Prospects of local sheep & goat breeds for sustainable farming in a changing mediterranean region

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Changing Mediterranean climate?
Drought & Rainfall in the Mediterranean


Lebanese estimates for climate change in Lebanon 2040

<table>
<thead>
<tr>
<th></th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temperatures</strong></td>
<td>↑ 1 to 2ºC</td>
</tr>
<tr>
<td><strong>Rainfall</strong></td>
<td>↓10-20%</td>
</tr>
<tr>
<td><strong>Drought periods</strong></td>
<td>↑ 9 days</td>
</tr>
<tr>
<td><strong>Snow cover</strong></td>
<td>↓ 40%</td>
</tr>
<tr>
<td><strong>Snow fall Limit</strong></td>
<td>1500m</td>
</tr>
<tr>
<td><strong>Sea levels (20mm/year)</strong></td>
<td>↑ 30-60 cm</td>
</tr>
</tbody>
</table>

Temperature Humidity Index

THI measured @ 12AM, 6 AM, 12 PM, 6PM

July 2017

THI max sun  blue line: THI min sun  green line: THI max sha  black line: THI min sha
World Water availability

1980

2015 Estimate

Water Availability (1,000m³/year per capita)
- More than 20 - very high
- 10 to 20 - high
- 5 to 10 - average
- 2 to 5 - low
- 1 to 2 - very low
- Less than 1 - catastrophically low

Source: Stockholm Environmental Institute, 1997: Comprehensive Assessment of the Freshwater Resources of the World.
Breeds & population in Lebanon

Small Ruminant population in Lebanon

1999
- **Awassi**: 378050
- **Local***: 217983
- **Shami**: 65395

*recent rise in goat numbers is mainly due to an increase in Saanen and other intensive dairy type goats

LMA survey in 2010 did not classify SR into breeds
# Status of Local Breeds

<table>
<thead>
<tr>
<th></th>
<th>Local Awassi</th>
<th>Baladi Goat</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lambing rate</strong></td>
<td>80 %</td>
<td>150 %</td>
</tr>
<tr>
<td><strong>Weight (Kg)</strong></td>
<td>35-55</td>
<td>25-35</td>
</tr>
<tr>
<td><strong>Milk (Kg)</strong></td>
<td>40-80</td>
<td>100-200</td>
</tr>
<tr>
<td><strong>Main Use</strong></td>
<td>Meat &amp; Milk, wool</td>
<td>Milk &amp; Meat</td>
</tr>
<tr>
<td><strong>Longevity (years)</strong></td>
<td>3-5</td>
<td>3-6</td>
</tr>
<tr>
<td><strong>Regulations</strong></td>
<td>++</td>
<td>--</td>
</tr>
</tbody>
</table>
# Information on characterization of breeds in Lebanon and assessment of risks to genetic diversity

<table>
<thead>
<tr>
<th>Breed</th>
<th>Documented information</th>
<th>Degree of risk of threat</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awassi Sheep</td>
<td>Available, limited studies</td>
<td>Low</td>
<td>Conditions for inbreeding are possible in small flocks</td>
</tr>
<tr>
<td>Mountainous/Baladi Goat</td>
<td>lack of studies</td>
<td>Medium</td>
<td>Indiscriminate crossbreeding with Shami to improve twinning and milk production that could end in breed substitution</td>
</tr>
<tr>
<td>Shami Goat</td>
<td>Available, limited studies</td>
<td>Low</td>
<td>Herd size is small (2-25), risk of inbreeding is high. Population is increasing in view of the breed’s ability to produce milk</td>
</tr>
</tbody>
</table>
Performance of Local Breeds under Harsh conditions

- Increased temperature, solar radiation
- Decreased precipitation
  - Poor water quality
  - Lack of natural watering station during travel
- Feed and pasture quality and availability (Travel time for grazing)
  - Dependence on agricultural by-products has increased
  - Large single crop fields has increased
  - Diversification of grazing means increased travel time
7-day heat stress – Merino whethers

Respiration Rate

Rectal Temperature

Χ hot conditions; •, thermoneutral conditions

Rectal Temperature

AM

Temperature (°C)

PM

Temperature (°C)

Adaptation

Experimental

Timepoint

El Masri et al., 2017, asas annual meeting. Paper in preparation
Adaptation Parameters

Results & Discussion

C

Panting Score

* : LS Means differ from No Salt equivalent (p<0.05);
+ : LS Means differ from Control (p<0.05)

• 100% of animals exposed to solar radiation were panting
• Panting score never exceeded 2.5 on a scale of 0 to 5

El Masri et al., 2017, asas annual meeting. Paper in preparation
El Masri et al., 2017, asas annual meeting. Paper in preparation
Effect of Heat Stress on Milk production in dairy sheep

Milk Production

- Sun- No Salt
- Control- No Salt
- Shade- No Salt
- Sun Salt
- Control Salt
- Shade Salt

Milk Volume (L)

<table>
<thead>
<tr>
<th>Adaptation</th>
<th>Experimental</th>
<th>Recovery</th>
</tr>
</thead>
</table>

Male Fertility

Rectal Temperature

5/14

10/9

B=Before HS
D= during HS
A=After HS

Awassi Reproductive Function under heat stress

<table>
<thead>
<tr>
<th>Period</th>
<th>Treatment</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0</td>
<td>Adaptation period</td>
<td>28 d</td>
</tr>
<tr>
<td>HS1</td>
<td>6 h heat stress per day</td>
<td>49 d</td>
</tr>
<tr>
<td>R1</td>
<td>Recovery after HS1</td>
<td>30 d</td>
</tr>
<tr>
<td>HS2</td>
<td>12 h heat stress per day</td>
<td>21 d</td>
</tr>
<tr>
<td>R2</td>
<td>Recovery after HS2</td>
<td>21 d</td>
</tr>
</tbody>
</table>

**Table:**

- **A**
  - Testicular Volume
  - P0 = Adaptation
  - HS1 = 6 h heat stress
  - R1 = Rest after HS1
  - HS2 = 12 h Heat Stress
  - R2 = Rest after HS2
  - Vol (mL)

**Graphs:**

- B: Abnormal Spermatozoa
  - Acrosome: ab, a, b
  - Mid-Piece: ab, a, b
  - Tail: ab, a, b

- C: Normal Spermatozoa
  - Acrosome: a

- D: Average Spermatozoa
  - P0, HS1, R1, HS2, R2

Sprinkling and ventilation

Ventilation of the house

- Decrease in respiration rate and skin temperature in both Awassi and Assaf sheep
- Increase in body weight gain

Koluman et al., 2011
Abi Saab et al., in preparation

Sprinkling

Abi Saab et al., 2014.
Animal Change Conference
## Effect of high salt load in water

Northwestern coastal desert - Egypt

<table>
<thead>
<tr>
<th>Sheep</th>
<th>Barki ewes</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P1</td>
<td>P2</td>
<td>P3</td>
<td>P4</td>
<td>P5</td>
<td></td>
</tr>
<tr>
<td>Average daily water intake (ml/100 kg BW)</td>
<td>5478</td>
<td>4444</td>
<td>3190</td>
<td>3235</td>
<td>2793</td>
<td></td>
</tr>
<tr>
<td>Average dry matter intake (g/kg(^{0.73}) per day)</td>
<td>61.0</td>
<td>51.9</td>
<td>49.7</td>
<td>54.7</td>
<td>49.9</td>
<td></td>
</tr>
<tr>
<td>Average nutrient intake (g/kg(^{0.73}) per day)</td>
<td>32.7</td>
<td>32.9</td>
<td>29.6</td>
<td>29.7</td>
<td>24.4</td>
<td></td>
</tr>
<tr>
<td>TDN</td>
<td>3.12</td>
<td>2.81</td>
<td>2.09</td>
<td>1.57</td>
<td>1.57</td>
<td></td>
</tr>
<tr>
<td>DCP</td>
<td>116</td>
<td>116</td>
<td>105</td>
<td>105</td>
<td>86</td>
<td></td>
</tr>
<tr>
<td>Maintenance (%)</td>
<td>142</td>
<td>128</td>
<td>95</td>
<td>71</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td>TDN</td>
<td>117</td>
<td>108</td>
<td>97</td>
<td>104</td>
<td>92</td>
<td></td>
</tr>
<tr>
<td>DCP</td>
<td>125</td>
<td>124</td>
<td>78</td>
<td>72</td>
<td>56</td>
<td></td>
</tr>
</tbody>
</table>

| Camels | Camelus dromedarius |  |  |  |  |  |
|        | P1         | P2 | P3 | P4 | P5 |   |
| Average daily water intake (ml/100 kg BW) | 2276 a | 2295 a | 1095 b | 972 b | 1565 b |
| Average dry matter intake (g/kg\(^{0.73}\) per day) | 51.0 a | 46.7 ab | 43.3 b | 48.8 a | 49.9 a |
| Average nutrient intake (g/kg\(^{0.73}\) per day) | 31.4 | 29.0 | 26.0 | 27.9 | 24.8 |   |
| TDN    | 2.70       | 2.67 | 1.68 | 1.56 | 1.21 |   |
| DCP    | 117        | 108 | 97  | 104 | 92 |   |
| Maintenance (%) | 125 | 124 | 78 | 72 | 56 |   |

| Air temperature (°C) |  |  |  |  |  |
| Min.    | 22.1       | 23.7 | 12.8 | 12.0 | 10.1 |   |
| Max.    | 28.8       | 29.5 | 23.0 | 18.9 | 17.3 |   |

a, b means in the same row with the same letter are not significantly different.

The animals consumed all their feed even the salty one.

Effect of Low water quality on Awassi

El Masri et al., 2017, asas annual meeting. Paper in preparation
a,b LSmeans without a common superscript differ between periods

P<0.05
Effect of feed restriction

Body Weight

Body Reserves

G1: Protein restricted
G2: control
G3: Protein supplementation

Makdessi et al, 2016
Follicular Activity by goat BCS

Folliculogenesis in Fat or Thin Goats

Kharrat et al, in preparation
Effect of flushing on prolificity

![Bar chart showing the effect of flushing on prolificity in 2014 and 2015 for different lots.

- Prolificity is measured as the average number of offspring per mother.
- The chart compares the prolificity of different lots (MP, Mfa, Mfb, GP, Gfa, Gfb) in 2014 and 2015.
- The x-axis represents the lots, and the y-axis represents the prolificity (chevreaux/chèvre) range from 0 to 2.0.}
Heat loss by convection as air movement takes heat away from body surface, or heat gain if air temperature is warmer than animal.

Heat loss by evaporation of water from skin and exhaled breath.

Heat loss by conduction from ground or rocks if warmer than animal, or heat loss to ground or rocks if cooler than animal.

Heat gain from radiant energy from the sun.

Heat loss through evaporation of sweat.

Radiant heat loss from body if warmer than environment.
Conclusion

• In Lebanon and other developing nations, the small ruminant sector is very fragile especially due to the socio-economical context

➔ Mitigation strategies include:
• Use of Agricultural by-product to complement poor transhumant pasture diet, especially at key times, in order to Ensure
  – body condition maintenance
  – decrease stress and traveltime
  – adequate weight at birth of the litter
• Housing outdoor at night
• Provide regular watering with “good” water quality
• Develop a decentralized selection strategy for resilience
  – Enhance small holder soci-economical viability
  – Conserve and protect local breeds at a lower cost
• NEED FOR Extension and proper transfer of science
Questions