many cereals and is called as "nutri cereal" as it contains fair quantity of protein, fat, energy, vitamins and minerals. Pearl millet contains the highest amount of iron among all the cereals; it is also a rich source of calcium and dietary fiber, phytochemical and micronutrients (Sehgal and Kwatra, 2006).

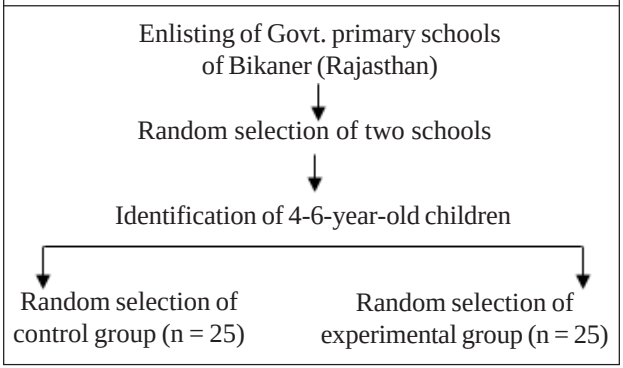
In the beam of the above scientific proceedings, present research has been propelled towards to development and quality evaluation of pearl millet based supplementary food and its impact on young children

METHODS

Locale of the Study

The study was conducted at the Department of Food and Nutrition, campus of College of Home Science, SKRAU, Bikaner and two Govt. middle Schools as per the selection criteria.

Figure 1: Selection of the Subjects



Assessment of Nutritional Status

At the beginning of the study the nutritional status of all the subjects had been assessed as follows:

Anthropometric Assessment: Height (Cameron, 1978) and weight (Robinson *et al.*, 1988) of all the subjects were measured for their anthropometric assessment at the interval of 15 days for a period of two and half month.

Clinical Examination: All the subjects were clinically examined from head to toe, to assess the presence or absence of clinical signs as suggested by Jelliffe (1966).

Hemoglobin Estimation: Hemoglobin level of all the subjects (50) was estimated by using Sahli's hemoglobin meter before and after completing the two and half months of the study.

Development and Quality Evaluation of Pearl Millet Based Supplementary Food Premix

Pearl millet is a staple food for arid zone people and economically weaker section in India. In spite of greater availability, low cost and comparatively good nutritive value use of pearl millet in our meal pattern is very low because of some major constraints acting as obstacles in its wide spread diversification and acceptability (Rai, 2007). Pulses are rich sources of protein and can supplement proteins to our cereal based diets. Thus, the quality of the protein from a mixture of cereals and pulses becomes superior to that of either one (Gopalan, 1989).

In view of the facts regarding nutritional quality of cereal pulse combination, different trials using various ingredients were made to develop an acceptable supplementary food premix suitable for young children. Apart from pearl millet

and moth bean, niger seeds, ground nut, fat and sugar were also added in order to supplement 1/3rd of the dietary requirements of the young children. (Mid Day Meal, 1995, GOR). The ingredients incorporated in the premix were on the basis of their local availability, low cost and greater energy, protein and iron contents (Gopalan, 1989).

Figure 2: Flow Sheet for Processing of Pearl Millet

Pearl millet grain
↓
Cleaning
↓
Tieing in muslin cloth
↓
Blanching (60 Sec, 98 °C)
↓
Sun drying (8 hours)
↓
Flour making
↓
Packaging
↓
Stored at room temperature

Table 1: Ingredients for Traditional Premix

Ingredients	Amount
Processed pearl millet flour	50 g
Moth bean flour	10 g
Niger seeds	5 g
Ground nut (coarsely ground)	5 g
Fat (hydrogenated)	20 ml
Sugar (powdered)	30 g

Method of Preparation

Pearl millet and moth bean were ground separately to flour.

↓

All ingredients were mixed, except sugar and hydrogenated fat sieved well and packed.

↓

The mixture was packed in an air tight plastic container with a label.

↓

The premix so developed was used for product development like biscuits as follows:

Table 2: Ingredients for Biscuit

Ingredients	Amount
Premix	70 g
Sugar (powdered)	35 g
Hydrogenated fat	20 g
Milk	50 ml
Vanilla essence	3 drops
Baking powder	1/4th tsp
Ammonia powder	1/4th tsp

Method

Hydrogenated fat, sugar and ammonia were mixed and creamed until light and fluffy.

↓

Baking powder was incorporated well with the premix and then mixed with creamed mixture

↓

Essence was then added to it and tough dough was prepared using milk.

↓

Dough was then rolled into ¼ “thickness, cut with biscuit cutter and placed on a greased tray.

↓

Tray was then placed in a preheated oven and baking was carried out at 175^{0}C for 30 minutes

↓

Biscuits were then cooled and served

Table 3: Ingredients for Traditional Kasar	
Ingredients	**Amount**
Premix	70 g
Sugar (powdered)	35 g
Hydrogenated fat	20 g

Method

The premix was roasted with hydrogenated fat till light brown

↓

Cooled and mixed well with sugar.

↓

Serve as *kasar.*

Table 4: Ingredients for Ladoo	
Ingredients	**Amount**
Premix	70 g
Sugar	35 g
Hydrogenated fat	20 g
Water	30 ml

Method

The premix was roasted with hydrogenated fat till light brown.

↓

The roasted premix was then mixed with sugar dissolved in hot water

↓

The mixture was converted into balls (ladoo) and stored till served.

Organoleptic Evaluation of the Biscuit Based on the Premix

Standardization of the developed products was carried out through organoleptic evaluation. Developed products were evaluated for their sensory characteristics like color, flavor, taste, texture and overall acceptability by selected 10 panel members (Swaminathan, 1987)

Intervention Programme

During the intervention programme experimental group (n = 25) of the study received the most acceptable supplementary food product for two and half months. The experimental subjects were receiving daily 90 g of supplementary food products by the researcher during their school hours under the intervention programme. Whereas the control group (n = 25) did not receive any supplementary food product although they were receiving Mid-Day Meal alike the experimental group.

Impact Analysis

Data obtained regarding anthropometric measurement, clinical symptoms and hemoglobin status during the intervention period were compared statistically with the standard values to find out impact of the intervention programme.

RESULTS

Anthropometric Assessment

In the present study, height and weight of the subjects were measured and discussed below:

Weight

During present investigation mean weight of the subjects was noted to be 15.67 ± 2.11 kg and it was 81.13% of the reference weight (19.72 kg) given by NCHS (1990). Results clearly depicts that mean weight of the subjects was lower than the reference weight which might be due to their dietary inadequacies Table 5.

Height

According to present data Table 5, mean height of the subjects was 44.66 inches ± 4.05 inches. Further mean height of the subjects was noted to be 97.91% of the reference height (45.10 inches) given by NCHS (1990).

Table 5: Mean Anthropometric Parameters of the Subjects			
Parameters	**Subjects (n=50)**	**Standard Value***	**% Standard Value**
Weight (kg)	15.67 ± 2.11	19.72	81.13
Height (inches)	44.66 ± 4.05	45.1	97.91
Note: *NCHS (1990).			

Nutritional Atatus of the Subjects

Nutritional Status Based on Weight

After assessing the weight and height measurements of the

subjects in comparison to NCHS (1990) standards, the nutritional status of the subjects was assessed as per McLaren classification (1976) based on weight. On assessing the nutritional status based on weight, it was found that immaterial of their age group and sex, 24% of the subjects were found to be falling in the normal grade. Further 76% of the subjects suffering from mild grade of malnutrition. However severe grade of malnutrition was not observed in any of the subject under the study Table 6. Thus, the results clearly indicate that majority of the subjects (76%) were malnourished, since the percentage of normal grade subjects was very low. It must be due to their poor dietary intake. Balgir *et al.* (1999) reported similar results in their study on assessing the nutritional status of the Ashram School Tribal children in Northern Orissa which concluded that on the whole 63.3% of the tribal children suffer from malnutrition in Orissa.

Nutritional Status Based on Height

The height of an individual is influenced both by genetic hereditary and environmental factors. The maximum growth potential of individual is decided by hereditary factors while among the environmental factors the most important being nutrition and morbidity, determine the extent of exploitation of genetic potential. Inadequate dietary intake and/or infection reduce nutrient availability at cellular level resulting in growth retardation, during the period of severe deprivation linear growth rate slows down and leads to stunting (short stature of an individual) Rao and Vijayaraghavan (1998). In present study while assessing grades of malnutrition based on height it was noted to be that 88% of the subjects were falling in normal category. It is also clear from Table 7 that only 6% of the subjects were found to be appeared in short stature category.

Table 6: Prevalence of Various Grades of Malnutrition Based on Weight

*Grades of Malnutrition Based on Weight	Male Subjects				Female Subjects				Grand Total
	4 Years	5 Years	6 Years	Total	4 Years	5 Years	6 Years	Total	
<60% severe	-	-	-	-	-	-	-	-	-
61-80% moderate	-	-	-	-	-	-	-	-	-
80-90% mild	9(18)	8(16)	5(10)	22(44)	8(16)	3(6)	2(4)	13(26)	35(70)
91-110% normal	4(8)	2(4)	2(4)	8(16)	4(8)	2(4)	1(2)	7(14)	15(30)
110-120% overweight	-	-	-	-	-	-	-	-	-
120 and above	-	-	-	-	-	-	-	-	-
Total	13(26)	10(20)	7(14)	30 (60)	12(24)	5(10)	3(6)	20 (40)	50(100)

Note: Values in parenthesis indicates percentage of the subject.

Table 7: Prevalence of Various Grades of Malnutrition Based on Height

*Grades of Malnutrition Based on Height	Male Subjects				Female Subjects				Grand Total
	4 Years	5 Years	6 Years	Total	4 Years	5 Years	6 Years	Total	
<80% dwarf	-	-	-	-	-	-	-	-	-
80-93% short	1(2)	-	1(2)	2(4)	-	-	1(2)	1(2)	6(12)
93-105% normal	17(34)	8(16)	3(6)	28(56)	7(14)	7(14)	5(10)	19(38)	44(88)
>105% giant									
Total	-	-	-	-	-	-	-	-	-

Note: *McLaren (1976).

Clinical Examination

Clinical examination is another method for assessing the nutritional status and prevalence of deficiency diseases Table 8. Essentially the method is an examination for changes, believed to be related to inadequate nutrition that can be seen or felt in superficial epithelial tissues especially the skin, eyes and hair. In the present study, clinical signs had been assessed as suggested by Jelliffe (1966).

Table 8: Percent Respondents with Clinical Signs

Clinical Signs	% Respondents (N = 50)
No clinical signs	5 (3)
Clinical signs present	95 (47)
Pale conjunctiva	70 (35)
Pale nails	10 (5)
Dry and brittle hairs	70 (35)
Lustureless hairs	80 (40)
Gums (purple)	40 (20)
Dental carries	70 (35)
Xerosis	95 (47)

Note: Values in parenthesis indicates number of subjects.

Data revealed that out of 50 subjects only 5% subjects did not show any signs of poor nutritional status (Table 8). The remaining 95% of the subjects displayed clinical signs like pale conjunctiva 70%, pale nails 10%, lusterless hairs 80%, dry and brittle hair 70%, dental carries 70%, xerosis, purple gums 40% and other symptoms regarding anemia like breathlessness and easy tiredness and headaches noted from almost all the subjects.

In accordance with present study Jogleker (2005) also analyzed the nutritional status of 400 children studying in Government Primary School of Raipur city. He revealed that 42.5% students had dull and dry hair, 53.25% had teeth carries whereas 32.25% had dull and dry eyes.

Biochemical Estimation

Hemoglobin estimation is regarded as a screening measurement, useful in defining various of iron deficiency anemia. Hemoglobin level of all the subjects (n = 50) was estimated by using Sahli's hemoglobin meter before and after completing the intervention period of 75 day. The percentage of anemic subjects was calculated as per classification suggested by WHO (1993) as follows Table 9:

Table 9: Mean Hemoglobin Level of the Subjects

Hb Levels (g/dl)*	Grades of Anemia	Percent Prevalence (N = 50)
>12.0	Normal	--
<12-9	Mild	50(100%)
9-Jul	Moderate	--
<7.0	Severe	--

Note: *WHO (1993).

Development and Standardization of Pearl Millet Based Supplementary Food Premix

Pearl millet is a crop, which is nutritiously superior to other cereals with respect to protein, energy, minerals and vitamins. It is also a rich source of dietary fibers and phytochemicals (Sehgal and Kwatra, 2006). In view of its merit over other cereal. Addition of pearl millet in any one's diet is worthy enough. Thus, a pearl millet based supplementary food premix was developed and standardized using 5:1 ratio of pearl millet and moth bean along with other ingredients in order to develop supplementary food products for later use.

Thus, three different products, i.e., biscuit, *kasa*r and *ladoo* were developed from the premix standardized and evaluated for the acceptability on nine-point hedonic rating scale and the results of are discussed below:

An overview of table X extrapolates that the mean scores of nine-point hedonic rating scores for color, appearance, texture, flavor and taste of biscuit, *kasar* and *ladoo* ranged from 8.50-8.90, 8.40-8.70 and 4.40-4.70 respectively. The mean scores for color appearance, texture, flavor, taste evidently indicates that the acceptability of biscuit and kasar ranged between" liked very much" to 'liked extremely'. Whereas similar sensory attributes for *ladoo* were stated to be "disliked slightly" to "neither liked nor disliked" by the panelists in the laboratory. The overall mean sensory scores were found to be maximum for biscuit (8.71), followed by *kasar* (8.55) and *ladoo* (4.52) on nine-point hedonic rating scale. The mean overall acceptability scores of the products also indicates that except *ladoo*, biscuit and *kasar* were almost equally acceptable by the panelists.

Results of the study regarding acceptability of *kasar* and biscuit are in conformity with those reported by Singh

Table 10: Mean Organoleptic Scores Obtained by the Standardized Products

Sensory Attributes	Mean Sensory Score on 9 Point Hedonic Scale			SEm ±	CD*
	Biscuit	*Kasar*	*Ladoo*		
Color	8.9	8.7	4.5	0.14	0.41
Appearance	8.7	8.5	4.5	0.16	0.47
Taste	8.8	8.6	4.4	0.17	0.51
Flavor	8.7	8.5	4.7	0.15	0.45
Texture	8.5	8.4	4.4	0.16	0.47
Overall mean	8.73	8.55	4.52	0.07	0.21

Note: * = Significant at 5% level of significance.

et al. (2006) as well as Rai (2007) who also reported that pearl millet-based biscuit and *kasar* respectively were organoleptically acceptable with high sensory scores ranging from "liked very much" to "liked extremely". Hence based on the results of sensory evaluation of the product in the laboratory only biscuit and *kasar* were identified for feeding the same to the subjects during intervention programme but regrettably when these products were evaluated by the subjects, they show their strong dislikes for *kasar* may be due to the comparative difficulty in its handling and unfamiliar sensory appeal while testing it by the subjects of experimental group in comparison to biscuit. Hence only biscuits were served to the subjects during entire intervention period. Hence proposal of serving kasar to the subjects was dropped.

Intervention Programme

In the present study pearl millet based supplementary food premix was served to subjects in the form of biscuit with the objective to find out impact of feeding it on the nutritional status of young children. The experimental group was fed with 90 g of biscuits everyday till the entire 3-month intervention period. The subjects in control group were not receiving such supplementary food under the study.

Impact Analysis of the Intervention Programme

Height and weight were recorded at every 15th day whereas the hemoglobin was estimated at the beginning and end of the present study. The effect of feeding supplementary food product on the group was assessed to bring out the actual impact of intervention on the subjects regarding their nutritional status.

The initial mean weight and height of the subjects under experimental group was noted to be 15.84 kg and 44.18 inches respectively. Almost similar values, i.e., 15.51 kg and 45.15 inch were also noted for the subjects in control group on the first day of the intervention programme. The mean Hb level of the subjects was estimated to be 7.58 and 7.48 g/dl respectively for the control group and experimental group at initially. The Table 11 clearly indicates that there was a non-significant difference in the mean height of the subjects of control group when compared with their counterparts at each 15 days of interval.

The mean body weight of the experimental subjects was noted to be 15.84 kg, 15.96 kg, 16.12 kg, 16.37 kg, 16.65 kg and 17 kg respectively for 1st 15th, 30th, 45th, 60th and 75th day of intervention programme indicating gradual increment in values. Whereas the mean body weight of their control counterparts was measured to be 15.51 kg, 15.51 kg, 15.51 kg, 15.51, 15.52 and 15.50 kg corresponding for 1st, 15th, 30th, 45th, 60th and 75th day. Table 12 Clearly shows results regarding mean gain in weight of the subjects during intervention programme.

Initial mean body height of subjects belonging to both the groups was noted 44.18 inches and 45.15 inches corresponding for the control and experimental group at 0 day. The mean body height of the experimental group was measured to be 44.18 inch, 44.18 inches, 44.20 inch, 44.23 inch, 44.26 inch and 44.29 inch as well as for control group 45.16 inch, 45.19 inch, 45.19 inch, 45.20 inch and 45.25 inch respectively for 0th 15th, 30th, 45th, 60th and 75th day (Table 11). Noticeably shows results regarding mean gain in height which is non-significant.

Table 11: Mean Height Levels of the Subjects During Intervention

Subjects	Mean Height Levels of the Subjects During Intervention					
	0 Days	15 Days	30 Days	45 Days	60 Days	75 Days
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Control	45.15 ± 3.13	45.16 ± 3.13	45.19 ± 3.14	44.19 ± 3.14	44.20 ± 3.14	44.25 ± 3.15
Experimental	44.18 ± 4.75	44.18 ± 4.75	44.20 ± 4.85	44.23 ± 4.85	44.26 ± 4.87	44.29 ± 4.90

Table 12: Mean Weight Levels of the Subjects During Intervention

Subjects	Mean Weight Levels of the Subjects During Intervention Programme					
	0 Days	15 Days	30 Days	45 Days	60 Days	75 Days
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Control	15.51 ± 2.47	15.57 ± 2.47	15.58 ± 2.47	15.58 ± 2.47	15.59 ± 2.48	15.61 ± 2.49
Experimental	15.84 ± 1.67	15.97 ± 1.70	16.12 ± 1.71	16.37 ± 1.74	16.65 ± 1.75	17.00 ± 1.78

Table 13: Mean Hemoglobin Levels of the Subjects During Intervention

Subjects	Mean Hemoglobin (g/dl) Levels of the Subjects	
	0 Days	75 Days
	Mean ± SD	Mean ± SD
Control	7.52 ± 0.24	7.52 ± 0.25
Experimental	7.48 ± 0.25	8.67 ± 0.29

Table 14: Percent Respondents with Clinical Signs at the End of Programme

Clinical Signs	% Respondents (N = 50)
No clinical signs	20 (10)
Clinical signs present	80 (40)
Pale conjunctiva	60 (30)
Pale nails	10 (5)
Dry and brittle hairs	60 (30)
Lustureless hairs	64 (32)
Gums (purple)	36 (18)
Dental carries	60 (30)
Xerosis	80 (40)

The mean Hb levels of the subjects during intervention programme has been displayed in the Table 13 the initial Hb levels of the in the control and experimental group eas estimated to be 7.52 and 7.48 respectively for both control and experimental group without significant difference.

Joglekar (2005) analyzed the nutritional status of children serving mid-day meal in Chattisgargh and reported that the mean weight of experimental group was increased by 20 ± -5.17 kg to 22.87 ± 5.82 kg (14.34% increase). The mean height of experimental group was increased by 117.77 ± 12.64 to 119.01 ± 12 cm (6.48%). The mean hemoglobin level was increased by 6.49 gm/dl. The enrolment of the students was increased 2548-1793 (9.62%, 55% (220) children had attendance more than 90%.

CONCLUSION

The intervention program was commenced for 75 days, in which 50 children studying in Govt. School of Bikaner city were selected. Subjects were divided into two groups (25 each) i.e., experimental group and study group. Experimental group received 90 g of biscuits for the entire intervention period, i.e., 75 days. Whereas control group did not receive such supplementation. In terms of stastical analysis experimental group showed significant increase in weight and hemoglobin. Slight improvement in clinical symptoms either reference to xerosis, dry and brittle hairs, lustureles hairs, etc.

REFERENCES

- Balgir R S, Murmu B and Dash S P (1999), "Physical Growth, Health and Nutritional Status of the Ashram School Tribal Children in Northern Orrisa", *The Ind. Jr. Nutr. Dietet*, Vol. 36, pp. 443-451.
- Cameron N (1978), "The Methods of Axiological Anthropometry", *Human Growth*, Vol. 2, Falkner F and Tanner J M (Eds.), Plenum Press, New York, London.Joglekar A R (2005), "Mid Day Meal Can Overcome the Problem of Anemia", *Scientific Programme and Abstracts*, Nutrition Society of India, The XXXVII Annual Meeting.
- Gopalan C, Rama Shastri B V, Balasubramanian S C, Narsinghu Rao B S, Reosthale Y G and K C (1989), "Nutritive Value of Indian Foods", National Institute of Nurition, ICMR, Hyderabad, India.
- Jelliffe (1966), "Assessment of the Nutritional Status of A Community Momograph Series 53" (WHO, Geneva).
- Joseph P A, Mary Frances R P, Christy F M, Penny M and Kathleen B M (2005), "The Two Faces of Adolescents Success with Peers", *Adolescent Popularity, Social Adaptation and Driant Behavior*, Child Development May-June, Vol. 76, No. 3, pp. 747-760.
- NCHS (1990), "Nutrition Monitoring and Assessment", Gopaldas T and Seshadri S (Eds.) (1987), Oxford University Press, UNICEF, New Delhi.
- NFHS-3 (2005-06) (2008), "The National Family Healthy Survey", Anemia Cases on the Rise, Women Worst Hit: Report, Press Trust of India, July 17.
- Rai K (2007), "Development and Evaluation of Convinience Foods Based on Pearl Millet", p. 99, M.Sc. Thesis, C.Hsc. SKRAU, Bikaner, Rajasthan, India.
- Rao D H and Vijayraghavan K (1998), "Dirt and Nutritional Situation in Ural India", *Ind. J. Med. Res*., Vol. 108, pp. 243-253.
- Robinson C H, Dawter M R, Chenowet W l and Garwick A E (1988), *Normal and Therapeutic Nutrition*, 17th Edition, pp. 138-145 & 365-383, Macmillion Publishing Co. Inc., Toranto, Canada, London, New York.
- Sehgal S and Kwatra A (2006), "Value Added Food Products from Millets", Proceeding of 3rd National Seminar on Millets Research and Development – Future Policy Development in India, Vol. 2, pp. 66-68, Director NRCS and Project Coordinator, AICSIP, NRCS, Rajendra Nagar, Hyderabad, Andhra Pradesh, India.
- Singh P, Maliwal P L and Sharma S N (2006), "Status Score Constraints and Future Policy Options of Millet Research in Rajasthan", Director NRCS and Project Cooordinator, AICSIA, NRCS, Rajendra Nagar, Hyderabad, Andhra Pradesh, India.
- Swaminathan M S (1987), "Food Science Chemistry and Experimental Foood", The Bangalore Priting and Publishing Co. Ltd., Mysore Road, Bangalore.
- World Health Organization (1993), "Prevention and Management of Anemia in Pregnancy", WHO/FHE/MSM/93.5, Geneva.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