



# **Paracanoe: difference in performance between athletes of KL1, KL2 and KL3 in Paralympic competition**

---

OCTUBER 2018

Luiz Gustavo SANTOS; Maria Florencia SIERRA; Leonardo MAIOLA;  
Edison DUARTE; Paulo César MONTAGNER João Paulo BORIN

# INTRODUCTION



- Paracanoe is considered a cyclical sport, characterized by race at 200meter.
- Competitors are physically disabled athletes





In a 200-meter race, optimal performance is judged by the ability of the athlete to advance at maximum speed, overcoming water resistance through a technically precise forward stroke action.

# STROKE PHASES

- ENTRY
- AQUATIC OR PROPULSIVE OR DRAWN
- Exits
- Aerial phase OR RECOVERY





# STROKE PHASES

## ➤ ENTRY



# STROKE PHASES

AQUATIC OR PROPULSIVE OR DRAWN



MICHAEL et al., 2009

# STROKE PHASES

## ➤ EXITS





# STROKE PHASES

➤ Aerial phase OR RECOVERY



MICHAEL et al., 2009



# AIM

Analyze KL1, KL2 and KL3 athlete's performance in a paralympic male paracanoe event, specifically regarding the variables, stroke frequency, mean speed, stroke index.



# METHODS

The sample-size was comprised of three voluntaries, paracanoe athletes from the Brazilian Male Paracanoe Team

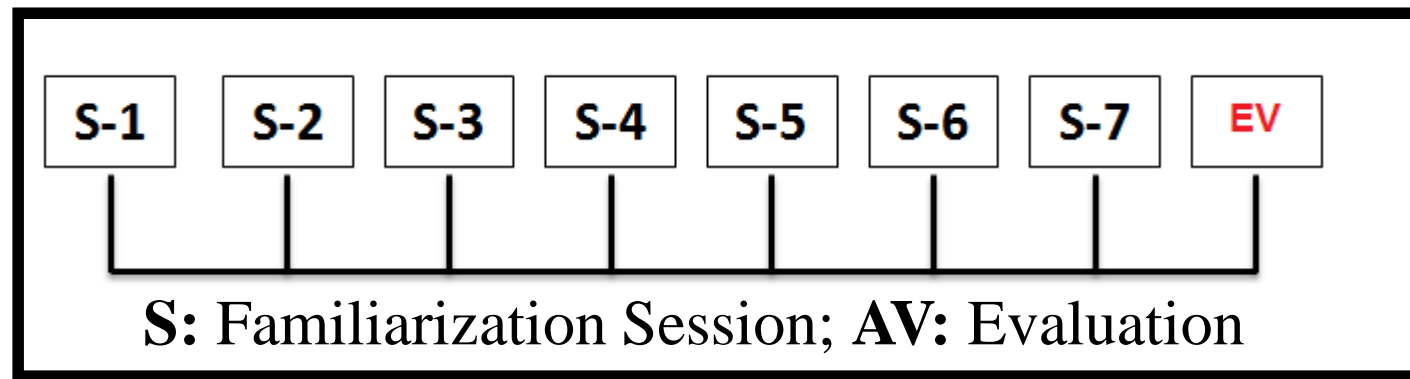
**KL1-** injury to the tenth thoracic segment;

**KL2-** bilateral transfemoral amputation;

**KL3-** unilateral transfemoral amputation;

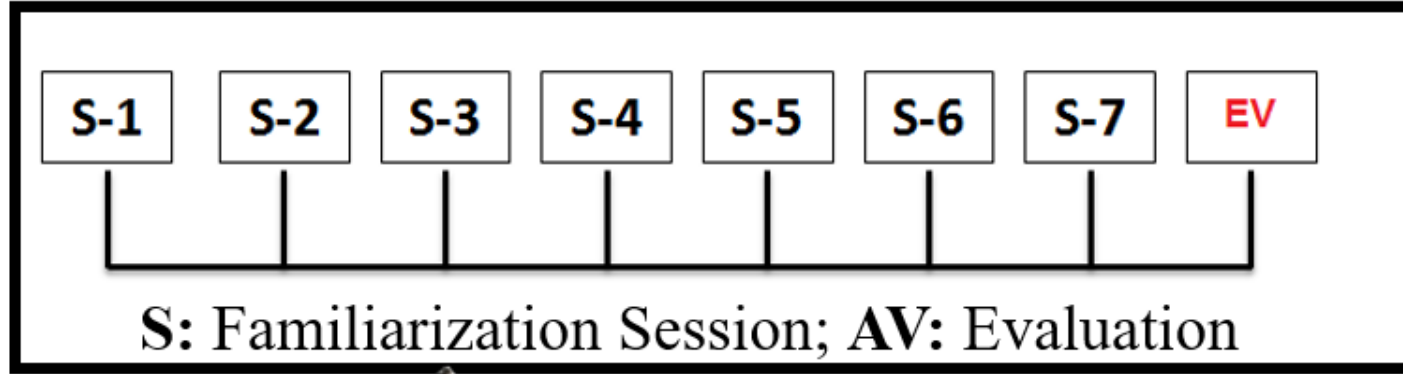
# Design Protocol

During the familiarization sessions and evaluation protocol it was necessary to calibrate the ergometer for each individual athlete, according to body weight





# Design Protocol



The familiarization session protocol consisted of two stages:

- 1º - Free paddling duration of 20 minutes, (KayakPro)
- 2º - Maximum performance simulation of a 200-meter race

# RESULTS



**The variables stroke frequency, speed and stroke index have been pointed out in the literature as significant indicators of efficiency.**



SF

The stroke frequency corresponds to the number of paddling cycles performed per minute and points to the intensity at which the athlete performed the test.

S

The efficiency of an athlete is associated with the ability to achieve the highest speed along with the highest energy saving during stroke cycles.

SI

The stroke index is the product of speed multiplied by stroke length (SL)—the distance covered by the canoe during a stroke cycle

# RESULTS

**Table 1:** Individual performance of athletes throughout the test (Mean  $\pm$  SD)

CAT	25 meters			100 meters			200 meters		
	SF	S	SI	SF	S	SI	SF	S	SI
KL1	127.5 ( $\pm$ 33.93)	14.21 ( $\pm$ 0.37)	6.90 ( $\pm$ 2.26)	154.8 ( $\pm$ 4.08)	16.64 ( $\pm$ 0.08)	8.77 ( $\pm$ 0.37)	155.08 ( $\pm$ 1.37)	15.47 ( $\pm$ 0.11)	7.62 ( $\pm$ 0.49)
KL2	123.58 ( $\pm$ 21.61)	13.97 ( $\pm$ 3.46)	7.52 ( $\pm$ 2.56)	134.83 ( $\pm$ 1.40)	17.07 ( $\pm$ 0.12)	9.99 ( $\pm$ 0.30)	126.09 ( $\pm$ 1.8)	16.05 ( $\pm$ 0.14)	9.49 ( $\pm$ 0.64)
KL3	158.33 ( $\pm$ 10.98)	19.39 ( $\pm$ 4.14)	10.76 ( $\pm$ 3.78)	157.54 ( $\pm$ 3.33)	20.88 ( $\pm$ 0.28)	12.85 ( $\pm$ 0.38)	146.45 ( $\pm$ 2.58)	18.62 ( $\pm$ 0.33)	11.00 ( $\pm$ 0.33)

**SF:** Stroke Frequency; **S:** Speed; **SI:** Stroke Index



Overlap of results between KL1 and KL2



Lower values when compared to KL3



KL1 and KL2 athletes have lower active muscle mass and less efficiency in paddling force transmission

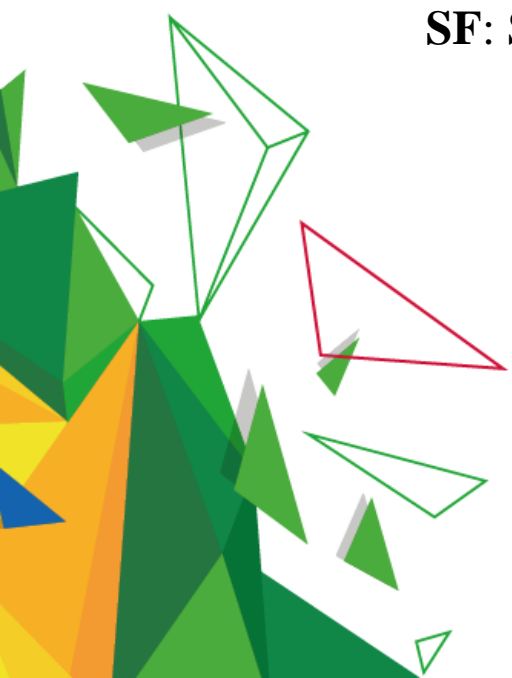


# RESULTS

**Table 1:** Individual performance of athletes throughout the test (Mean  $\pm$  SD)

CAT	25 meters			100 meters			200 meters		
	SF	S	SI	SF	S	SI	SF	S	SI
KL1	127.5 ( $\pm$ 33.93)	14.21 ( $\pm$ 0.37)	6.90 ( $\pm$ 2.26)	154.8 ( $\pm$ 4.08)	16.64 ( $\pm$ 0.08)	8.77 ( $\pm$ 0.37)	155.08 ( $\pm$ 1.37)	15.47 ( $\pm$ 0.11)	7.62 ( $\pm$ 0.49)
KL2	123.58 ( $\pm$ 21.61)	13.97 ( $\pm$ 3.46)	7.52 ( $\pm$ 2.56)	134.83 ( $\pm$ 1.40)	17.07 ( $\pm$ 0.12)	9.99 ( $\pm$ 0.30)	126.09 ( $\pm$ 1.8)	16.05 ( $\pm$ 0.14)	9.49 ( $\pm$ 0.64)
KL3	158.33 ( $\pm$ 10.98)	19.39 ( $\pm$ 4.14)	10.76 ( $\pm$ 3.78)	157.54 ( $\pm$ 3.33)	20.88 ( $\pm$ 0.28)	12.85 ( $\pm$ 0.38)	146.45 ( $\pm$ 2.58)	18.62 ( $\pm$ 0.33)	11.00 ( $\pm$ 0.33)

**SF:** Stroke Frequency; **S:** Speed; **SI:** Stroke Index



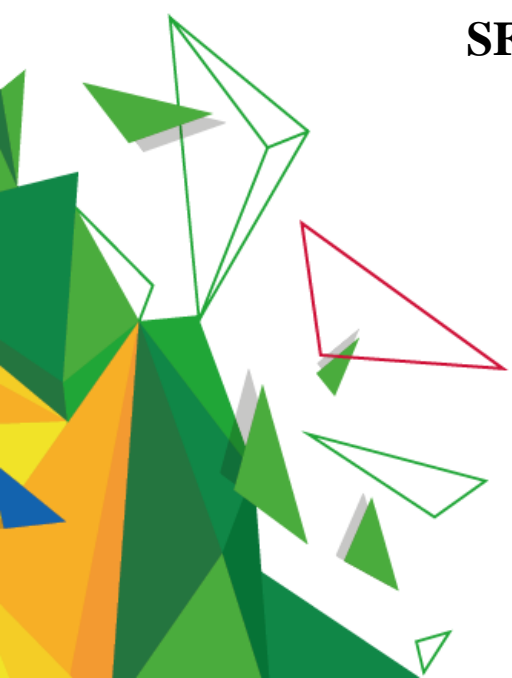
- ➡ Approximation between KL1 and KL3 in terms of stroke frequency
- ➡ A decrease of that same variable for the KL2 and KL3 athletes
- ➡ The KL1 athlete maintains a constant increase in stroke frequency until the 150-meter mark
- ➡ The overall performance of the KL1 athlete is lower than that of the KL3 athlete.

# RESULTS

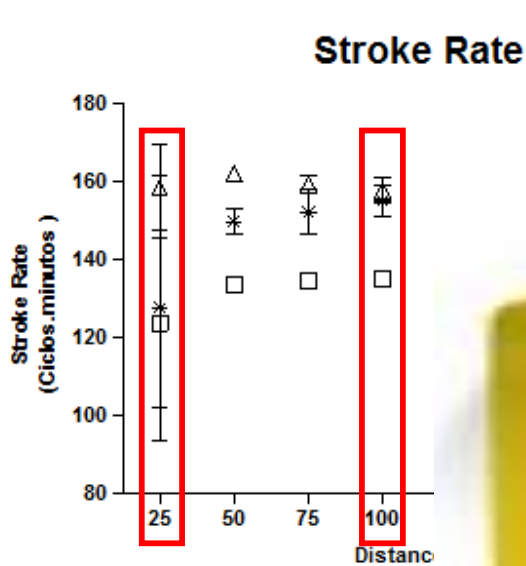
**Table 1:** Individual performance of athletes throughout the test (Mean  $\pm$  SD)

CAT	25 meters			100 meters			200 meters		
	SF	S	SI	SF	S	SI	SF	S	SI
KL1	127.5 ( $\pm$ 33.93)	14.21 ( $\pm$ 0.37)	6.90 ( $\pm$ 2.26)	154.8 ( $\pm$ 4.08)	16.64 ( $\pm$ 0.08)	8.77 ( $\pm$ 0.37)	155.08 ( $\pm$ 1.37)	15.47 ( $\pm$ 0.11)	7.62 ( $\pm$ 0.49)
KL2	123.58 ( $\pm$ 21.61)	13.97 ( $\pm$ 3.46)	7.52 ( $\pm$ 2.56)	134.83 ( $\pm$ 1.40)	17.07 ( $\pm$ 0.12)	9.99 ( $\pm$ 0.30)	126.09 ( $\pm$ 1.8)	16.05 ( $\pm$ 0.14)	9.49 ( $\pm$ 0.64)
KL3	158.33 ( $\pm$ 10.98)	19.39 ( $\pm$ 4.14)	10.76 ( $\pm$ 3.78)	157.54 ( $\pm$ 3.33)	20.88 ( $\pm$ 0.28)	12.85 ( $\pm$ 0.38)	146.45 ( $\pm$ 2.58)	18.62 ( $\pm$ 0.33)	11.00 ( $\pm$ 0.33)

**SF:** Stroke Frequency; **S:** Speed; **SI:** Stroke Index

- 
- ➔ There was no overlap of results between the categories
  - ➔ The athlete belonging to KL3 presented the highest SI efficiency, followed by the KL2 and KL1 athletes, respectively.
  - ➔ The athlete who performed the least number of strokes and had the longest stroke length (KL3) also obtained the highest SI; the athlete who performed the highest number of strokes and had the lowest stroke length (KL1) obtained the lowest SI

# RESULTS

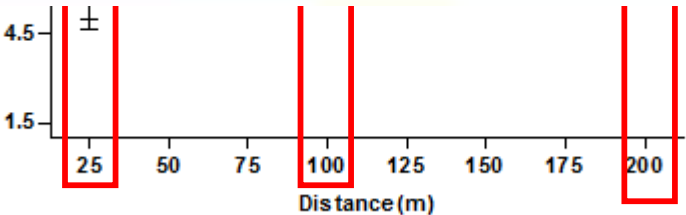


## Speed

25

The **COACH** must understand the relationship between stroke frequency and speed, as well as the direct influence of SI. And to identify the efficiency of the athlete's technique.

- \* S\_KH\_KL1
- S\_KH\_KL2
- △ S\_KH\_KL3





# CONCLUSION

Results found in this study in respect to stroke frequency, mean speed and stroke index, show the different characteristics of paracanoe races which,

when analyzed according to each category, indicate the need for specific training adaptations

# CONCLUSION

The coach will have tools to better monitor the training

coach can develop an individualized session



COMITÊ PARALÍMPICO  
BRASILEIRO







# Obrigado!

[luiz.gustavo@cpb.org.br](mailto:luiz.gustavo@cpb.org.br)  
[leonardo.maiola@canoagem.org.br](mailto:leonardo.maiola@canoagem.org.br)