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## ABSTRACT

**Background:** Short stature is a common reason for pediatric endocrinologist consultation, but in many cases, no cause can be identified. Childhood hypophosphatasia has widely variable clinical features from short stature to low bone mineral density with skeletal deformities, and the place of serum alkaline phosphatase (ALP) activity assay could be raised as etiological exploration is not consensual.

**Objective and hypotheses:** The aim of our study was to evaluate the ALP levels in a cohort of short stature children.

**Method:** Children referred in our teaching hospital of Rouen for evaluation of short stature (height < -2 SD, or decreased growth velocity greater than 1 SD) from the 1st January 2010 to the 31st December 2014 were included in the present retrospective study. Children were eligible when a growth hormone stimulation test and an ALP assay were performed. Anamnestic, auxological, biological and radiological data were collected.

**Results:** 167 children (101 boys, and 66 girls) were included at a mean age referral of 8.6 years old [0.5-18] with a mean height at -2.4 SD [-5.0; 0.5]. Whereas the majority of patients revealed normal ALP level, 11 showed low ALP levels (i.e. <120 U/ml) [67-119], among whom 4 had a somatotropin deficiency. None of them demonstrated radiological abnormalities or skeletal deformations. 7 among the 11 patients had a second ALP assay revealing for 6 of them normal ALP level, mostly concomitant with an acceleration of growth velocity. No controls were available up to now for the others children.

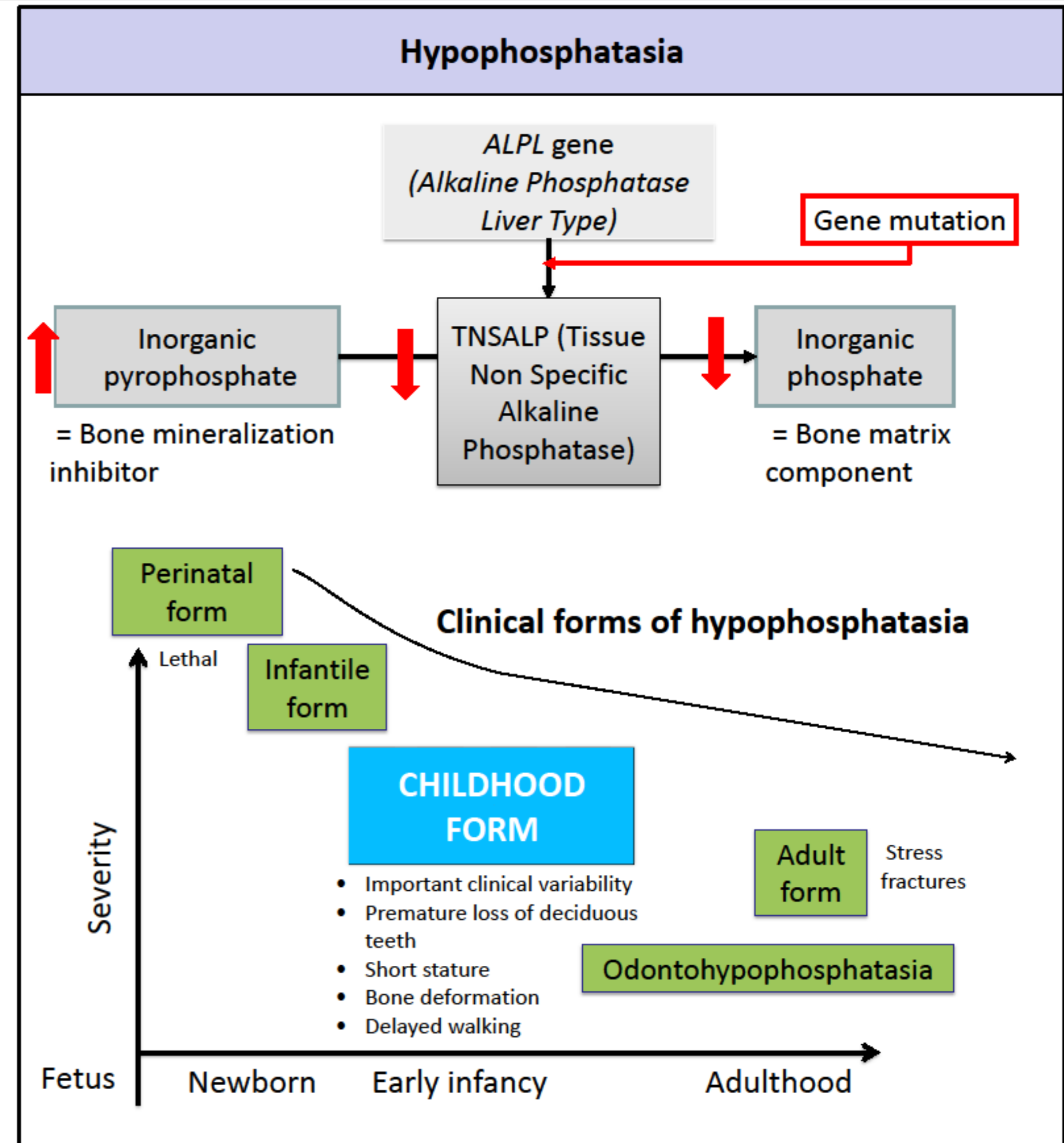
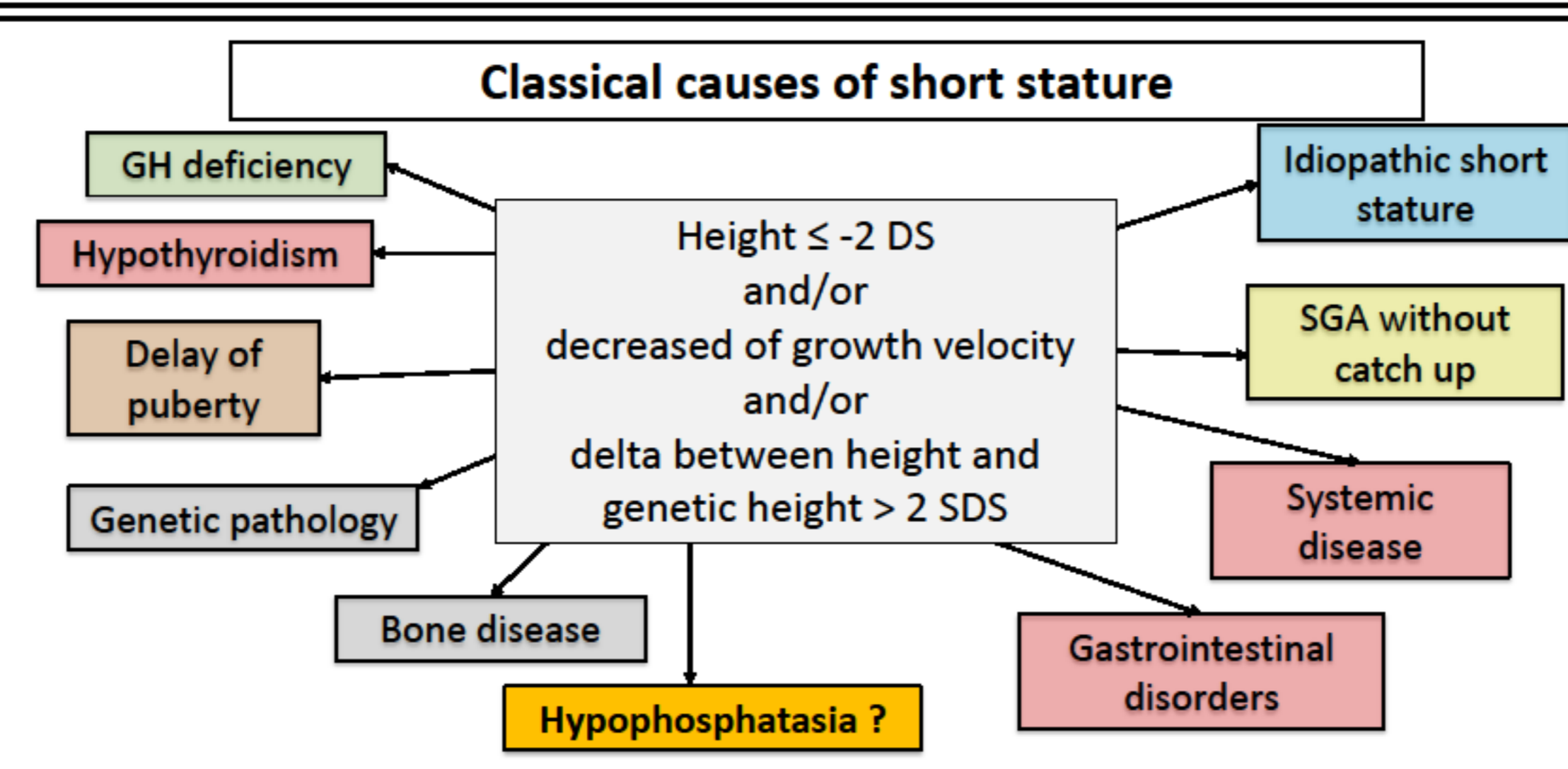
**Conclusion:** Abnormal ALP activity was observed in 6.5% studied patients suggesting that hypophosphatasia could be a rare cause of short stature and that ALP assay need to be performed until further studies in larger population confirm this hypothesis.

## INTRODUCTION

**Suggested investigations of the of the short stature child** (Wit et al. Growth Horm IGF Res 2008)

<b>General biology:</b> <ul style="list-style-type: none"> <li>• Blood: <ul style="list-style-type: none"> <li>• Electrolyte panel, CBC, ESR, CRP,</li> <li>• Creatine, iron, albumin</li> <li>• Alkaline phosphatase*</li> <li>• Anti-endomysium and anti-transglutaminase antibodies, total IgA</li> </ul> </li> <li>• Urine: pH, glucose, protein, blood and sedimentation</li> </ul>	<b>Endocrine test:</b> <ul style="list-style-type: none"> <li>• TSH, T4</li> <li>• Anti thyroid antibody</li> <li>• IGF-1, IGFBP3</li> <li>• GH provocation test</li> </ul>	<b>Radiographic analysis:</b> <ul style="list-style-type: none"> <li>• Bone age</li> <li>• Skeletal X-ray,</li> <li>• Cranial MRI</li> </ul>
<b>Others:</b> <ul style="list-style-type: none"> <li>• Karyotype</li> <li>• +/-genetic consultation</li> </ul>		

\* In this review, ALP assay is proposed, but without explanation and not performed systematically



## AIM OF THE STUDY

We aimed to analyze the different causes of short stature including the possible hypophosphatasia hypothesis through systematic measurement of ALP assay to determine whether hypophosphatasia could be a cause of short stature

## PATIENTS AND METHOD

Monocentric Retrospective Observational Study

We included children referred in our hospital for evaluation from the 1st January 2010 to the 31st December 2014 with these criteria:

### Inclusion criteria:

- Height  $\leq -2$  DS
- and/or decreased growth velocity greater than 1 SD
- and/or delta between height and genetic height > 2 SDS
- with measures of ALP assay and growth hormone stimulation test

### Exclusion criteria:

- Hepatic impairment that may interfere with ALP assay

We recorded following data at the time of the exploration:

- **Anamnestic:** parental height, history of SGA, known chronic disease
- **Auxological and clinical:** age, sex, height, weight, Tanner stage, dysmorphic features
- **Biological:** IGF1, GH stimulation test, TSH, T4, ACTH, cortisol, CBC, ALP level
- **Radiological:** Bone age, and skeletal X-ray if available

We defined low ALP level if < 120 U/l

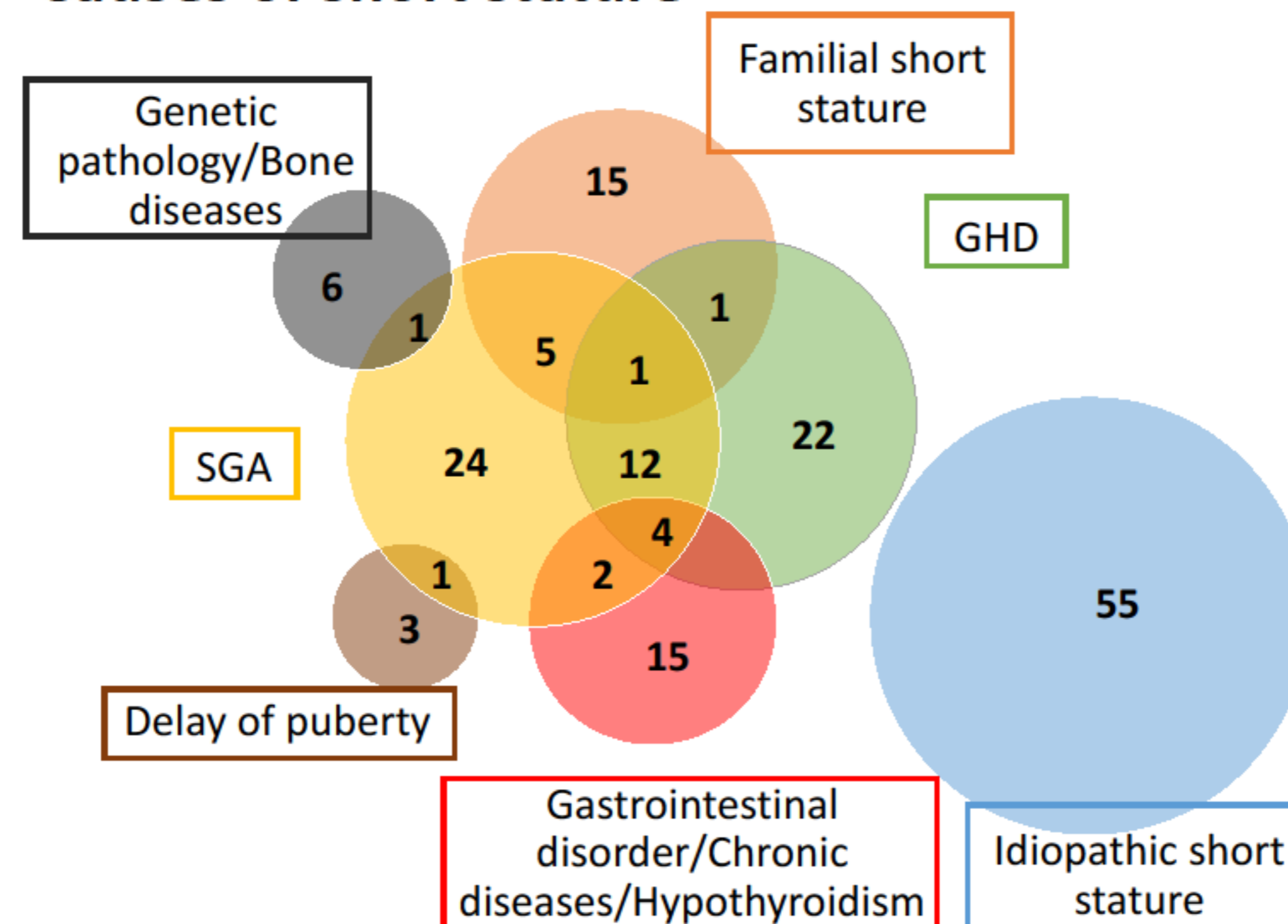
## RESULTS

### STUDIED POPULATION

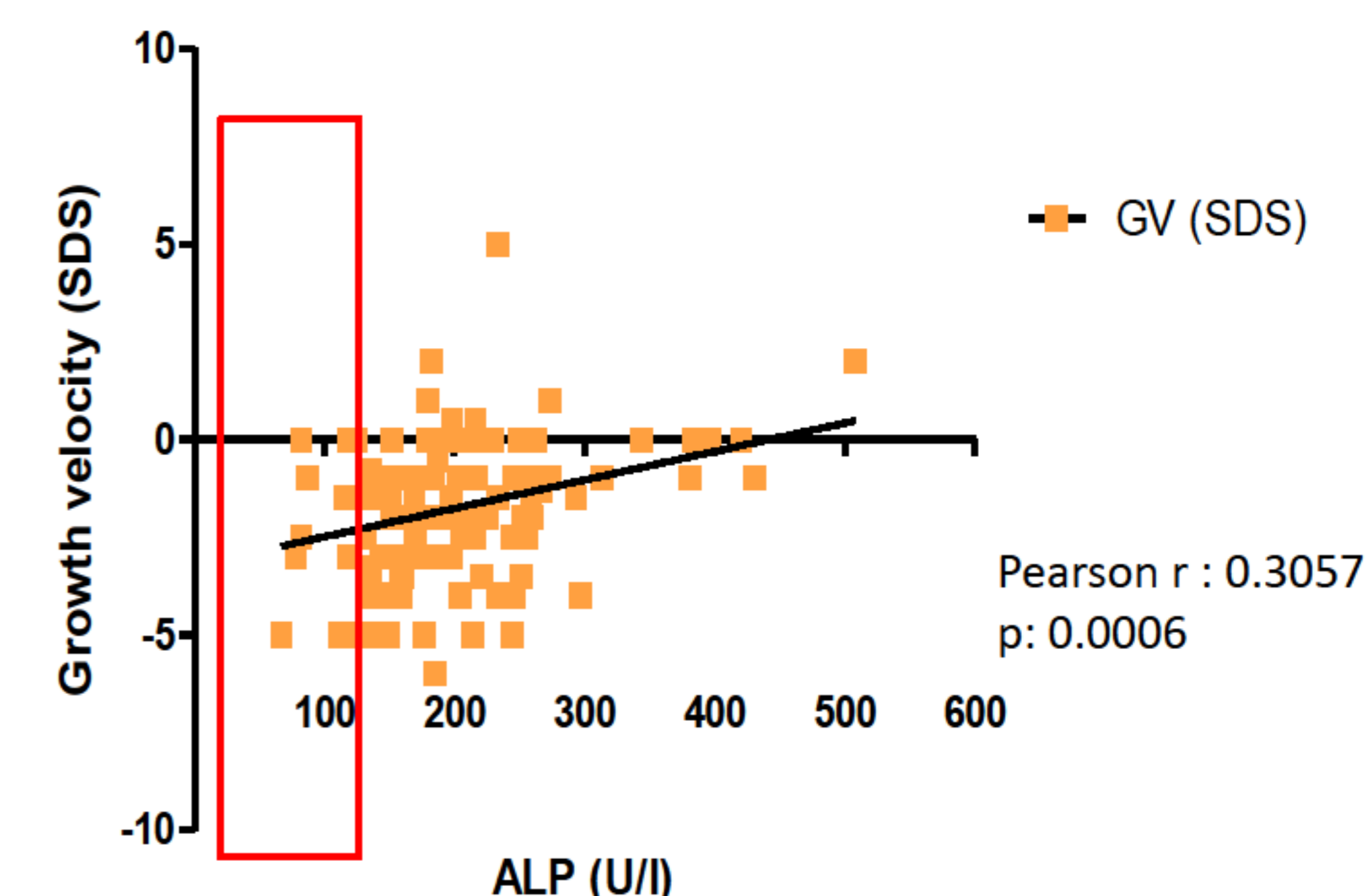
167 children included

101 boys, 66 girls (sex ratio: 1,53)  
Mean age referral: 8,6 years [0,5-18]  
Median height: -2,2 SDS [-5 ; 0,5]

### Causes of short stature



### CORRELATION BETWEEN HEIGHT VELOCITY AND ALP



Great variability of ALP level in the all cohort of short children with a weak positive correlation with the height velocity.

11 children (6 boys - 5 girls) demonstrated low ALP level (mean ALP level: 102 UI/l [67-119])

## CONCLUSION AND PERSPECTIVES

Abnormal ALP activity was observed in 11 out of the 137 children studied (6.5%), suggesting that hypophosphatasia could be a rare cause of short stature.

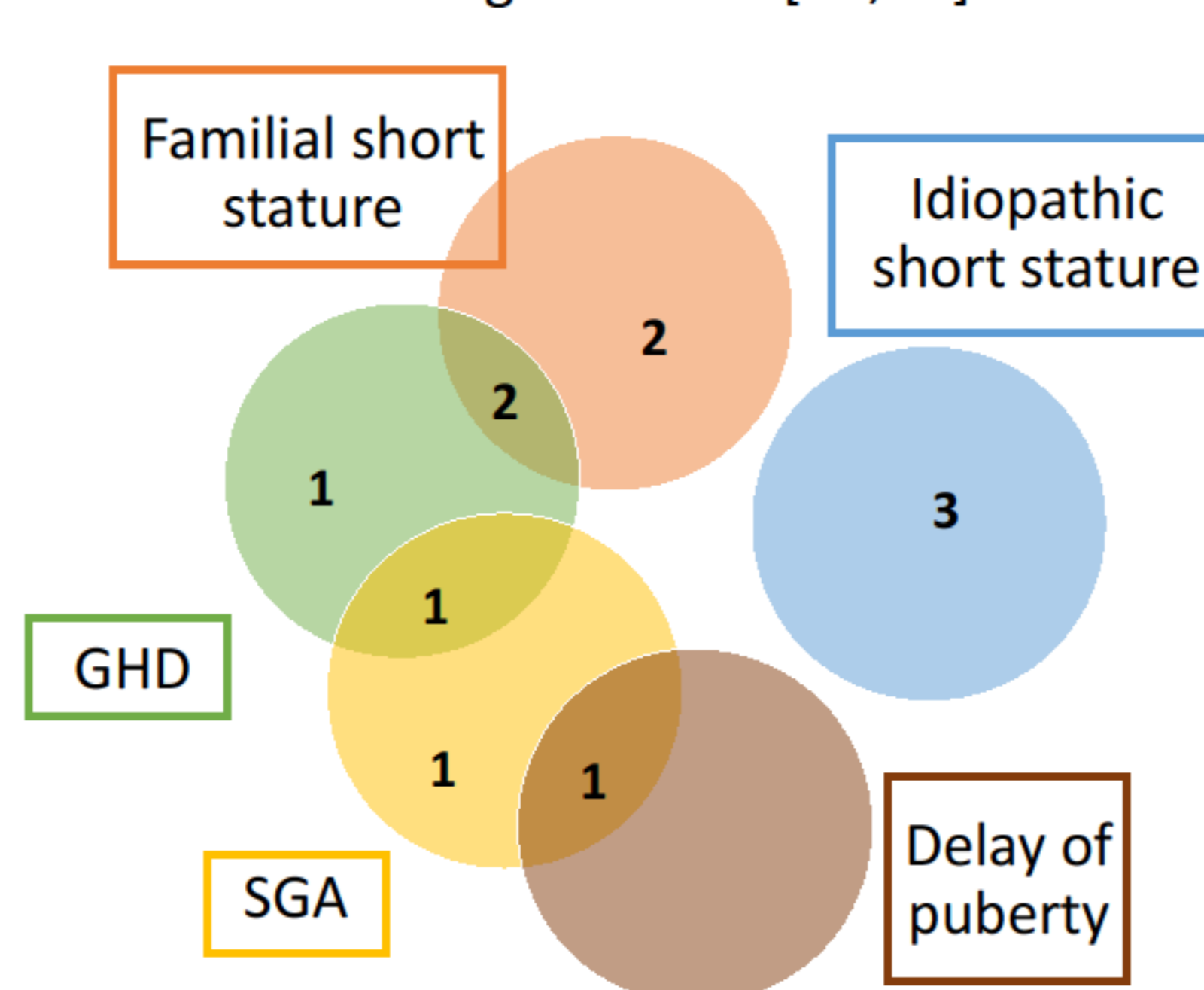
However, a large majority of children with low ALP level at first evaluation showed either normal ALP level at control (likely attributable to increase height velocity) or normal skeletal X-ray, that makes the diagnosis of hypophosphatasia unlikely.

Further larger studies with systematic ALP assay need to be performed to determine whether hypophosphatasia could be a cause of short stature.

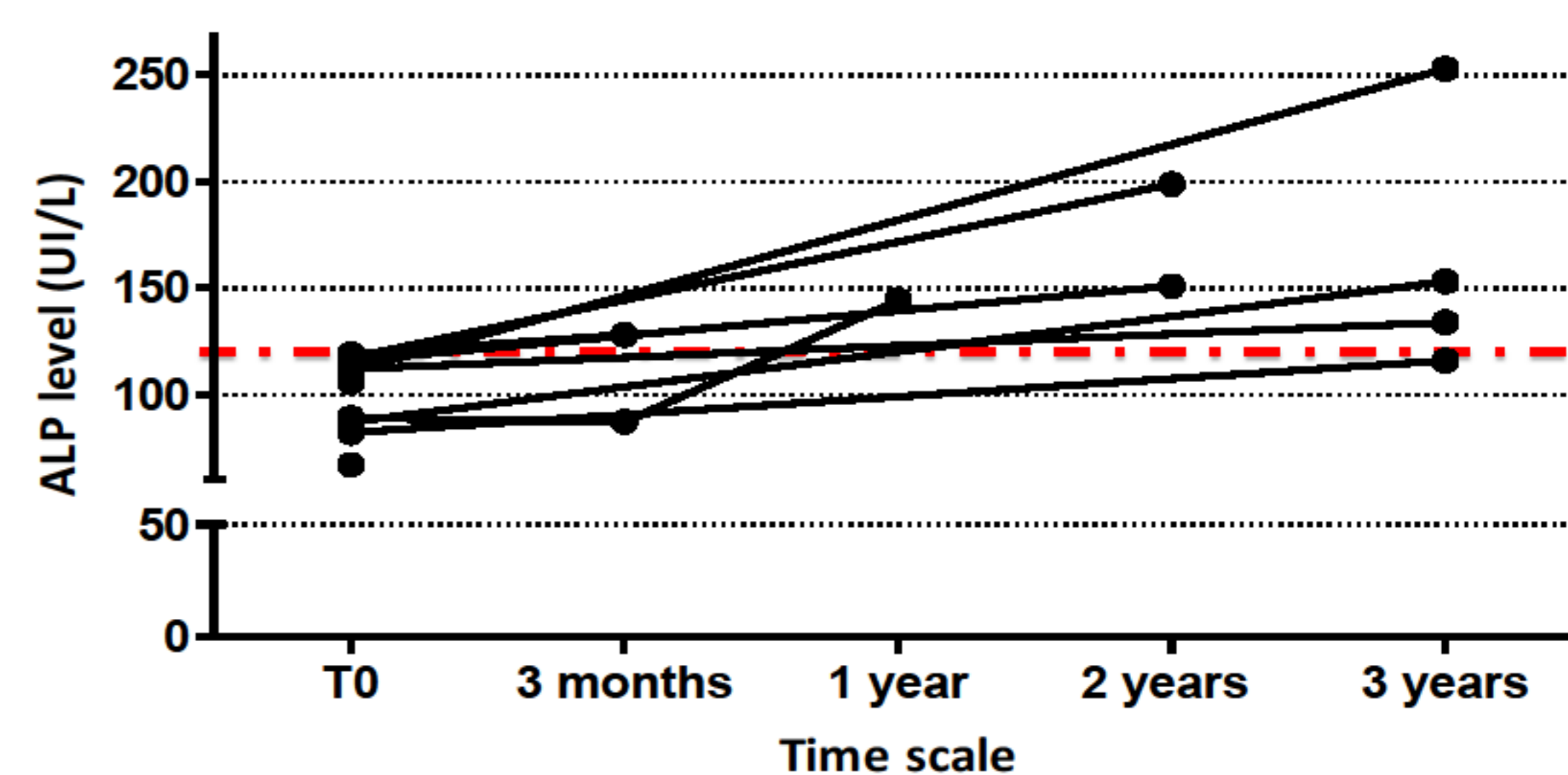
## ALP ASSAY RESULTS

### Short stature etiology for the 11 children with ALP < 120 UI/l

Mean age: 9,3 years [3-15]  
Median height: -3 SDS [-5 ; -2]



### ALP levels evolution



ALP assay control revealed spontaneous normalization of the ALP level in 8 out of the 11 children with a positive correlation with growth velocity. No ALP control was performed for the 3 other children. Skeletal X-ray showed no anomalies in 2 out of these children.

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