INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

INDICATORS OF EXERCISE LOAD

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INDICATORS OF EXERCISE LOAD

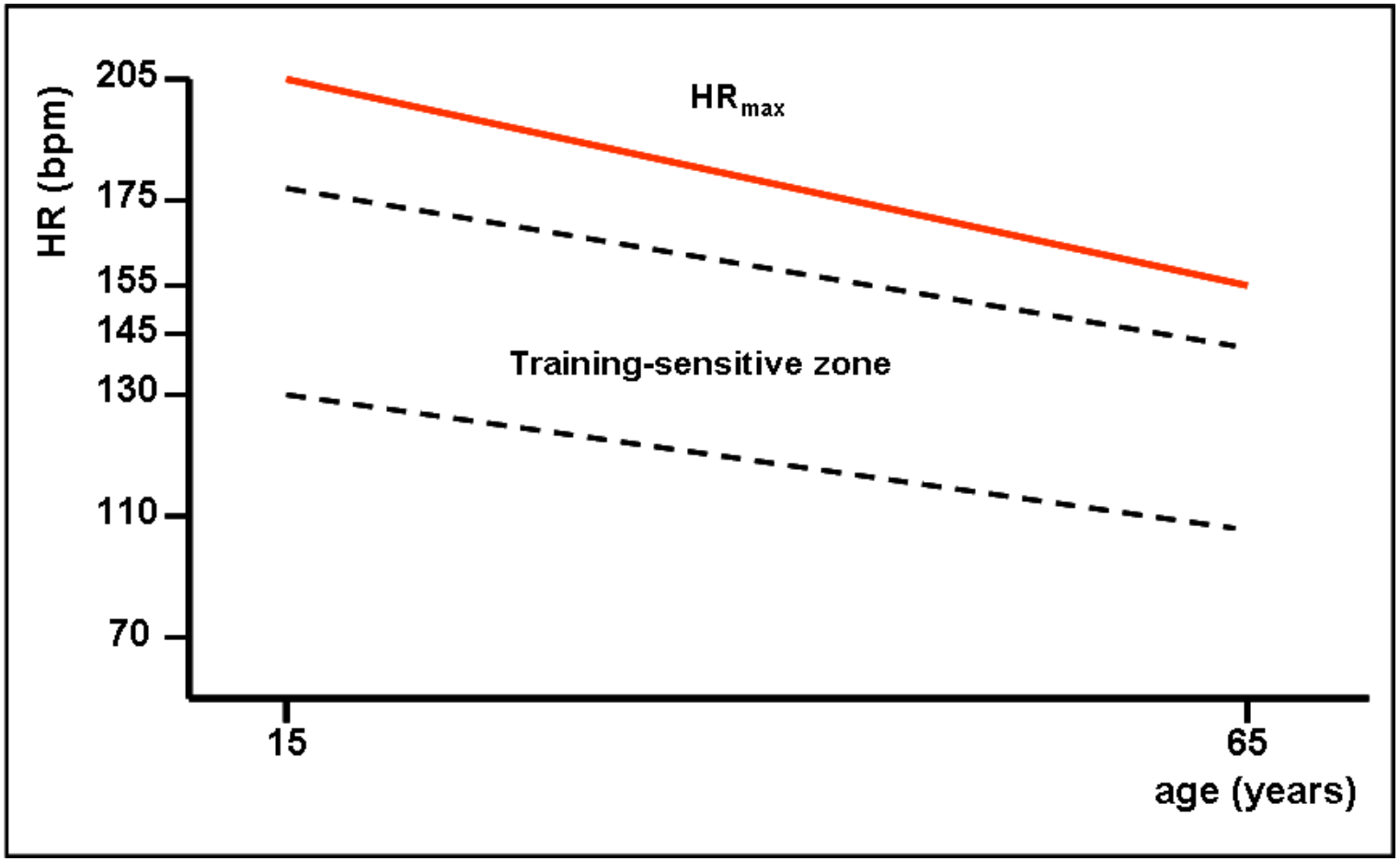
- Indicators of exercise load provide information on the condition of organism during training activity
- They are sensitive to changes in the size of load

- Heart Rate (HR, beat/min)
- Maximal oxygen consumption (VO_2max, ml/kg/min)
- Aerobic capacity (% VO_2max)
- Lactate (lactic acid, mmol/l)
- Respiratory exchange ratio (RER)

HEART RATE

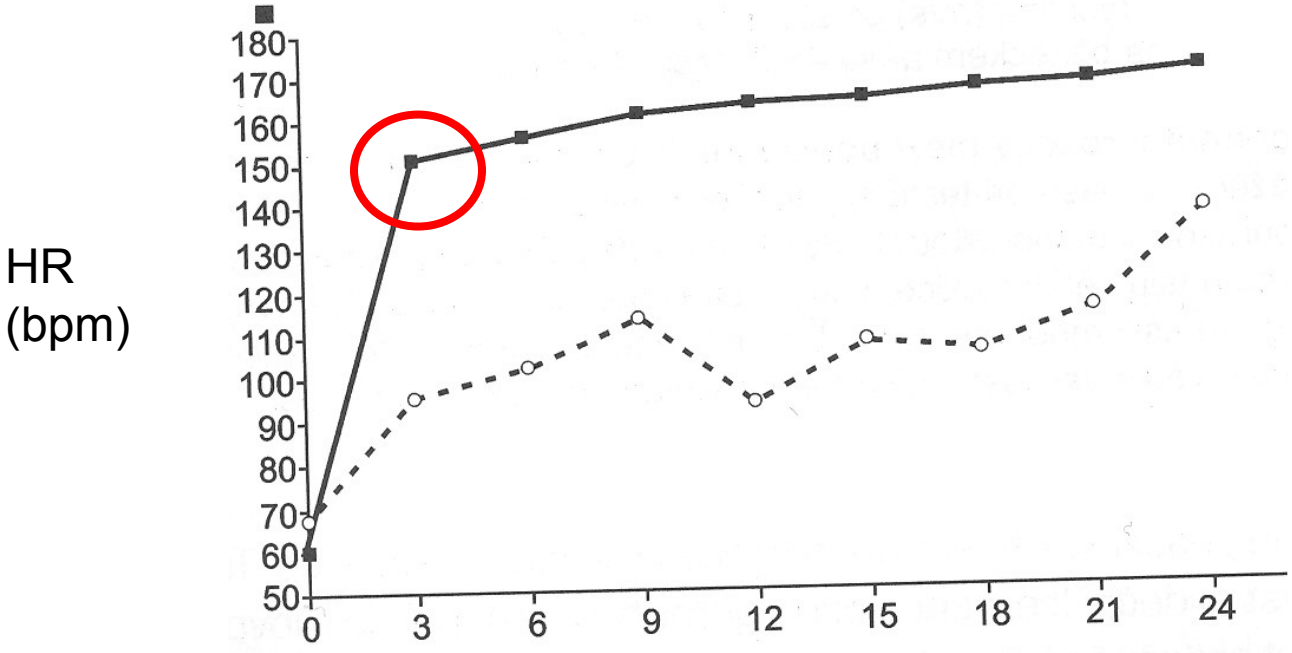
- Maximal heart rate lowers generally with age.

HRmax = 220-age ± 15 beats/min



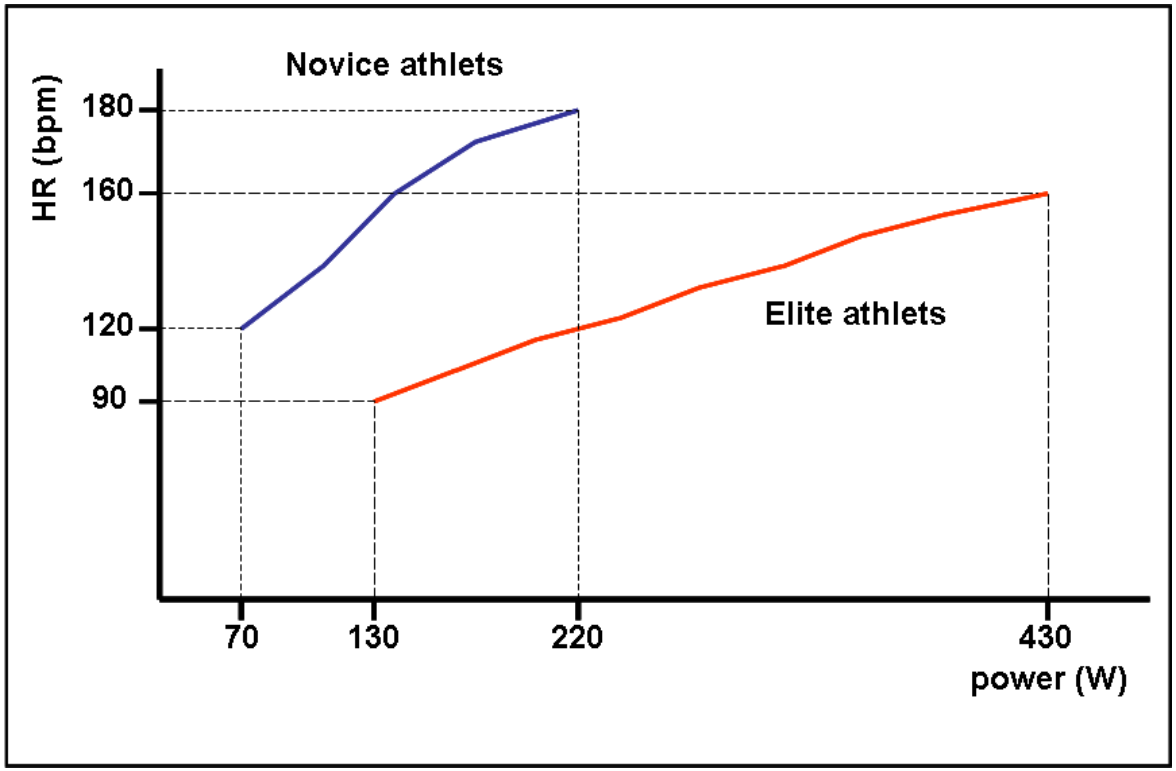
HEART RATE

- Heart rate increased to the highest level individually and then rises only slowly with the same load



HEART RATE

- Elite athlets have slower increase in heart rate

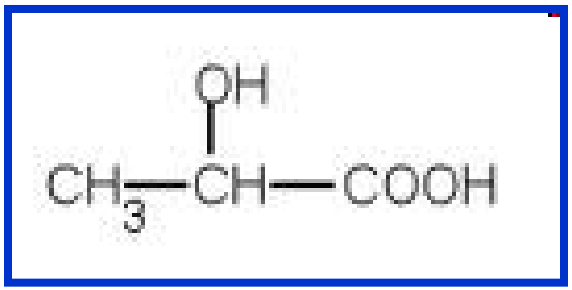


Untrained at rest: 70 bpm

Trained at rest: 30 bpm

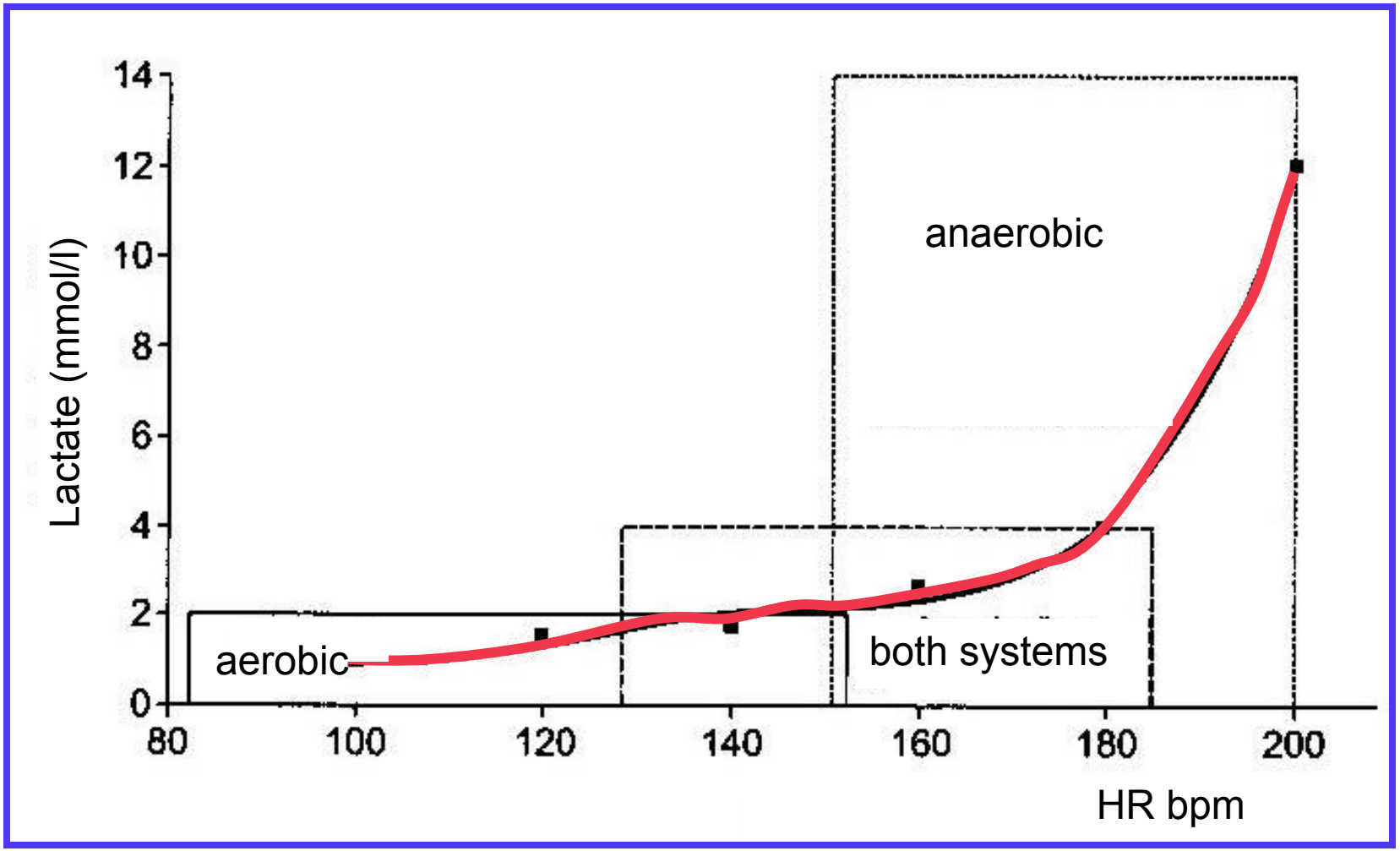
- Women have a higher HR than men with the same load
- Children have a higher HR than adults
- As a result of long-term and systematic loading, the heart chambers get larger and the strength of myocardium gets better.

LACTATE (Lactic acid)



- In human body, lactate is constantly present in the concentration of 0.5-2.2 mmol/l
- Lactate is a substrate for glycolysis required
- When lactate appears, it is always a sign of overload of aerobic energy repletion and the start of anaerobic metabolism
- Surplus appears with motor activities of maximum or sabmaximum intensity
- Surplus lactate in the blood is always related to anaerobic processes

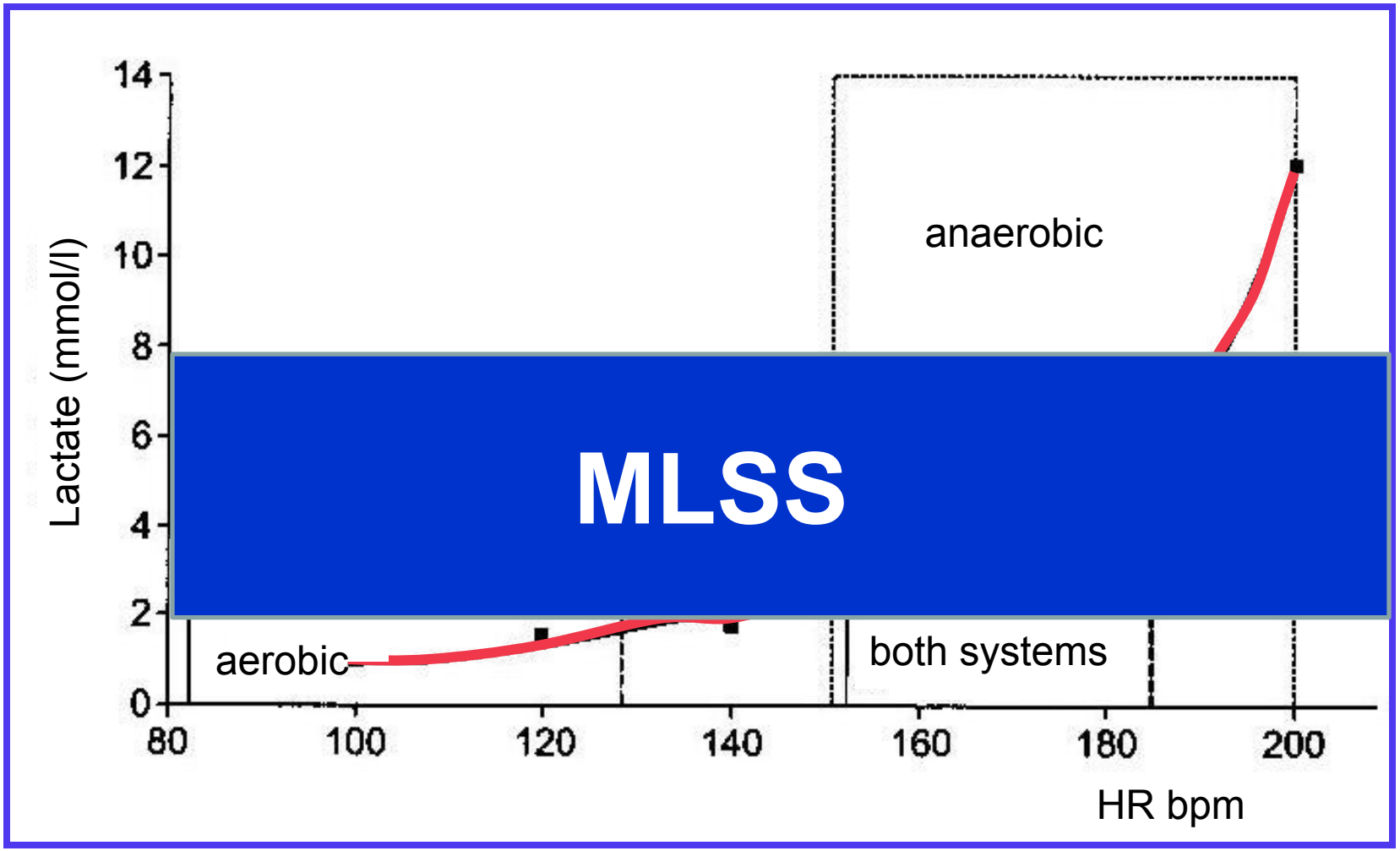
The increase in lactate levels during increasing exercise load intensity



According to the amount of lactate in blood and depending on the intensity of motor activity, the dominant system of energy repletion can be estimated:

Aerobic exercise load	<2mmol/l
Aerobic- anaerobic exercise load	3 – 7 mmol/l
anaerobic exercise load	>7 mmol/l

Maximal lactate steady state (MLSS)



- The exercise intensity or relative intensity at which blood lactate begins an abrupt increase above the baseline concentration has been termed **the lactate threshold (LT)**

- **Maximal lacatate steady state** (MLSS)

  (concentration between 2 - 8 mmol/l)

- Important starting point for the preparation of sports training

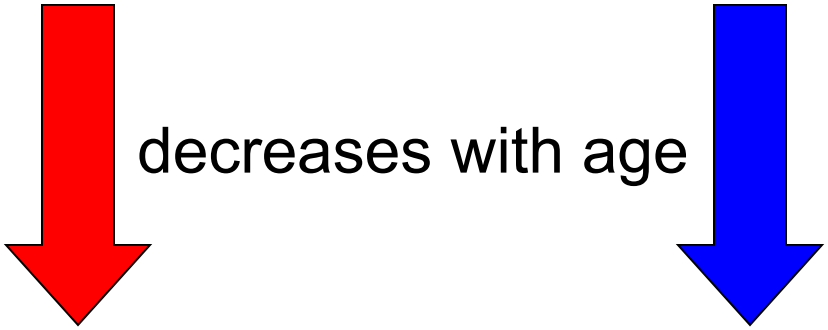
Aerobic performance

Maximal oxygen consumption (VO_{2max}) represents the ability of the organism to receive oxygen, transport and use it (ml/kg/min)

Untrained (20 years): men 45 ml/kg/min

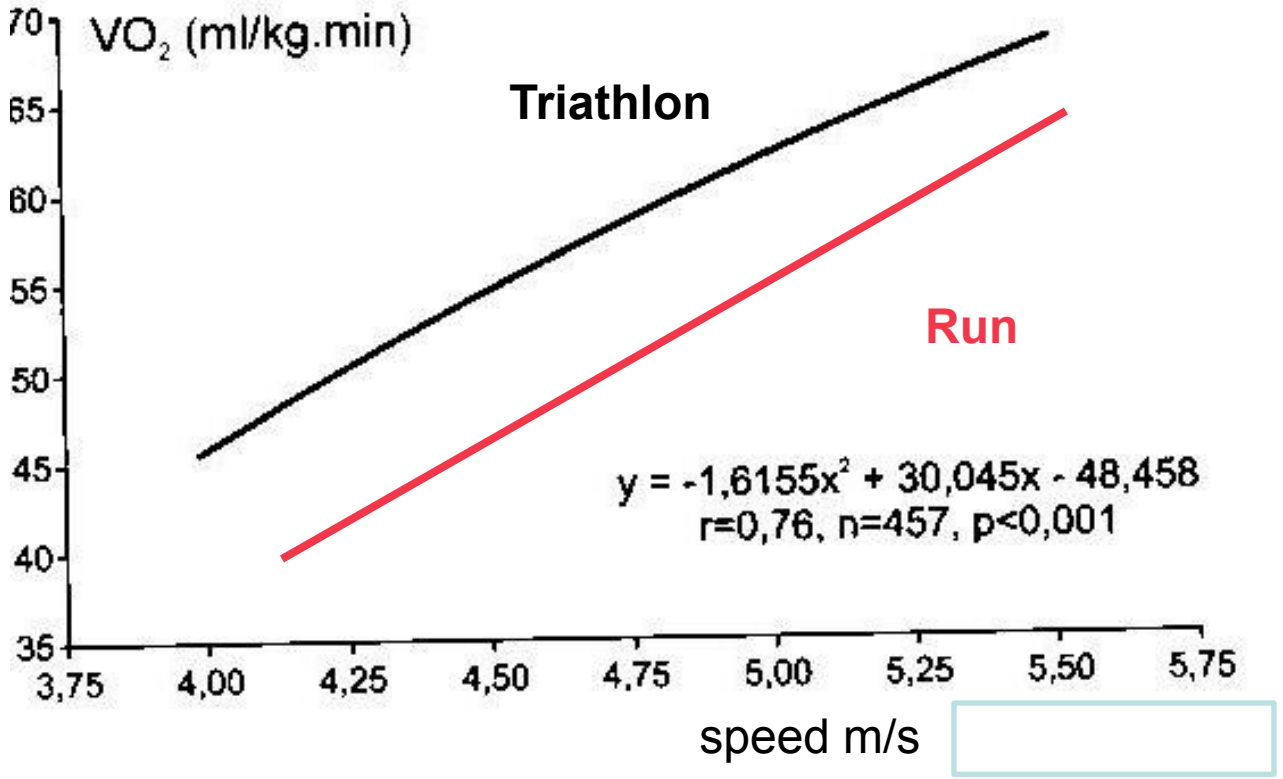
women 35 ml/kg/min

Trained: until 90 ml/kg/min (cross country skiing)



Aerobic capacity

Aerobic capacity(% VO_{2max}) expresses what share of maximal oxygen consumption is used for aerobic energy repletion (until 2 mmol/l of lactate)



Lower oxygen consumption = better economy of movement

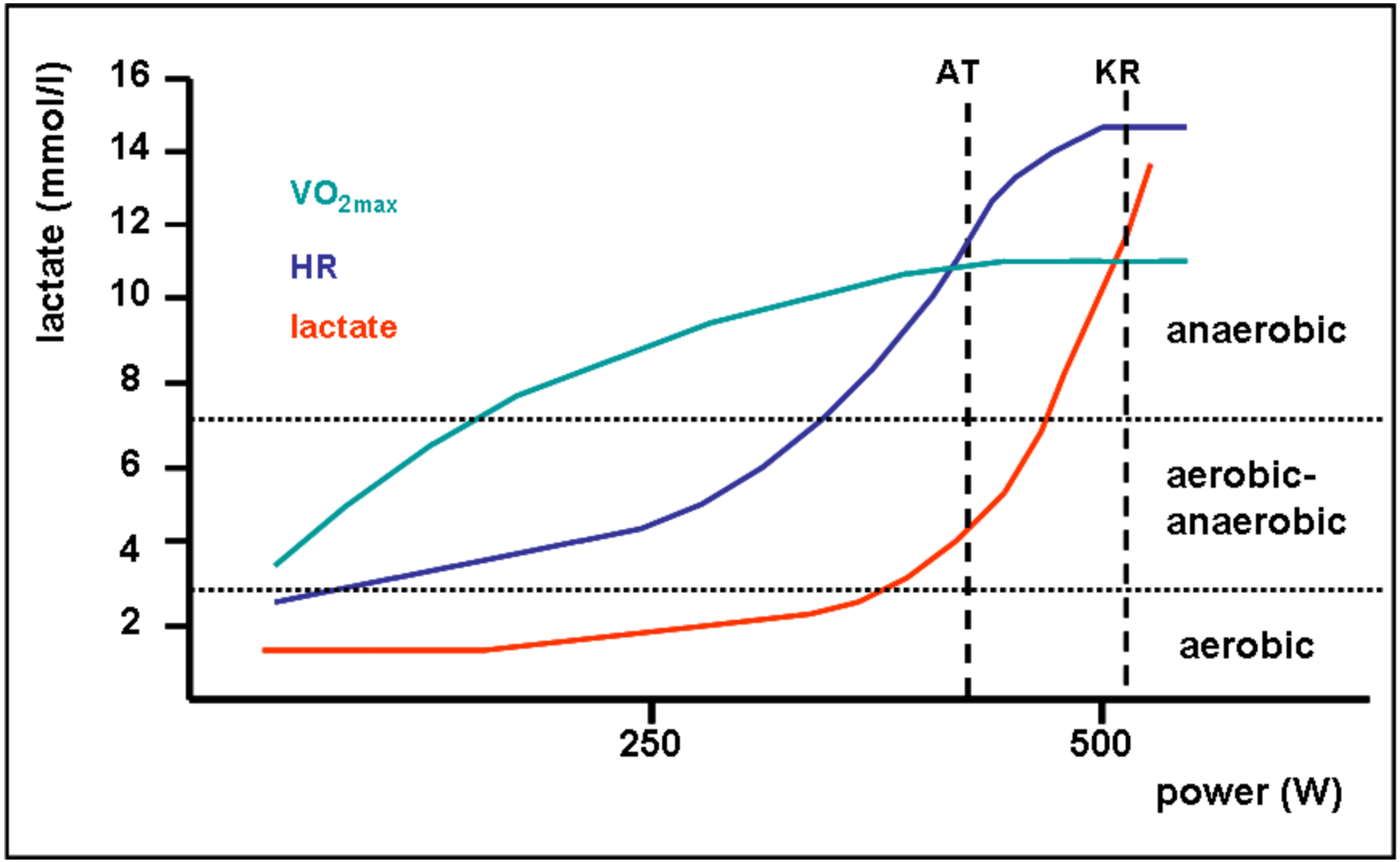
Respirační kvocient

- The most important factor limiting the performance of the energy supply and oxygen consumption
- The ration of eliminating carbon dioxide (CO_2) and oxygen intake (O_2) makes **respiratory exchange ratio (RER).**

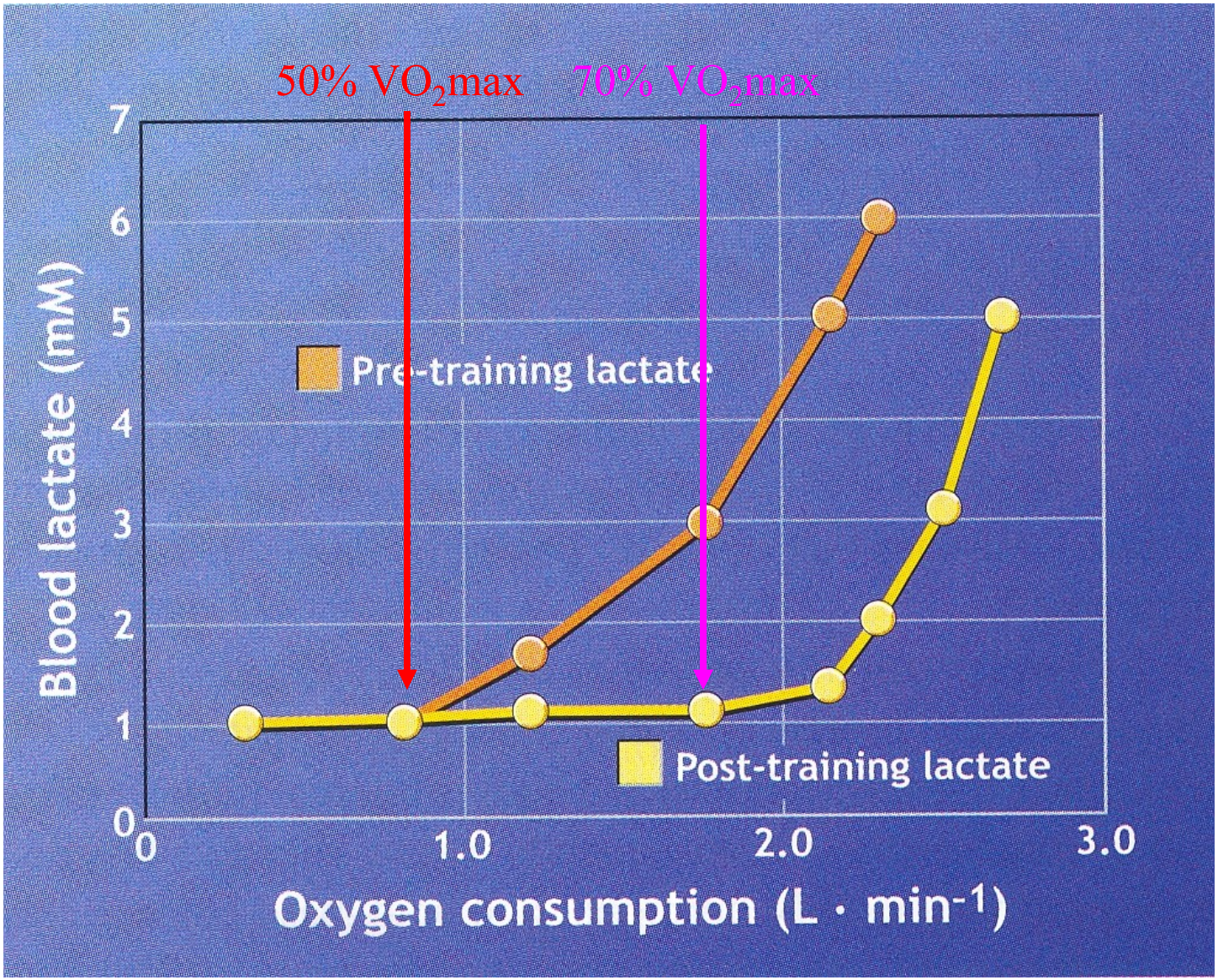
RER	Metabolismus
1,0	**Carbohydrates**
0,9	**Carbohydrates - fats**
0,8	**Fats – carbohydrates**
0,7	**Fats**

Dynamics of indicators of load

Dynamics HR, VO_{2max} and Lactate during exercise load

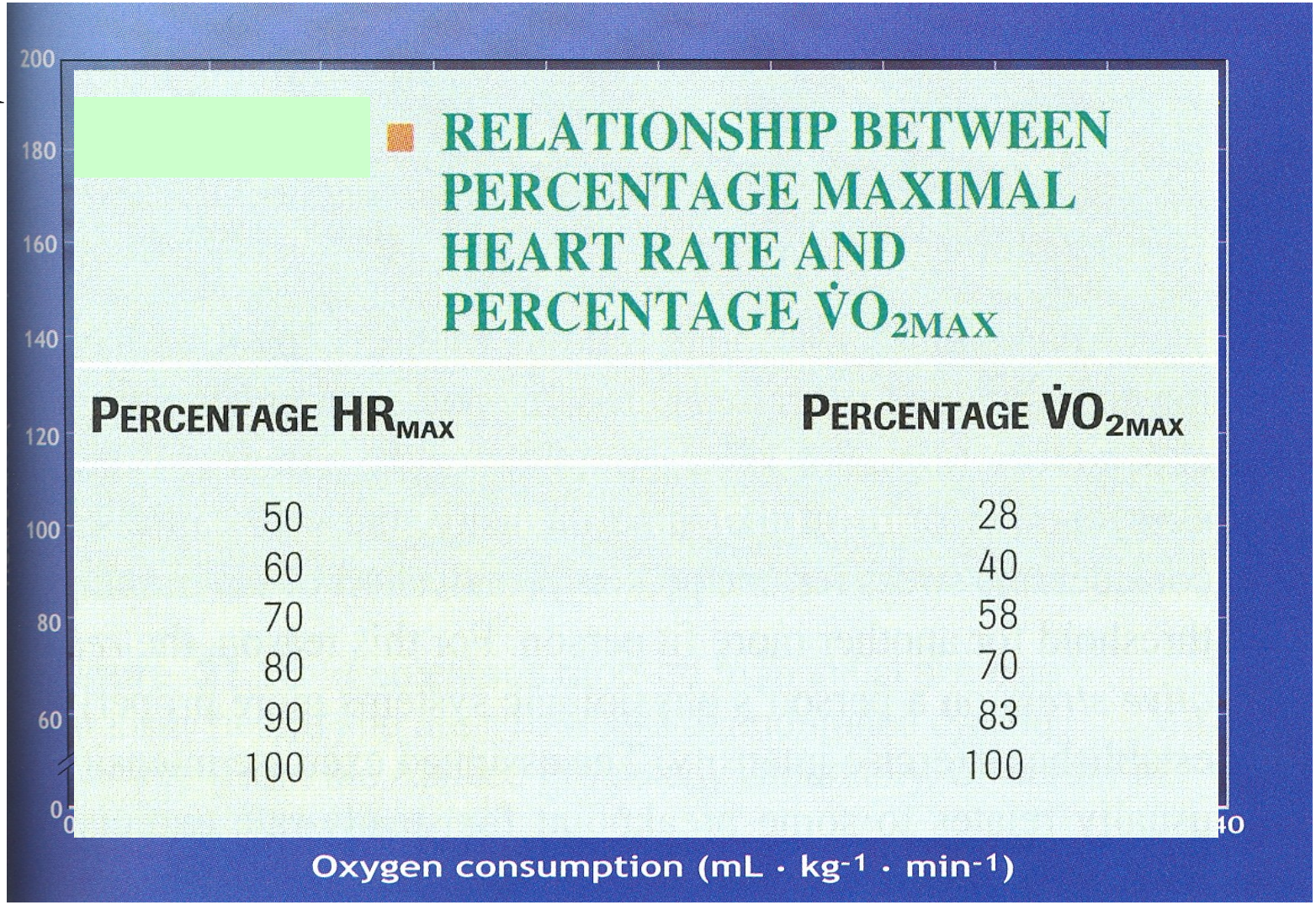


The difference between trained and untrained athletes



Relationship between heart rate and oxygen compsumtion

HR



Spiroergometry

Parameter	Unit	Rest	AT	AT % Pred	AT % MAX	MAX	MAX % Pred	Pred.
Time	sec	0:00 - 3:04	6:46	-	-	9:58 - 10:31	-	-
Speed	km/h	6.7	11.0	-	100	11.0	-	-
Elev	%	0.0	8.0	-	53	15.0	-	-
Load	W	101	373	149	70	531	212	251
load/kg	W/kg	0.00	0.00	-	0	-	-	-
HR	beats/min	119	176	92	93	190	99	191
O_2Pulse	100ml/(beat*kg)	18.3	29.7	140	97	30.5	144	21.2
Vo_2	l/min	1.90	4.51	137	90	4.99	151	3.30
Vo_2/kg	ml/(kg*min)	22.1	52.4	125	90	58.1	138	42.1
RER	-	0.70	0.92	79	86	1.07	92	1.07 - 1.25
V_E	l/min	36	101	79	75	135	106	128
BR	l/min	129.6	65.0	-	212	30.7	-	> 15.0

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Thank you for your attention