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# IMPACT OF NUTRITION COUNSELING ON THE ANTHROPOMETRIC AND BIOCHEMICAL PROFILE OF LACTOSE INTOLERANT CHILDREN

**Sloney Sachar and Sonika Sharma***
Department of Food and Nutrition, Punjab Agricultural University, Ludhiana

*Corresponding author: Sloney1991@gmail.com, drsonika@pau.edu

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## ABSTRACT

The impact of nutrition counseling on the anthropometric and biochemical profile of Lactose Intolerant (LI) children was evaluated by selecting 30 lactose intolerant children (1-5 yrs) from different hospitals of Ludhiana city. The requisite data were collected using personal interview schedule. The nutrition interventions like personal counseling, nutrition education through lecture-cum-discussion, demonstration of lactose free recipes were imparted to the parents of LI children for a period of three months. Malnutrition was observed to be highly prevalent among children with LI before Nutrition Counseling (N.C.) though its incidence decreased significantly after N.C. Almost all of the subjects were found to be stunted, wasted and underweight. The percentage of stunted children (70%) remained the same after N.C. However a significant decrease was observed in percentage of underweight (76.67 to 66.66%) and wasting (70 to 56.67%) after NC. A significant increase was observed after N.C. in the mean serum protein (5.92g/dl to 6.19g/dl), calcium (7.06mg/dl to 7.2mg/dl) and vitamin D (15.11ng/ml to 15.63ng/ml) levels of the subjects. Overall nutrition counseling showed a positive impact on the anthropometric and biochemical profile of the children. The present study recommends an extended follow up to further improve the anthropometric and biochemical profile of lactose intolerant children.

**Key Words:** Lactose intolerance, anthropometric profile, biochemical profile, nutrition counseling

## INTRODUCTION

Lactose is a disaccharide found naturally in milk and other dairy foods. During digestion, the intestinal enzyme, lactase, breaks down lactose into the simple sugars, glucose and galactose for absorption into the bloodstream. Most people produce sufficient amounts of lactase at birth and during childhood to digest normal amounts of dietary lactose (Miller *et al.* 2007). However, sometime after two years of age, intestinal lactase activity begins to decline in some individuals (NIH 2009). The symptoms include cramps, flatulence, nausea, abdominal pain, gas, gut pain, bloating, diarrhea, headache, severe fatigue, cognitive dysfunction, muscle and joint pain. (Waud *et al.* 2008). Management of lactose intolerance requires both education and product development (Savaiano 2011). Avoiding milk and other dairy foods due to concerns about lactose intolerance may not only be unnecessary, but also could lead to nutrient shortcomings which may predispose individuals to negative health outcomes (Nicklas *et al* 2011, Heaney *et al* 2011) The dairy food group (milk, cheese, yogurt) is a substantial contributor of essential nutrients such as calcium, potassium, phosphorus, magnesium, zinc, high-quality protein, vitamin A, vitamin D, vitamin B12, and riboflavin. Lactose intolerance may be partly to blame for decreased intake of calcium-rich dairy foods which may contribute to low calcium intake risk factor for reduced bone density and osteoporosis (Keith *et al* 2011, Nicklas *et al* 2011). "Lactose-intolerant" individuals have reduced peak bone mass and increased incidence of osteopenia, and are at greater risk of osteoporosis and bone fractures (Savaiano 2003). The American Academy of Pediatrics supports use of dairy foods as an important source of calcium for bone mineral health and of other nutrients that facilitate growth in children and adolescents. If dairy products are eliminated, other dietary sources of calcium or calcium supplements need to be provided (Melvin 2006). Nutrition counseling plays an important role in the management and in improving the nutritional status of subjects. Thus, the present study was undertaken to assess the nutritional status of lactose intolerant children through anthropometric and biochemical parameters and to develop educational module and to study the impact of nutrition counseling to lactose intolerant children and their parents.

## MATERIAL AND METHODS

The present study was undertaken to explore lactose intolerance awareness and dietary survey of the lactose intolerant subjects. The methodology used for the study included the selection of 30 pediatric lactose intolerant patients in the age group of 1-5 years from the different hospitals (CMC & H, DMC & H and Deep Hospital) of Ludhiana city of Punjab. The data was collected by personally administering the questionnaire to

the mothers/ caretakers of the lactose intolerant children. Body weight and height was recorded using the standard methods (WHO 2006).

To evaluate the nutritional status of the children, the data on height and weight were classified using Standard Deviation (Z Scores) (height for age, weight for age and weight for height) using WHO standards (WHO 2006). Calcium by OCPC method (Gitelman, 1967), Vitamin D (HPLC Technique, Tsugara *et.al.* 2005), Vitamin A (Bessey *et al.* 1946), Protein (Biuret method, Robinson and Hogdon, 1940) were tested. Nutrition education was provided to the subjects and their parents for a period of three months through personal counseling, lecture-cum-discussion method, demonstration of lactose free recipes. An educational material was prepared in the form of a booklet-"Understanding Lactose Intolerance" covering various aspects of lactose intolerance. Percentage distribution, mean and standard deviation was computed for various variables. Student paired t- test was applied to test the significance of mean differences for anthropometric and biochemical parameters of the subjects. Data was analysed by using Statistical Package for Social Sciences (SPSS) Software.

**IMPACT OF NUTRITION INTERVENTION ON THE ANTHROPOMETRIC PROFILE OF THE SUBJECTS**

Measurement of growth has been a widely used tool for the assessment of health and nutrition. For the evaluation of growth performance, the observed level of growth has to be compared with a standard, which is considered to be the best representative of the normal growth. World Health Organization (WHO) in 2006 made provisional recommendations for the interpretation of anthropometric data during childhood. The cut-off point for malnourished children was taken as -2SD below the reference median as recommended by WHO, 2006. Children falling between -2SD and -3SD of standard were considered as moderately stunted, underweight or wasted and those below -3SD were classified as being severely malnourished.

Table 1 and 2 present the impact of nutrition interventions on the anthropometric measurements of the subjects. It could be easily deciphered from the data that subjects in both the age groups were stunted and underweight. The results indicated that there was no significant difference in the height of the subjects even after the nutrition interventions. This might be due to the fact that the time gap between the two periods of anthropometric measurements was only three months which was quite less to observe any significant changes in the height of the subjects.

Table 2 revealed the fact that a significant improvement was observed in the weight of the subjects after the nutrition intervention. The maximum increase was observed in the age group of 1-3 years. The average weight of boys in this age group increased from 79.22 to 87.93 per cent of the standard, while that of girls increased from 77.89 to 93.17 per cent of the standard. The possible explanation could be the fact that the children in this age group are completely dependent on their parents and eat only what they are given. Moreover, not all the subjects in this age group were enrolled in school, hence, the risk of consuming lactose containing food from an outside source was also decreased in contrast to the other subjects. The increase in weight observed in the boys in the age group of 4-5 was from 89.01 to 91.62 per cent of the standard. While the increase in weight among girls in the age group of 4-5 was from 81.76 to 88.65 per cent of the standard.

Similar findings were reported in a study conducted by Hegde *et al.* (2014) on children aged 2-5years of age, the quarterly mean weights (in kgs) were calculated and 76.9% of these mean recordings were within normal limits. The quarterly mean heights (in cms) were calculated and it was found that all the mean heights were lower than 95% of the expected.

**Table 1: Impact of nutrition intervention on the anthropometric measurements of the subjects**

| Age Group | Height (cm) | | | | Average Standard Height (cm) | | Weight(Kg) | | | | Average Standard Weight | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre | | Post | | | | Pre | | Post | | | |
| | M | F | M | F | M | F | M | F | M | F | M | F |
| 1-3 n=12 | 84.47 ± 4.99 | 83.66 ± 5.49 | 84.66 ± 5.01 | 83.98 ± 5.45 | 91.08 | 89.08 | 10.18 ± 0.87 | 9.58 ± 0.79 | 11.3 ± 1.07 | 11.46 ± 1.49 | 12.85 | 12.30 |
| 4-5 n=18 | 98.62 ± 6.84 | 97.41 ± 5.56 | 98.89 ± 6.93 | 97.73 ± 5.69 | 103.71 | 102.26 | 14.66 ± 2.38 | 13.05 ± 2.05 | 15.09 ± 2.27 | 14.15 ± 2.21 | 16.47 | 15.96 |

**Table 2: Impact of nutrition interventions on the percentage of anthropometric measurements of the subjects in comparison of average standard values**

| Age Group | Height(cm) | | | | Weight(Kg) | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre | Post | Pre | Post | | | | |
| | M | F | M | F | M | F | M | F |
| 1-3(n=12) | 92.74 | 93.91 | 92.95 | 94.27 | 79.22 | 77.89 | 87.93 | 93.17 |
| 4-5(n=18) | 95.09 | 95.25 | 95.35 | 95.57 | 89.01 | 81.76 | 91.62 | 88.65 |

## PREVALENCE OF MALNUTRITION

Table 3 depicts the prevalence of malnutrition among the subjects belonging to different age groups of the present study. The data clearly suggested that stunting was prevalent in almost all of the subjects across the age groups. It was observed to be highest in the age group of 1-3 years as 75 per cent of the subjects in this age group were found to have a height lesser than the standards, followed by 66 per cent of the subjects in the age group of 4-5 years. The overall percentage (70.00%) of the stunted subjects (>-2SD) remained unchanged, even after the interventions.

Upon analyzing the weight for age Z- score (WAZ), it was found that majority (90%) of the underweight subjects were in the age group of 1-3 years, followed by those in the age group of 4-5 years (65%). A considerable improvement was observed in the weight for age of the subjects as a positive effect of the nutrition interventions. The proportion of the underweight subjects in the age group of 1-3 years dropped to 83 per cent (Fig 1) and was dropped to 55 per cent in the age group of 4-5 years. Overall, as a result of the interventions imparted to the subjects and their parents, the total percentage of subjects having a normal weight increased from 23.33 to 33.34 per cent.

With regards to weight for height, wasting (>-2SD) was observed to be maximum (83.00%) in the age group of 1-3 years, followed by the subjects in the age group of 4-5 years (61.00%). After the interventions, it was observed that 67 and 50 per cent of the subjects in the age group of 1-3 and 4-5 years were wasted. The total percentage of the subjects having a normal weight for height increased from 30 to 43.33 per cent.

The overall percentage of stunting, underweight and wasting before intervention was 70%, 76.67% and 70% but after intervention the percentage of underweight was decreased to66.66% and percentage of wasting decreased to 56.67%.

Similar findings were revealed by Kapur *et al.* (2005) in a study on dietary intake and growth pattern of children aged 1-3 years of Delhi. Anthropometric analysis revealed that children were grossly undernourished. 75% of children were underweight, 35% were severely undernourished, 74% were having chronic malnutrition, 39% were severely stunted and 19% were wasted.

A cross sectional study on 600 children of 1-5 year age group in urban slums of Mysore city was carried out and the prevalence of underweight, stunting and wasting was 129 (21.5%), 135 (22.5%) and 9 (7.5%) respectively(Kumar *et al.* 2013). Manjunath *et al.* (2014) reported the prevalence of underweight, stunting and wasting as 60.4%, 55.4% and 43% respectively among 101 under -five children of Kadukuruba tribes of Mysore district.

Anuradha *et al.* (2014) reported that the prevalence of under-nutrition (≤ 80 percentage of standard weight for age) among 3-5 years of children was 66.5%. The prevalence of grade 1 malnourishment was 46.2%.The prevalence of under nourishment increased with increasing age and the difference was found to be statistically significant (p< 0.05).

Encapsulating the above findings of the present study, it was observed that the overall percentage of all the subjects having a normal height for age did not increase from 30 per cent due to the lesser time period of follow-up, whereas, a considerable increase of 10 and 13.33 per cent was observed in the weight for age and weight for height of the subjects.

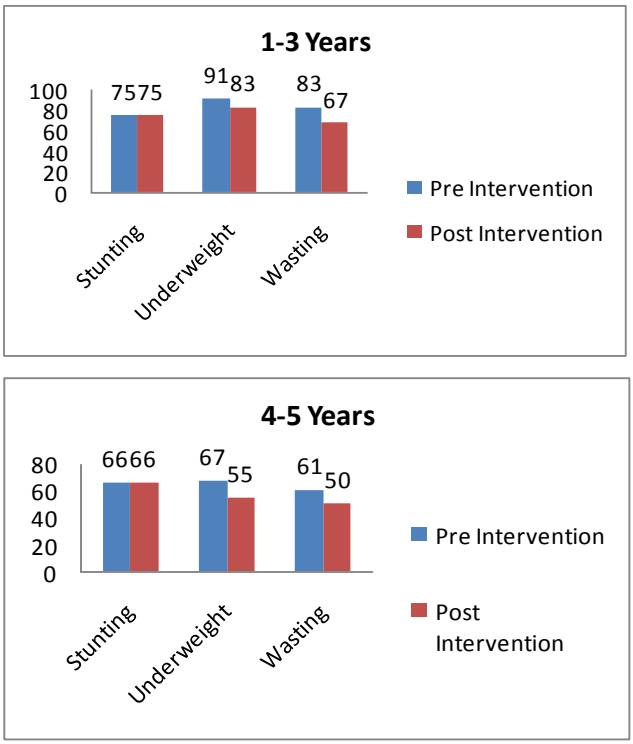


**Fig.1: Impact of nutrition intervention on the prevalence of malnutrition among subjects belonging to different age groups**

## IMPACT OF NUTRITION INTERVENTION ON THE BIOCHEMICAL PROFILE OF THE SUBJECTS

Table 4 presents the impact of nutrition interventions on the biochemical profile of the subjects. The data revealed that the mean calcium levels of all the subjects before and after the intervention were below the normal range of 8.5-10.8 mg/dl. However there was a significant (P≤ 0.01) increase from 7.06±0.75 mg/dl to 7.2±0.65 mg/dl. Similarly, a significant (P≤ 0.01) increase in the serum protein levels of the children was also observed. The mean value observed before the nutrition intervention was 5.92±0.68 g/dl which significantly increased to 6.19±0.54 g/dl. This value was within the range of normal value.

Though an increase was observed in the average values of serum retinol after the nutrition intervention, the increase observed was not significant. The mean value increased from 19.70±0.24 µg/dl to 19.87±0.27 µg/dl, however both these values were much below the normal range of 30-95 µg/dl.

Before intervention the serum vitamin D values in children are 15.11±4.48ng/ml and after nutrition intervention this value significantly increased to

15.63±4.14ng/ml but both these values were much below the normal range of 20-100 ng/ml. Aggarwal *et al*. (2012) supported the present results by reporting that mean serum 25-hydroxycholecalciferol D level of Indian children was 15.9 ± 12.4 ng/ml, and 82.1% of children had serum vitamin D levels <20 ng/ml, indicative of vitamin D deficiency. Rowicka *et al.* (2012) suggest that the disturbances in the balance between bone formation and bone resorption processes may occur in children containing lactose-free formulas. In the age group of 1-5 years, 61.8% children had vitamin A levels <20 mcg/dl (NNMB, 2006).

**Table 3: Impact of nutrition intervention on the prevalence of malnutrition among subjects belonging to different age groups**

| Anthropometric Index | 1-3(n=12) | | 4-5(n=18) | | Total (n=30) | |
|---|---|---|---|---|---|---|
| **Height for age(stunting)** | **Pre** | **Post** | **Pre** | **Post** | **Pre** | **Post** |
| **≥ Median (normal)** | 1(8.34) | 1(8.34) | 3(16.67) | 3(16.67) | 4(13.33) | 4(13.33) |
| **-1SD to Median (normal)** | 2(16.67) | 2(16.67) | 3(16.66) | 3(16.66) | 5(16.66) | 5(16.66) |
| **-2SD to -1SD (mild)** | 3(25.00) | 3(25.00) | 6(33.34) | 6(33.34) | 9(30.00) | 9(30.00) |
| **-3SD to -2SD (moderate)** | 5(41.66) | 5(41.66) | 5(27.77) | 5(27.77) | 10(33.34) | 10(33.34) |
| **<-3SD (severe)** | 1(8.33) | 1(8.33) | 1(5.56) | 1(5.56) | 2(6.67) | 2(6.67) |
| **Weight for age (underweight)** | | | | | | |
| **≥ Median (normal)** | 0(0.00) | 0(0.00) | 2(11.12) | 2(11.12) | 2(6.67) | 2(6.67) |
| **-1SD to Median (normal)** | 1(8.33) | 2(16.66) | 4(22.21) | 6(33.33) | 5(16.66) | 8(26.67) |
| **-2SD to -1SD (mild)** | 4(33.33) | 5(41.67) | 8(44.43) | 7(38.87) | 12(40.00) | 12(40.00) |
| **-3SD to -2SD (moderate)** | 6(50.00) | 5(41.67) | 2(11.12) | 2(11.12) | 8(26.67) | 7(23.32) |
| **<-3SD (severe)** | 1(8.34) | 0(0.00) | 2(11.12) | 1(5.56) | 3(10.00) | 1(3.34) |
| **Weight for Height (wasting)** | | | | | | |
| **≥ Median (normal)** | 0(0.00) | 1(8.33) | 3(16.66) | 3(16.66) | 3(10.00) | 4 (13.33) |
| **-1SD to Median (normal)** | 2(16.67) | 3(25.00) | 4(22.23) | 6(33.33) | 6(20.00) | 9(30.00) |
| **-2SD to -1SD (mild)** | 6(50.00) | 6(50.00) | 6(33.33) | 6(33.34) | 12(40.00) | 12(40.00) |
| **-3SD to -2SD (moderate)** | 4(33.33) | 2(16.67) | 5(27.78) | 3(16.67) | 9(30.00) | 5(16.67) |
| **<-3SD (severe)** | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) | 0(0.00) |

#Values in parentheses indicate percentages

**Table 4: Impact of nutrition intervention on the biochemical profile of the subjects**

| | Pre intervention | Post intervention | T test | Normal Range |
|---|---|---|---|---|
| **Total Proteins (serum) (g/dl)** | 5.92±0.68 | 6.19±0.54 | 2.31* | 6-8 g/dl |
| **Calcium (mg/dl)** | 7.06±0.75 | 7.2±0.65 | 1.76* | 8.5-10.8 mg/dl |
| **Serum Retinol (µg/dl)** | 19.70±0.24 | 19.87±0.27 | $1.37^{NS}$ | 30-95 µg/dl |
| **Vitamin D** | 15.11±4.48 | 15.63±4.14 | 2.99** | 20-100 ng/ml |

*Significant at 5% level, ** Significant at 1% level, $^{NS}$ Non significant

## CONCLUSION

More than 70% of the subjects were found to be stunted, wasted and underweight before Nutrition Counseling. Whereas there was a significant reduction in the number of subjects who were underweight and wasted after intervention. Levels of serum proteins, calcium and Vitamin D significantly improved but calcium and vitamin D levels were still below the normal range after intervention.

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