LH + TH: Use of Natural/Terrestrial Altitude by Kenyan Distance Runners

I INTERNATIONAL SYMPOSIUM OF ALTITUDE TRAINING

CAR Sierra Nevada
Granada, SPAIN
February 14-16, 2008

Randall L. Wilber, Ph.D., FACSM
Athlete Performance Laboratory
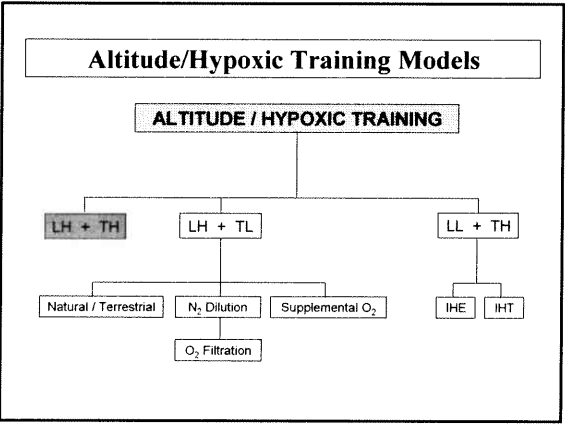United States Olympic Committee
Colorado Springs, CO, USA

Slide 1

Muchas gracias !
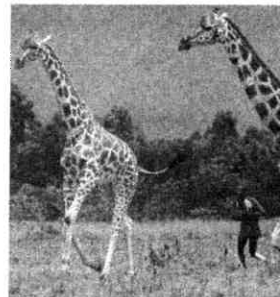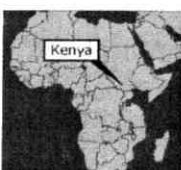
Dr. Jukka Lahtinen
Dr. Carmen Calderon Soto

Slide 2

LH + TH: Use of Natural/Terrestrial Altitude Training by Kenyan Distance Runners

- Background

- Reasons for Success

- Summary

Slide 3

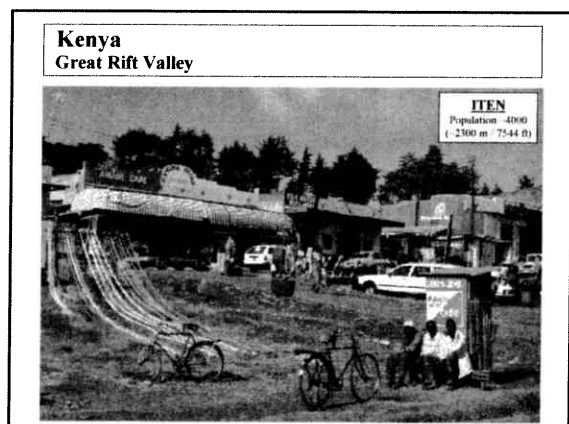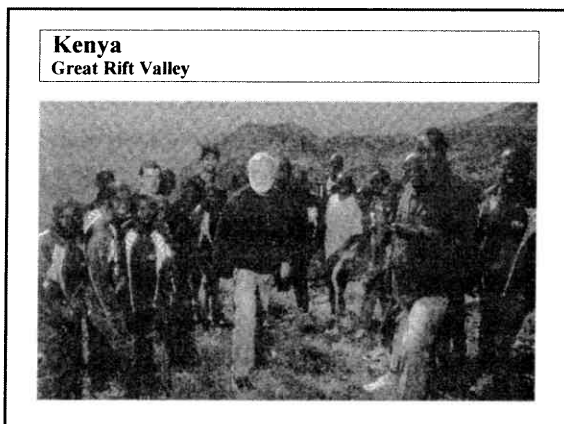**Altitude/Hypoxic Training Models**

ALTITUDE / HYPOXIC TRAINING

- LH + TH
  - Natural / Terrestrial
  - N_2 Dilution
    - O_2 Filtration
  - Supplemental O_2
- LH + TL
- LL + TH
  - IHE
  - IHT

Slide 4

Kenya
LH + TH

Slide 5

TOKYO 1964
800 m

Wilson Kiprugut

TOKYO 1964

Slide 6

MEXICO CITY 1968
(2300 m / 7544 ft)

				1968 WORLD RECORD
800 m	Doubell (AUS)	Kiprugut (KEN)	Farrell (USA)	
	1:44.3 = WR	1:44.5	1:45.4	1:44.3
1500 m	Keino (KEN)	Ryun (USA)	Tummler (GER)	
	3:34.9 OR	3:37.8	3:39.0	3:33.1
3000 m St	Biwott (KEN)	Kogo (KEN)	Young (USA)	
	8:51.0	8:51.6	8:51.8	8:24.2
5000 m	Gammoudi (TUN)	Keino (KEN)	Temu (KEN)	
	14:05.0	14:05.2	14:06.4	13:16.6
10,000 m	Temu (KEN)	Wolde (ETH)	Gammoudi (TUN)	
	29:27.4	29:28.0	29:34.2	27:39.4
Marathon	Wolde (ETH)	Kimihara (JPN)	Ryan (NZ)	
	2:20:26	2:23:31	2:23:45	2:09:36

MEXICO CITY 1968
(2300 m / 7544 ft)

Ben Jipcho

Kip Keino

Ron Clarke

Naftali Temu

Percentage of medals won by Kenyan and Ethiopian male athletes in distance running events (800 m - Marathon) in the Olympic Games since 1968

Kenya
Great Rift Valley

KENYA

Kenya
Great Rift Valley

~ 2300 m / 7544 ft

~ 1000 m / 3280 ft

Kenya
Great Rift Valley

Kenya
Great Rift Valley

ITEN
Population ~4000
(~2300 m / 7544 ft)

Kenya
Great Rift Valley

Kenya
Great Rift Valley

Kenya
Great Rift Valley

January 2008

WELLS FA

Wesley Ngetich

Simeon Kipkemboi   Paul Ereng   Lucas Sang

LH + TH: Use of Natural/Terrestrial Altitude Training by Kenyan Distance Runners

- Background

⇒ ■ Reasons for Success

- Summary

Kenya
Reasons for Success

- Development of a high VO_{2max} as a result of extensive walking and running at an early age
-
-
-
-
-
-
-

Kenya
Reasons for Success: VO_{2max}

- Kenyatta University students (n=87) ♂♀
- National caliber Kenyan runners (n=307) ♂♀
- International caliber Kenyan runners (n=97) ♂♀

JOURNAL
SPORTS
SCIENCES
Onyrea et al. 24:419-422, 2006

Method of travel to school ≥ 5km (%)

■ Run
■ Walk
■ Transport

Control   National Runner   International Runner

Kenya
Reasons for Success: VO_{2max}

Kenya
Reasons for Success: VO_{2max}

Kenya
Reasons for Success: VO_{2max}

- Kenyan male elite distance runners (n=6) ♂
- Scandinavian male elite distance runners (n=6) ♂
- Evaluated at sea level and 2000 m / 6560 ft

Kenya
Reasons for Success

- Development of a high VO_{2max} as a result of extensive walking and running at an early age
- Development of good metabolic "economy/efficiency" based on body shape and long, slender legs
- Unique viscoelastic property of the Achilles tendon and m. triceps surae that promotes superior running biomechanics and "economy"

Kenya
Reasons for Success: Economy / Efficiency

Larsen et al.

Body dimensions, exercise capacity and Physical activity of adolescent Nandi boys in western Kenya.

Ann. Hum. Biol. 31: 159-173, 2004.

Kenyan runners had longer legs (5%) vs. Scandinavian runners

Kenyan runners had thinner/lighter calves (400g less; 12%) vs. Scandinavian runners
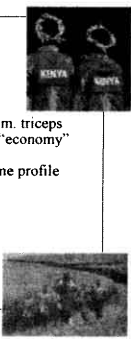
Kenya
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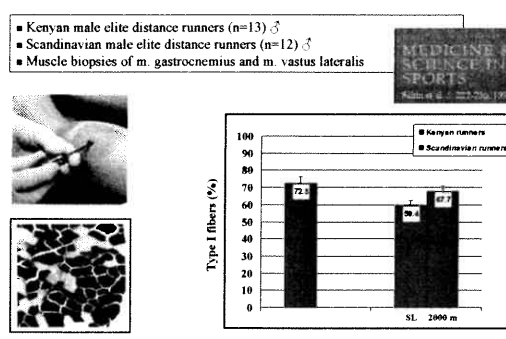- Evaluated at sea level and 2000 m / 6560 ft

Scandinavian
Kenyan

Kenya
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- Favorable muscle fiber composition and oxidative enzyme profile

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Kenya
Reasons for Success: Skeletal Muscle Fiber Composition

- Kenyan male elite distance runners (n=13) ♂
- Scandinavian male elite distance runners (n=12) ♂
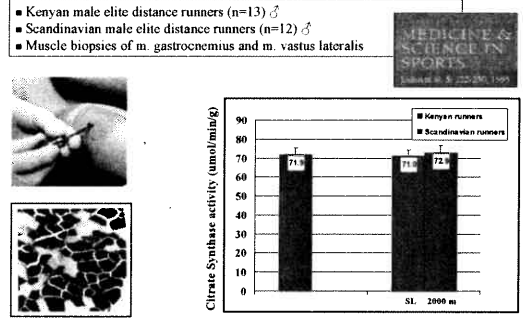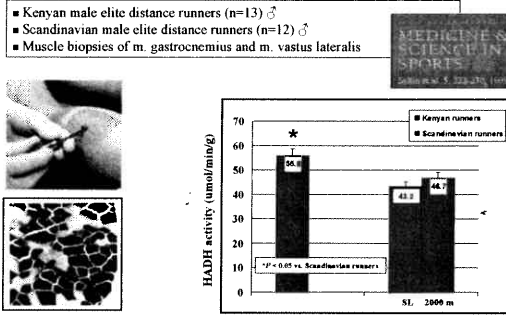- Muscle biopsies of m. gastrocnemius and m. vastus lateralis

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Kenya
Reasons for Success: Oxidative Enzyme Profile

- Kenyan male elite distance runners (n=13) ♂
- Scandinavian male elite distance runners (n=12) ♂
- Muscle biopsies of m. gastrocnemius and m. vastus lateralis

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Kenya
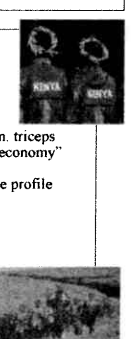**Reasons for Success: Oxidative Enzyme Profile**

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- Scandinavian male elite distance runners (n=12) ♂
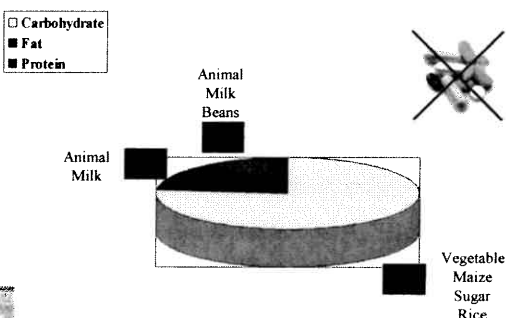- Muscle biopsies of m. gastrocnemius and m. vastus lateralis

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- Favorable muscle fiber composition and oxidative enzyme profile

- Traditional Kenyan diet

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Kenya
Reasons for Success: Diet

- □ Carbohydrate
- ■ Fat
- ■ Protein

Animal Milk Beans

Animal Milk

Vegetable Maize Sugar Rice

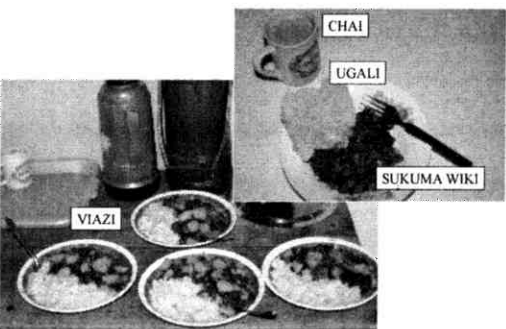Onywera et al. IJSNEM, 14: 709-719, 2004

Kenya
Reasons for Success: Diet

CHAI
Black tea
Cream
Sugar

Kenya
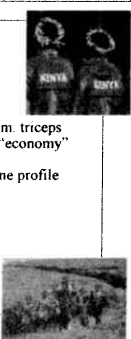Reasons for Success: Diet

UGALI

Kenya
Reasons for Success: Diet

CHAI
UGALI
SUKUMA WIKI
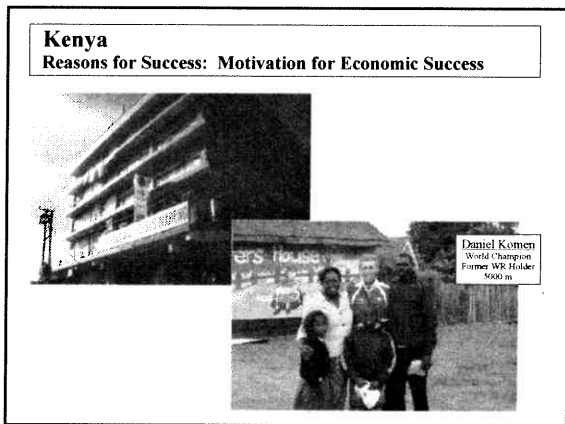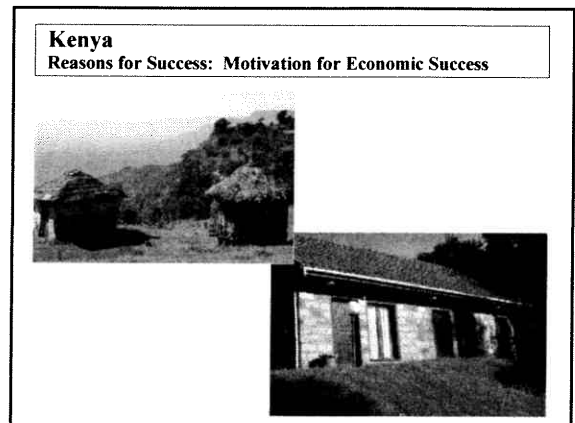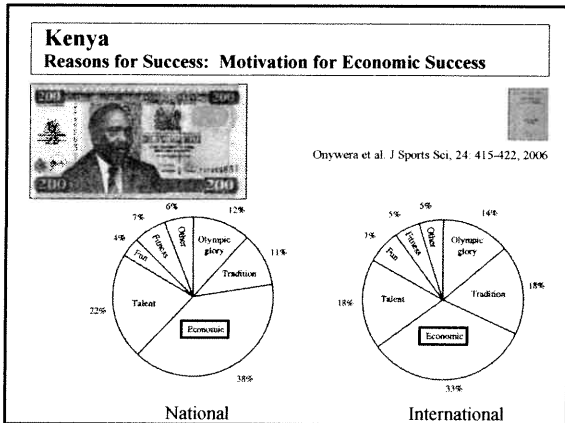VIAZI

Kenya
Reasons for Success: Diet

Kenya
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- Favorable muscle fiber composition and oxidative enzyme profile
- Traditional Kenyan diet
- Motivation for economic success
-
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Kenya
Reasons for Success: Motivation for Economic Success

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Kenya
Reasons for Success: Motivation for Economic Success

Onywera et al. J Sports Sci, 24: 415–422, 2006

National International

Kenya
Reasons for Success: Motivation for Economic Success

Kenya
Reasons for Success: Motivation for Economic Success

Daniel Komen
World Champion
Former WR Holder
3000 m

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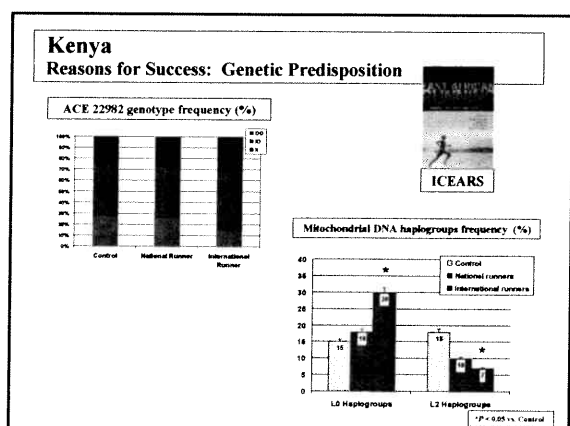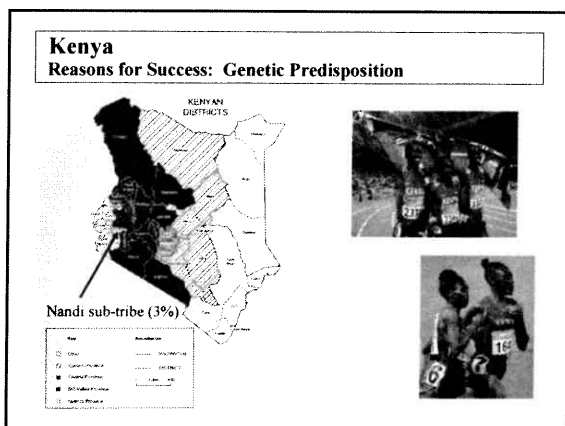- Traditional Kenyan diet
- Motivation for economic success
- Genetic predisposition

Kenya
Reasons for Success: Genetic Predisposition

KENYAN DISTRICTS

Nandi sub-tribe (3%)

Kenya
Reasons for Success: Genetic Predisposition

ACE 22982 genotype frequency (%)

Control National Runner International Runner

ICEARS

Mitochondrial DNA haplogroups frequency (%)

L0 Haplogroups L2 Haplogroups

*P < 0.05 vs Control

7

Kenya
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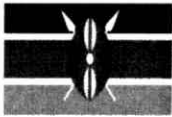- Genetic predisposition
- Living (for millennia) and training at altitude

Kenya
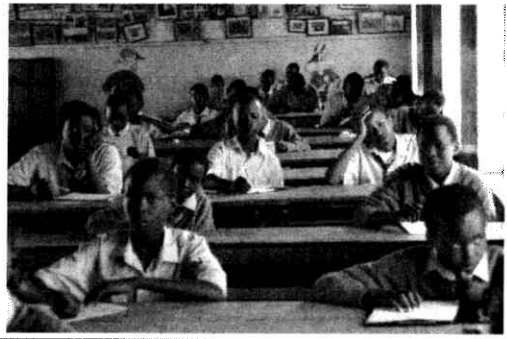**Reasons for Success: LH + TH**

Schools

Tradition of Excellence

Kenya
Reasons for Success: LH + TH

Brother Colm O'Connell

Kenya
Reasons for Success: LH + TH

Kenya
Reasons for Success: LH + TH

Kenya
Reasons for Success: LH + TH

Kenya
Reasons for Success: LH + TH

Kenya
Reasons for Success: LH + TH

Coach Byronne Kipchumba

Kenya
Reasons for Success: LH + TH

Training Camps

Kenya
Reasons for Success: LH + TH

KIMBIA / New Balance
Camp

Kenya
Reasons for Success: LH + TH

Kenya
Reasons for Success: LH + TH

Kenya
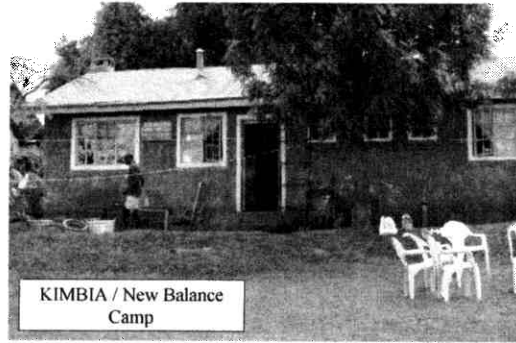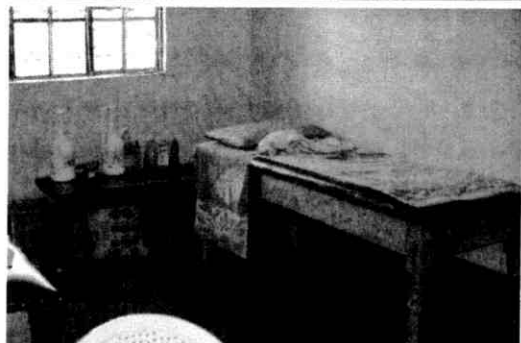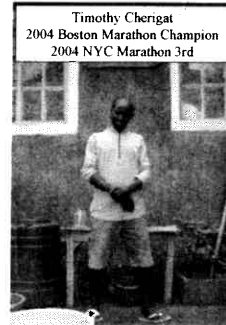Reasons for Success: LH + TH

Kenya
Reasons for Success: LH + TH

Timothy Cherigat
2004 Boston Marathon Champion
2004 NYC Marathon 3rd

Honour roll

Kenya
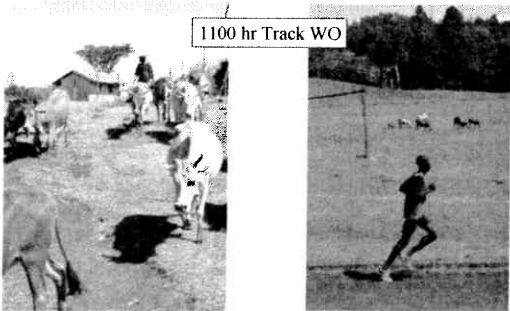Reasons for Success: LH + TH

Training

Kenya
Reasons for Success: LH + TH

0600 hr Run
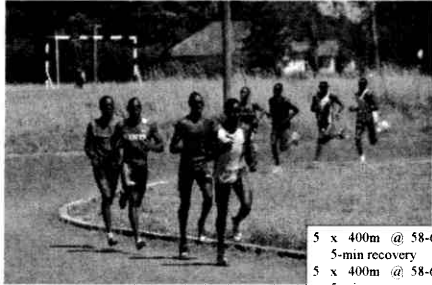

Kenya
Reasons for Success: LH + TH

1100 hr Track WO

Kenya
Reasons for Success: LH + TH
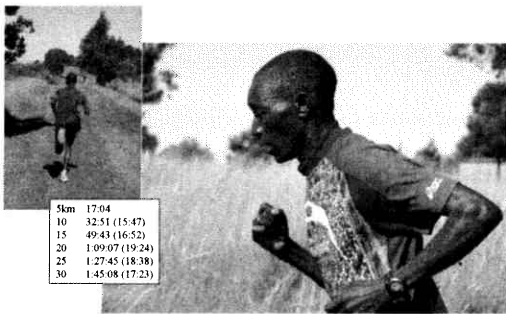
10

Kenya
Reasons for Success: LH + TH

5 x 400m @ 58-60s on 30s
5-min recovery
5 x 400m @ 58-60s on 30s
5-min recovery
5 x 400m @ 58-60s on 30s

Kenya
Reasons for Success: LH + TH

1700 hr Road WO

Kenya
Reasons for Success: LH + TH

5km	17:04
10	32:51 (15:47)
15	49:43 (16:52)
20	1:09:07 (19:24)
25	1:27:45 (18:38)
30	1:45:08 (17:23)

Kenya
Reasons for Success: LH + TH

Table 6.8 Weekly Training Schedule for Kenyan Runners at St. Patrick's High School

Kenya
Reasons for Success: LH + TH

	A	B
10km best time	28:15	28:54
Total weekly distance (km)	158	174
Weekly distance run at vLT (km)	10.8	25.4
Weekly distance run at vLT (% Total)	6.9	14.4
Weekly distance run at vVO_{2max} (km)	7.8	0
Weekly distance run at vVO_{2max} (% Total)	5.0	0

Billat el al. MSSE, 35: 297-304, 2003

Kenya
Reasons for Success: LH + TH

Train Hard !   Win Easy

- "Our success is based on attitude, not altitude" ... Coach Mike Kosgei
- "There are no races in Europe as hard as the tempo runs we do here!" ... Julius Korir
- "Tempo training is practicing the pain we will face in competition; who wants to run slow in competition?" ... Julius Ondieki
- "Don't waste good training time – if you feel good then run hard!" ... John Ngugi

Slide 1:

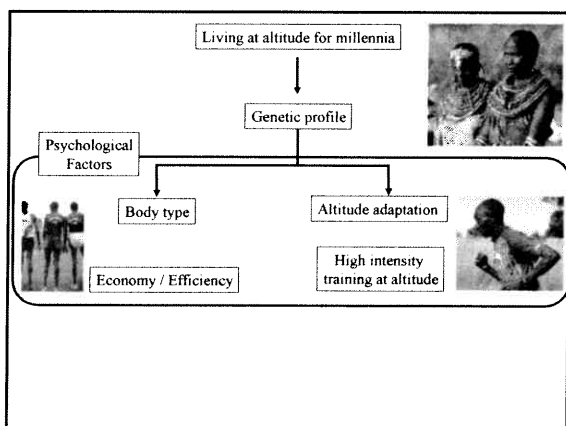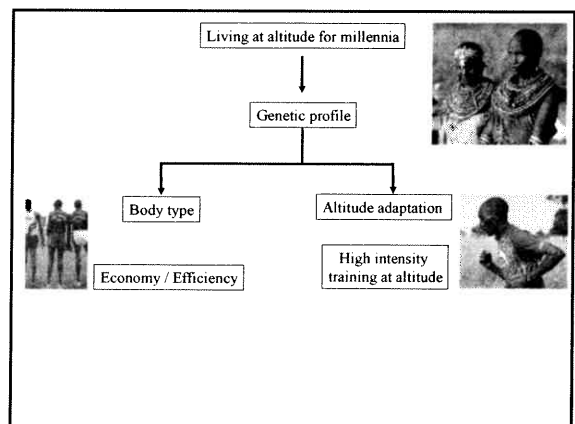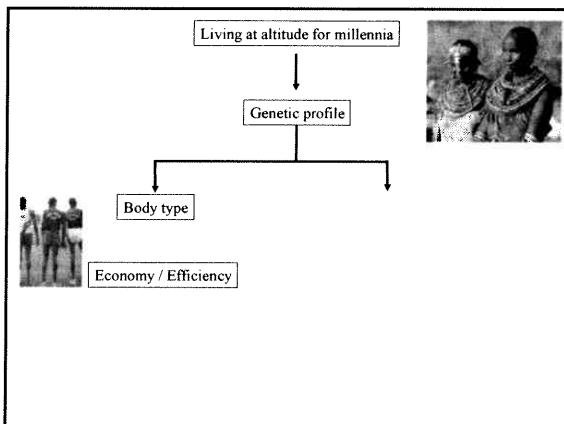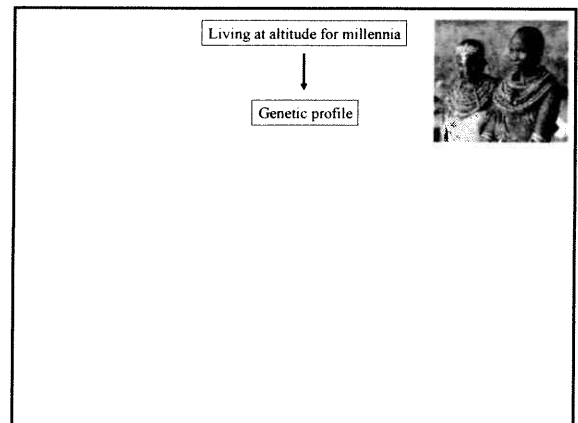**LH + TH: Use of Natural/Terrestrial Altitude Training by Kenyan Distance Runners**

- Background
- Reasons for Success
⇨ - Summary

Slide 2:

Living at altitude for millennia → Genetic profile

Slide 3:

Living at altitude for millennia → Genetic profile → Body type → Economy / Efficiency

Slide 4:

Living at altitude for millennia → Genetic profile → Body type, Economy / Efficiency, Altitude adaptation, High intensity training at altitude

Slide 5:

Living at altitude for millennia → Genetic profile → Body type, Economy / Efficiency, Altitude adaptation, High intensity training at altitude; Psychological Factors

Slide 6:

Living at altitude for millennia → Genetic profile → Body type, Economy / Efficiency, Altitude adaptation, High intensity training at altitude; Psychological Factors → ENDURANCE PERFORMANCE

Muchas gracias !