



# SEVERE OSTEOPENIA IN ADOLESCENCE: POOR BONE HEALTH FOR LIFE

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**Abstract** — Osteoporosis is a systemic skeletal disorder characterized by low bone mass that leads to increased bone fragility and susceptibility to fracture. Lactose intolerance is characterized by abdominal pain and/or diarrhea following the ingestion of lactose in people with lactase deficiency. The most common therapeutic approach to lactose intolerance is to exclude dairy products from the diet, which are the main source of calcium. We studied a group of patients with symptoms attributable to lactose intolerance part of whom was receiving a lactose-free diet and measured their intake of calcium, bone density and body mass index. We found that both groups were introducing a lower amount of calcium than recommended, with no difference between a free-lactose diet and a regular diet. Osteopenia was present in 35% of patients and it was inversely related to body mass index. Proper nutritional education is necessary in children in order to prevent overweight and osteopenia. Also the importance of exercise should be reinforced at school, because the peak of bone mass is obtained during adolescence and it is an essential factor in determining the future risk of osteoporosis and fractures.

**Index Terms** — TRANS2CARE, BMI, Osteoporosis, Lactose Intolerance, Diet

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## 1 BACKGROUND

Osteoporosis is a systemic skeletal disorder characterized by low bone mass that leads to an increased bone fragility and susceptibility to fracture. A low bone mineral density (BMD) is a major risk factor for fracture and children with osteoporosis may develop skeletal disease even in youth. Lactose intolerance is a clinical syndrome that follows the ingestion of lactose in people with lactase deficiency a single nucleotide polymorphism located 14 kb upstream of the lactase gene (LCT-13910 C > T) has been associated with lactase persistence. (1)

The most common therapeutic approach to lactose intolerance is to exclude from the diet, all dairy products, which are the main source of calcium intake. (2) Bone Mineral Density and Bone Mass Index should be evaluated in all subjects with lactose intolerance

## 2 OBJECTIVES

The purpose of this study was to investigate the bone mineral density (BMD) and the calcium intake in a population of adolescents-young adults with genetically proven lactose intolerance. The results were compared with those of non-lactose intolerant subjects.

## 3 APPROACH & METHODS

### Patients

All the children referred to the Gastroenterology Service of the Pediatric Unit of the University of Ferrara were included in the study

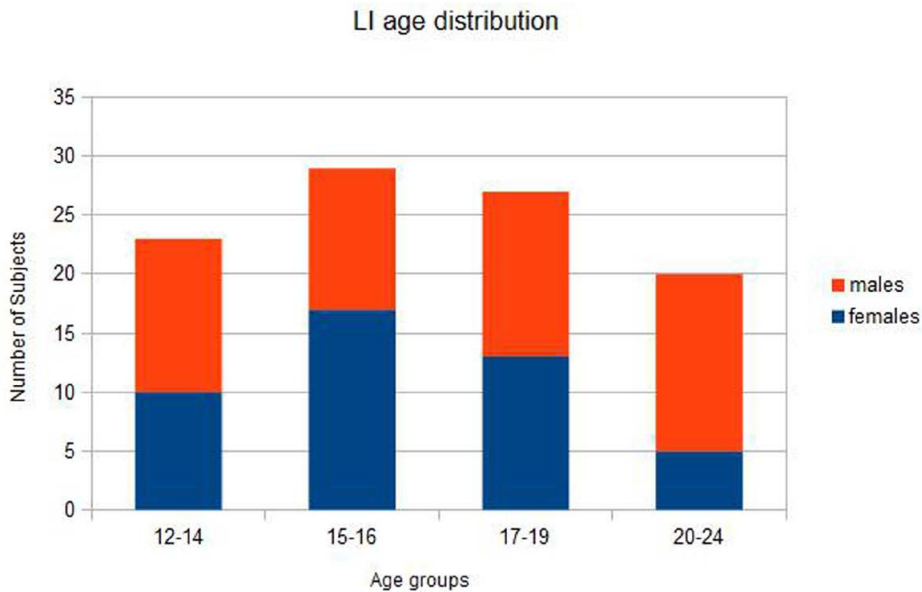


Figure 1. Distribution of males and females into different age groups.

### Methods

A dietary record was obtained from all the individuals included in the study, to record their daily calcium intake (mg/die). The intake was then compared with the Recommended Daily Allowance (RDA) tables. Anthropometric variables: weight, height, Body Mass Index (BMI), using the Italian parameters (Cacciari tables).

Quantitative ultrasound to evaluate Bone Mineral Density (BMD) on the proximal phalange of the last four fingers of the non-dominant hand measuring. Amplitude-dependent speed of sound (AD-

SoS) that is the ultrasound wave speed (m/s) and reflects bone density and elasticity. The AD-SoS values were converted to Z-scores using the normative data obtained from a reference pediatric Italian population.

Osteopenia is defined as an AD-SoS < 10<sup>th</sup> centile and Z-score < -1.5 SD. Osteoporosis is defined as a Z-score < -2 SD and there is at least one fracture.

## 4 RESULTS

The study population consisted of 99 Lactose Intolerant (LI) subjects: 45 females and 54 males, aged 12 to 24 yrs (fig.1). All underwent quantitative ultrasound and a breath test to investigate symptoms compatible with lactose intolerance. So far, 21 non-LI subjects are the control population and still in enrollment. All the subjects filled out a dietary record.

The amount of calcium introduced with the diet is reported in Table 1

	Non-LI	LI	
Intake Ca (Mg/die)	876.8±331.5	936.7±474.3	n.s.
Intake Ca (%)	72.8±23.2	73.3±22.3	n.s.
BMI (mean±sd)	21.3±3.5	21.5±3.6	n.s.
<75% RDA (% subjects)	47	40	
Osteopenia (% subjects)	23	12	
Overweight/obese (% subjects)	14	6	
Two components of MetS			

Table 1. LI= Lactose Intolerant. n.s. = not significant. RDA=Recommended Daily allowance

There was no difference in calcium intake between LI and non-LI (p-value >0.05), but in almost half of the subjects of both groups the amount introduced was less than 75% of the recommended daily allowance.

In addition we found an inverse correlation between BMI and BMD (fig.2). This correlation was confirmed in both LI and non-LI, and it was more significant in obese patients than in overweight ones. This result, albeit previously suggested in the literature, was unexpected and of great clinical significance.

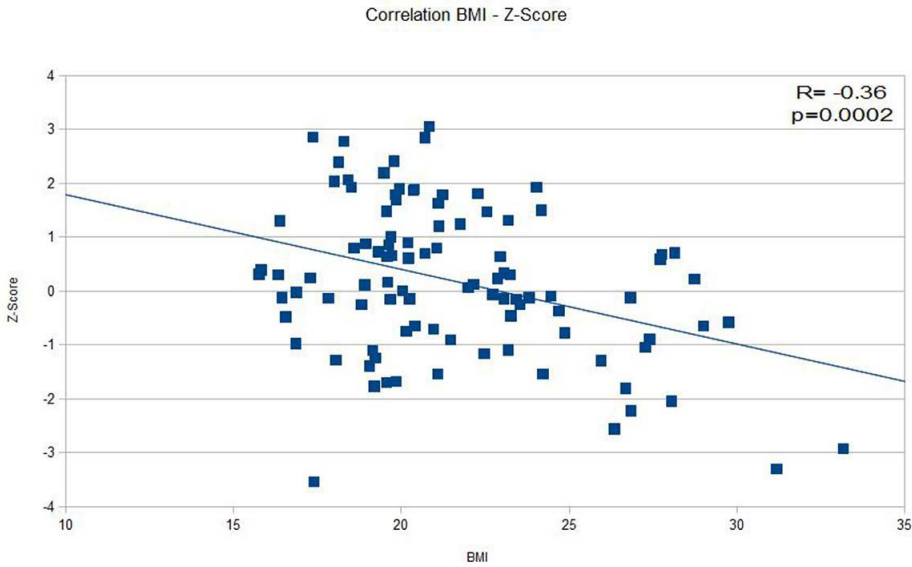


Figure 2. Inverse correlation between BMI and Z-score

## 5 POTENTIAL NEW SERVICES

We suggest that an education program should be incorporated in the schools' curricula to make aware the children and their families to the importance of introducing the right amount of calcium with food. In fact, our results confirm the importance of a healthy diet and of proper exercise in order to prevent overweight and its complications.

## 6 CURRENT COLLABORATIONS

Dept. of Life and Reproduction Sciences, Unit of Biology and Genetics, University of Verona, Italy where the lactase deficiency is genetically defined. (T2C affiliate)

## 7 CONTACT OR COLLABORATIONS NEEDED

Schools: Principals and teachers. This program needs a team to work in synergy to implement the education program.

Associations: to draw attention to the problem and help to apply the program not only in schools.

## 8 COMMUNICATION TOOLS

ResearchGate: [https://www.researchgate.net/profile/Alessandro\\_Baldan/](https://www.researchgate.net/profile/Alessandro_Baldan/)

LinkedIn: <http://www.linkedin.com/pub/alessandro-baldan/28/40a/bb2>

Website: [www.trans2care.eu](http://www.trans2care.eu)

## **9 FUNDS NEEDED**

**9.1 For basic research (investigation of biological mechanisms): 50000 €**

**9.2 For applied research (solutions for real-world problems): 90000 €**

**9.3 For pilot & demonstrator activities (to develop a prototype): 80000 €**

## **10 CONCLUSION**

This project would promote the food knowledge in pediatric age children, and proper diet habit, to improve health care and life quality.

## **ACKNOWLEDGEMENT**

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