

## RELIABILITY OF HEIGHT PREDICTION METHODS IN SHORT STATURE CHILDREN

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*Abstract: According to our former studies on height prediction in short children the Bayley – Pinneau (BP) and Tanner – Whitehouse (TW2) methods were accurate while Roche – Wainer – Thissen (RWT) estimation proved less correct. We focused on the possible nature and cause of this inaccuracy. RWT predicted values were ranged into 3 groups (underestimated – averaged – overestimated) and related chronological age (CA), bone age (BA) were analyzed. The same was carried out in the values calculated by BP and TW2 methods. We found underestimation in 9 of 44 cases predicted by RWT, both their CA and BA were significantly lower compared with that of the averaged group. In the total values underestimated by the different methods the CA and BA were also significantly lower in RWT group compared with that of the BP group. Taking account of these results it seems the less reliability of RWT method is limited to CA under 12 years, BA under 14 years.*

*Key words: Short stature; Height prediction; Chronological age; Bone age.*

### Introduction

There are several methods for prediction adult height using anthropometric data, variables that can be observed at a single examination. Most favourable are the methods of Bayley – Pinneau (BP), that of Roche – Wainer – Thissen (RWT) and that of Tanner and Whitehouse (TW2). They can help us to differentiate children with height below 3rd percentile: who can get benefit by growth promoting therapy and who do not. Controlling the effect of any treatment height prediction would be also useful. It was revealed in the course of our former comparative studies in short stature children (Muzsnai and Péter 1989) that BP or TW2 methods were accurate under certain circumstances (e.g. in growth hormone or anabolic steroid treatment) while RWT estimation proved to be less correct. We focused on our attention whether the later had a trend to over- or underestimate adult height, or it depended on the chronological age, perhaps on the bone age.

### Subjects and Methods

We selected patients referred for short stature to the pediatric endocrinology, boys and girls who had already achieved adult height. Children's height was around the 3rd percentile at the time of the first visit according to both the Tanner – Whitehouse (1976) and Eiben – Pantó (1986) growth standards. Predicted height were calculated in 179 cases by three methods: developed by Bayley and Pinneau (1952), Roche, Wainer and Thissen (1975), Tanner and al. (1983) summarized on the *Table 1*. Bone age was determined for BP and RWT methods from the Greulich – Pyle Atlas (1959), while the TW2 prediction has an own bone age assessment system (Tanner et al. 1983). Accepting  $\pm 1$  cm to final height predicted values were ranged into 3 groups: underestimated, average, overestimated and related chronological age (CA), bone age (BA) were analyzed. Data were compared by Student *t* test.

**Table 1. The validity range (year) and parameters used for the calculation in the height prediction\***

	BP	RWT	TW2
Boys	7 — 18.5	1 — 16	6 — 18.5 —
Girls	6 — 18.0	1 — 14	5 — 14.5 —
1.	Height	Recumbent length	Height
2.	GP bone age	GP bone age	T bone age
3.	—	Weight	Chronological age
4.	—	Midparent stature	—

\* BP : Bayley — Pinneau method  
 RWT : Roche — Wainer — Thissen method  
 TW2 : Tanner — Whitehouse method  
 GP : Greulich — Pyle Atlas  
 T : Tanner Atlas

### Results and Conclusion

Groups with underestimated, average and overestimated height obtained by the different methods and related chronological age are shown on the *Figure 1*. Under the bars the number of cases were indicated. We found underestimation in 9 cases from the 44 cases of RWT prediction, their mean CA (11 year) was significantly lower ( $p = 0.02$ ) compared with that of the average group (14.4 year). Similar differences were not found either in the BP or in the TW2 estimated groups.

On the *Figure 2* we give the bone age of the formerly separated groups; almost the same situation can be seen. There was also a significant difference ( $p = 0.02$ ) between the RWT underestimated group (8.7 year) and the average group (12.6 year), but not between the others. In general the BA was retarded in all groups.

The *Figure 3* shows the CA and BA only of the underestimated groups. Comparing the CA or BA in the total number of underestimated groups by the different methods, both were significantly lower (CA —  $p = 0.04$  and BA —  $p = 0.01$ ) in RWT group compared with that of the BP group.

Considering that both RWT and BP prediction methods use the Greulich — Pyle Atlas in the assessment of the bone age we conclude: the less reliability of RWT method for prediction of adult height is connected with the age, it is limited to chronological age under 12 years, bone age under 14 years. This suggests that the age validity range of the RWT method (Table 1) would be modified.

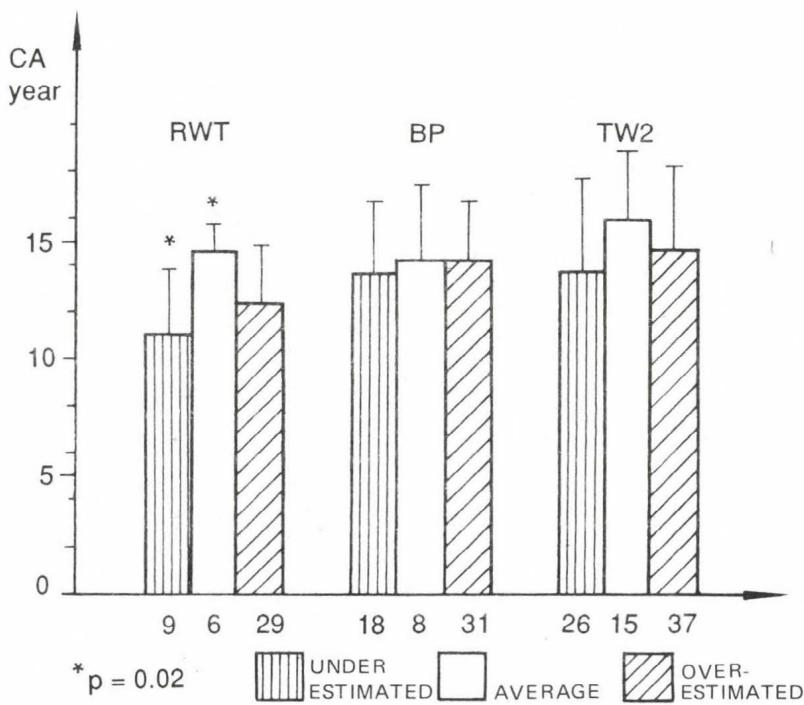


Fig. 1: Underestimated, average, and overestimated height obtained by the different methods and related to chronological age

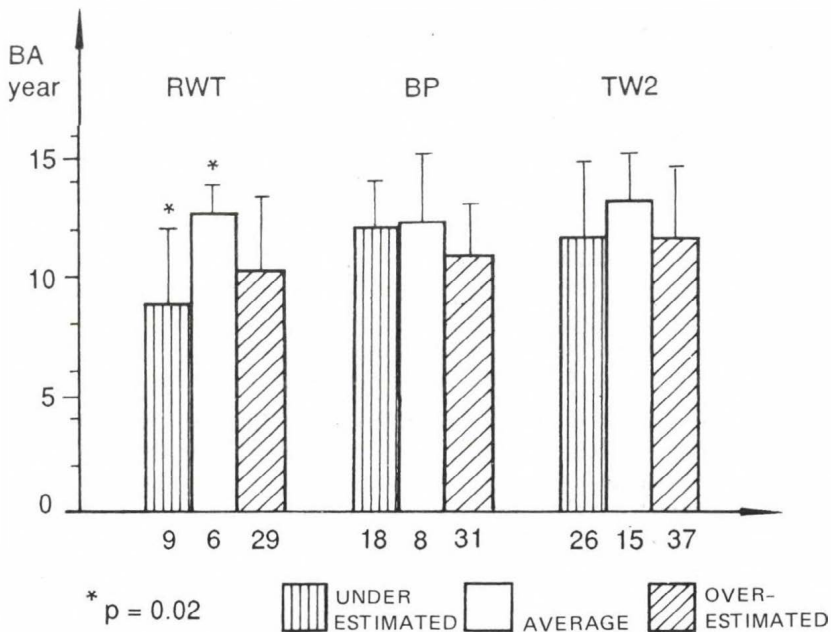


Fig. 2: Underestimated, average, and overestimated height obtained by the different methods and related to bone age

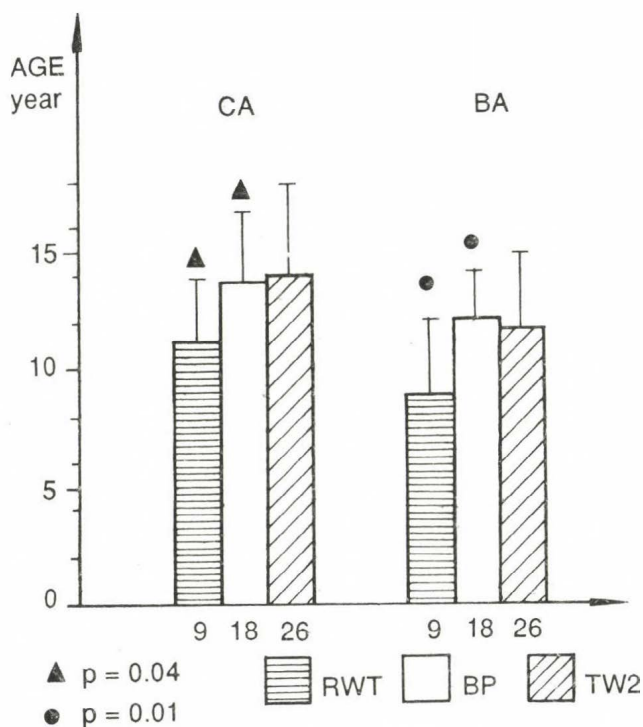


Fig. 3: Chronological age and bone age in underestimated groups

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Paper presented at the Fifth International Symposium of Human Biology, Keszthely, Hungary, June 1991; Received 1 August, 1991.

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