# VARIABILITY IN RUNNING KINEMATICS MODIFICATION PATERN DEPENDING ON VELOCITY IN JUNIOR TRIATHLETES

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## INTRODUCTION

Thriathlete running foot kinematics has very important differences from runner`s one, in contact time and lower limb angles. Physical and Technical requirements during training and competition in swimming and cicling have influence in foot running technical performance. The aim of this study is to find the possible existent modifications in kinematics running foot depending on speed, on a sample of International Junior Triathletes during a Maximal Aerobic Speed Test (MAST).

## METHODS

11 subjects from Mexican National Junior Team were measured. Values are shown (Average ± SD), Age: 17.71 ± 0.83, Weight: 61.28 ± 3.67, Height: 172.53 ± 5.69, $HR_{max}$: 203.5 ± 2.12. It was used: Cosme Indoor treadmill, Polar Heart Rate monitor, Canon SD 40S camera for motion capture, Dart Fish 4.5 and VirtualDub 1.6.7 for video analysis.

A 5 min of Continual Foot Run (CFR) at 2.22 $m{\cdot}s^{-1}$ warming up, stretching and then the MAST begining at 2.22 $m{\cdot}s^{-1}$, increasing 0.27 $m{\cdot}s^{-1}$ each 2 min until exhaustion.

The variables were extracted from the analysis of 10s filmed at 60 fps in the middle of each phase of the MAST. Contact time (Ct) and Stride frequency (Sf), Stride Length (Sl), degrees o ankle at the moment of contact with the floor (ºC) and degrees of the ankle at the moment of the lift (ºL) were analyzed.

In order to determinate if differences exist between the analyzed variables a Repeated Measure ANOVA was carried out. To determinate de variables relationships Pearson Correlation, average comparison and contingence analysis. As well as coefficient of variation (cv) was measure.

## RESULTS AND DISCUSSION

Values of analyzed parameters are shown in (Table 1). Significative differences were found in Sf, Sl and Ct for each velocity of the MAST. Main difference is between 3.32 $m{\cdot}s^{-1}$ and 3.88 $m{\cdot}s^{-1}$. This last velocity is the one who [1] determined as the most economical due to the stability of the $VO_2$ ratio. Figure 1, shown the velocity where Ct values and ºC and ºL get crossed.

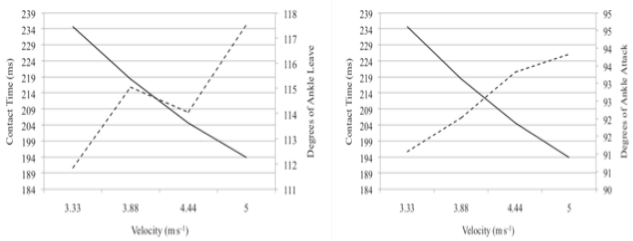


**Figure 1**: Left one, relationship between Ct (full line) and ºC (dot line). Right ones relationship Ct (full line) and ºL (dot line).

Significative differences were found for the same velocities in ºL, ($p<0.04$), the cv modification percentage is higher for Sf than for Sl between this velocities, but from 3.88 $m{\cdot}s^{-1}$ forward, the variation is higher for Sl, probably due to the kinematic modification produced when running in treadmill [2].

## CONCLUSIONS

The variation of velocity between 3.32 $m{\cdot}s^{-1}$ and 3.88 $m{\cdot}s^{-1}$ produce changes in running kinematics, that is why an excess of training volume at velocities lower than 3.88 $m{\cdot}s^{-1}$ could modify the technical pattern, hampering a good adaptation to the technique that is necessary to run at competition velocities in sprint distance triathlon.

## ACKNOWLEDGEMENTS

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## REFERENCES

1. Numela A, et al., *Int J Sports Med*. **28**:655-661, 2007.
2. Mercer JA, et al., *Eur J Appl Physiol*. **87**:403-408, 2002

**Table 1:** Values of analyzed variables. First column under each velocity are, average values and sd., second column is cv.

| | | Tc (ms) | | Sf (Hz) | | Lc (m) | | C (º) | | L (º) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Av and Sd | cv | Av and Sd | cv | Av and Sd | cv | Av and Sd | cv | Av and Sd | cv |
| v ($m{\cdot}s^{-1}$) | **3.32** | 230 ± 7.65 | 3.33 | 90.93 ± 4.62 | 5.08 | 2.20 ± 0.1 | 4.55 | 91.7 ± 0.99 | 1.08 | 113.2 ± 5.04 | 4.45 |
| | **3.88** | 225 ± 5.03 | 1.97 | 92.06 ± 4.33 | 4.70 | 2.53 ± 0.11 | 4.35 | 93.3 ± 1.94 | 2.08 | 120.8 ± 5.36 | 4.44 |
| | **4.44** | 212 ± 10.83 | 5.11 | 92.61 ± 2.54 | 2.74 | 2.90 ± 0.07 | 2.41 | 93.05 ± 3.62 | 3.89 | 117.25 ± 5.20 | 4.43 |
| | **5** | 199 ± 11.48 | 5.77 | 94.65 ± 3.62 | 3.82 | 3.17 ± 0.11 | 3.47 | 93.05 ± 1.72 | 1.85 | 116.1 ± 5.31 | 4.57 |