Energy footprint assessment of sheep meat produced in Tunisia under two different farming systems



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Plan

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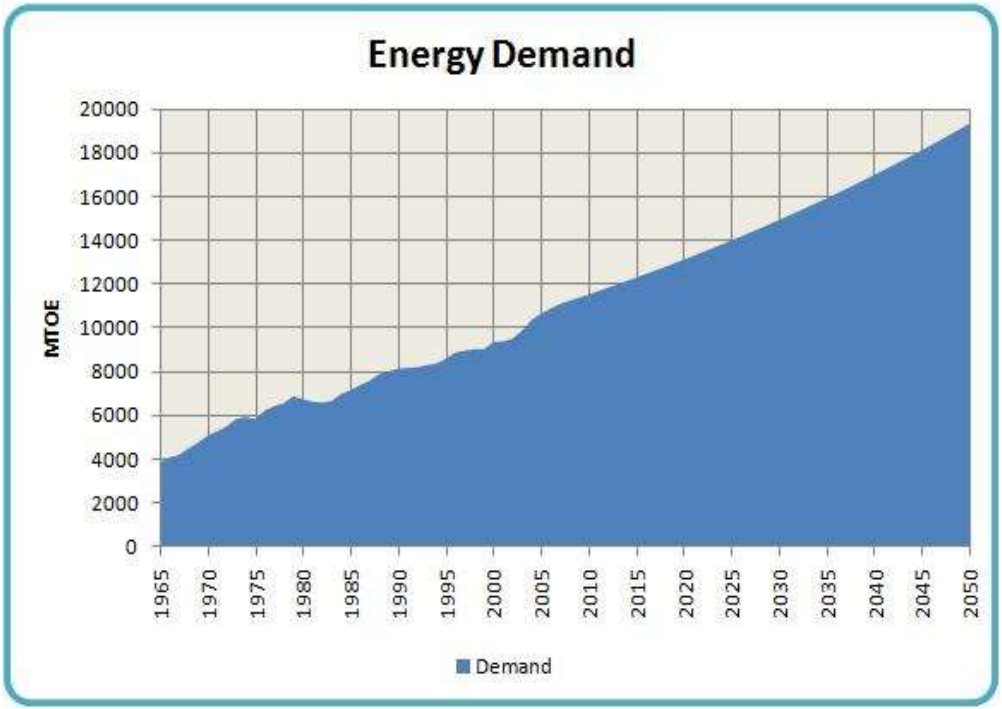
Why the Study ?

Growing demand for agricultural products especially in the developing countries

- The population growth and the rapid economic development.
- Degradation of natural resources (water, land and energy).
- Fossil energy has been identified as a major input of livestock production systems.



(FAO, 2013)

Research objective

Objective

This study aimed to assess and compare the Energy footprint of sheep meat produced in Tunisia under two farming systems; the mixed sheep-cereal farming system (prevailing in Northern Tunisia, mainly de regions of Beja, Jendouba) and the agro-pastoral farming system (prevailing in southern Tunisia mainly Tataouine and Kebili).

Justification

No knowledge so far on the energy use for livestock production in Tunisia- basis for decision making.

What is the energy footprint ?

- Energy footprint (EF) was proposed as a metric to measure the direct and indirect use of energy of a product.
- EF was expressed as mega joule (MJ) per unit of live weight (LW).
- Electiric and fossil energy

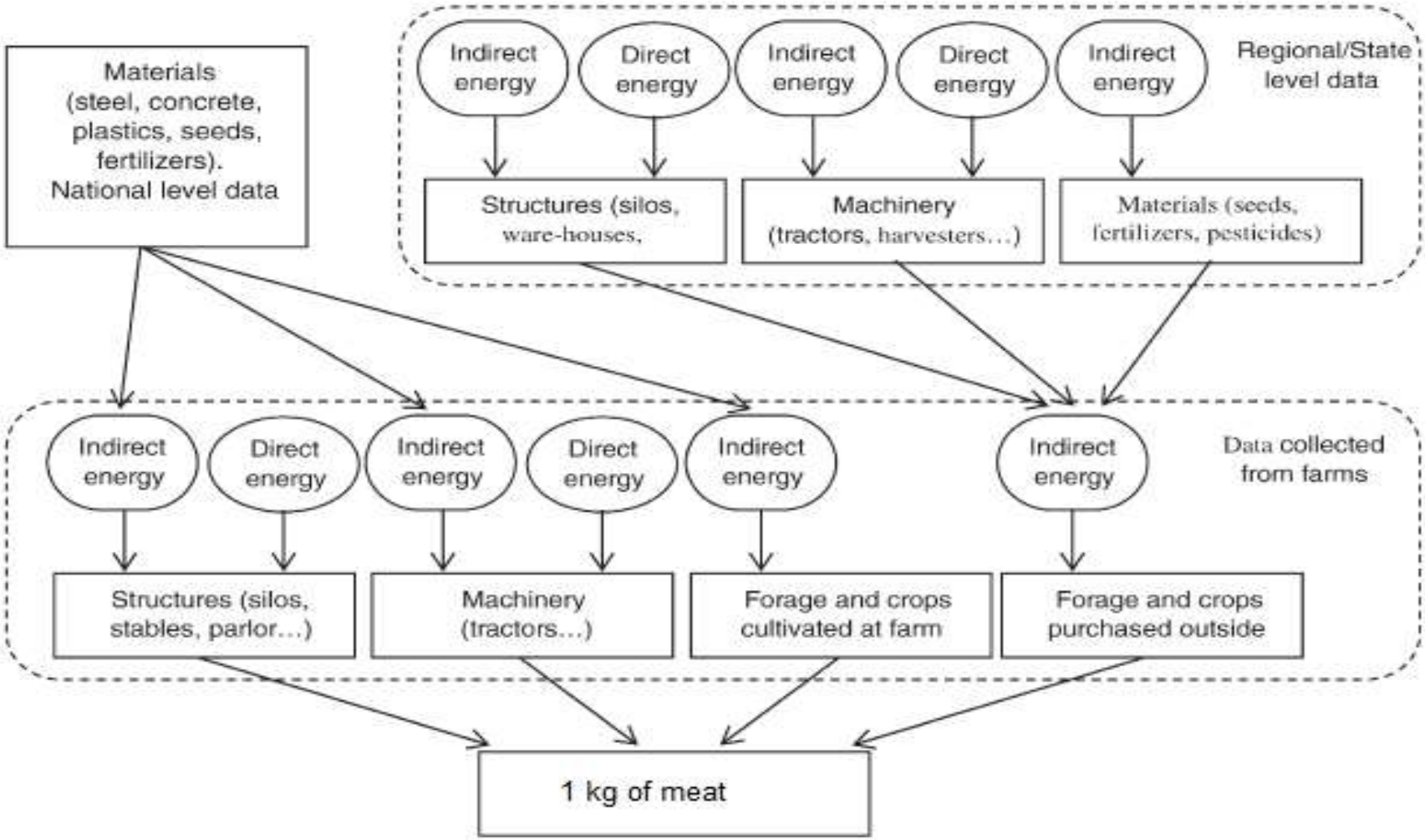


Fig. 1. Scheme for the assessment of direct and indirect energy inputs for meat production.

The energy input was calculated following the methodology of Khan et al., 2009; Pagani et al., 2016

$$EF_{sheep} = EF_{feed} + EF_{pumping\ drinking\ and\ irrigation\ water} + EF_{Lighting\ and\ housing} + EF_{transport}$$

Fossil energy	Electric energy
$Ec = F_c * T_c * C_v * L$ Ec= energy use of the machine Fc= the fuel consumption Tc= the time consumed in operation (h) Cv= the caloric value of the fuel (kW h/l) L= actual fuel consumption over fuel consumed at rated power.	For electric motors, the energy use was calculated by the product of rated power of the electric motor.

Study area and farming systems description

- A total of 80 sheep farms

System	Mixed sheep-cereal	Agro-pastoral
Region	North	South
Governorate	Beja and Jendouba	Tataouine and Kebili
Annual rainfall	700-1200 mm	<200 mm
Average minimum and maximum temperatures	5°C and 38°C	15°C and 42°C
Main feed ingredients	20 to 30% of concentrate feeds Grazing on natural pasture, fallows and cereal stubbles in summer.	40 to 60% of Concentrate feeds and fodder crops mainly from the north region of Tunisia+ rangeland.
Nub of surveys	40 farms	40 farms

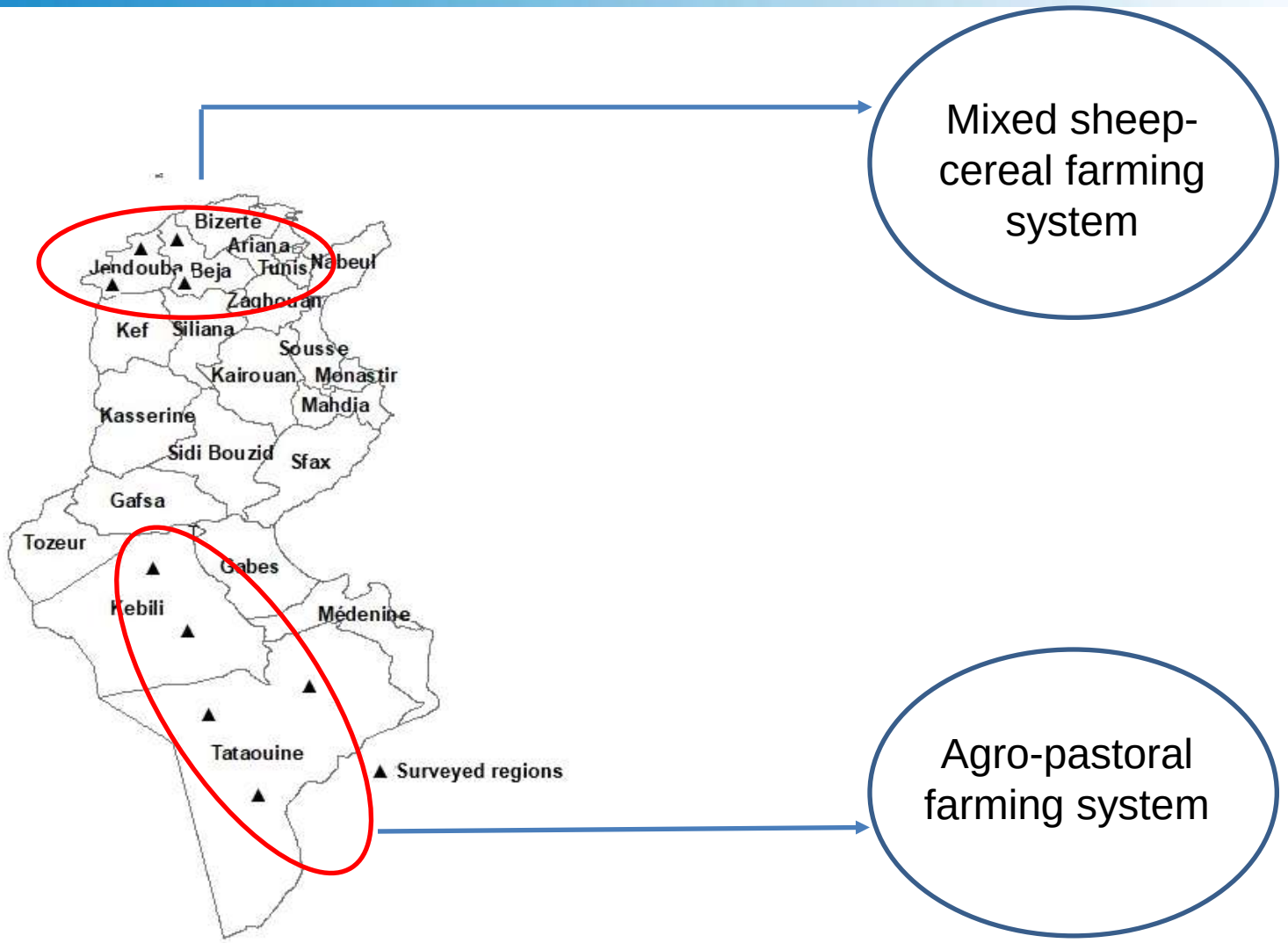
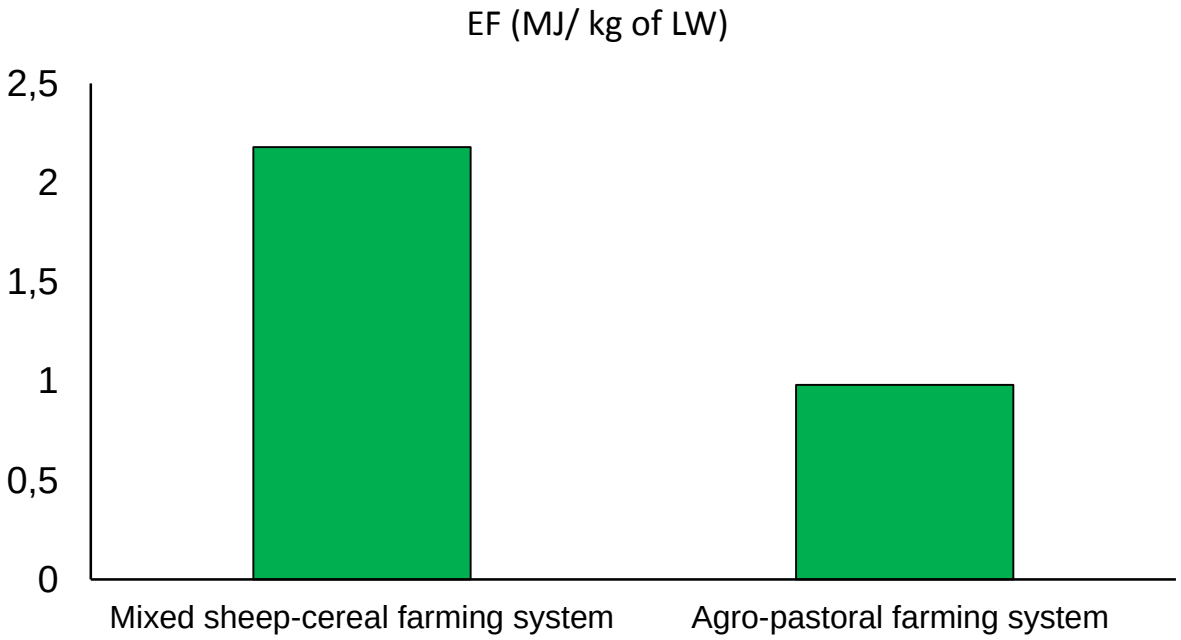


Fig. 2. Localization of the surveyed sheep farms in Tunisia.

Results

The average EF of all evaluated farms was 1.58 MJ/ kg of LW.



- **The EF in the Northern system is two time higher than the Southern system.**
- **This difference could be ascribed to the high use of energy during feed production on the farm scale.**

Results

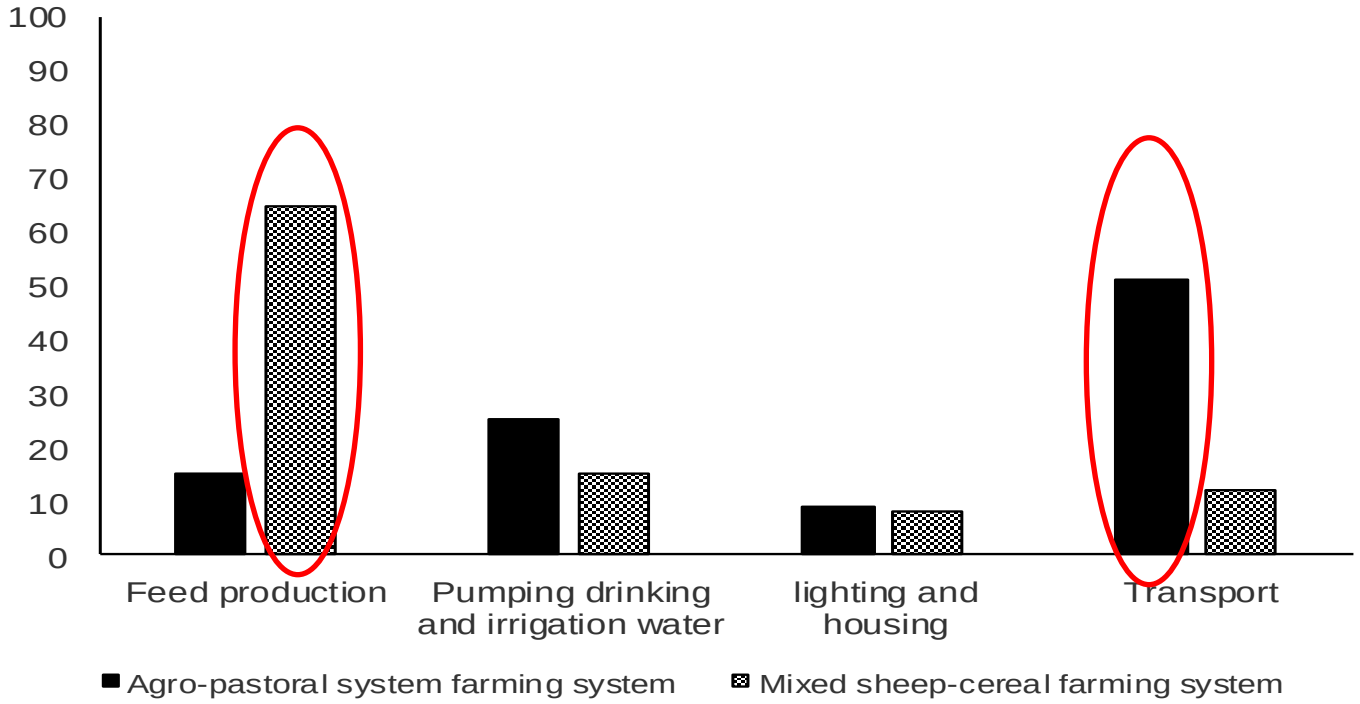


Fig. 3. Percentage of energy use per step of production in the agro-pastoral and the mixed sheep-cereal farming system in Tunisia.

- ✓ **Feed production in the northern farms represent the hotspot in term of energy use. While the transport of animal and feeds reveals the highest consumption of energy in the southern farms.**

Conclusions

- Producing sheep production under the agro-pastoral farming system is more sustainable and efficient in term of energy use than the Mixed sheep-cereal farming system.
- The comparison of the EF of sheep farming systems in north and south Tunisia provides useful insights in terms of energy saving strategies for this sector.
- Energy efficiency intervention strategies should promote a sustainable agricultural mechanization through the adoption of conservation agriculture to save energy.
- The use of low-energy use feeds.

Perspectives and recommendations

- **Further research should focus on the reduction of farming dependency on fossil fuels through the integration of renewable energy sources in farm scale could lead to a transition to low carbon farms, driven by locally available resources such as biogas energy from manure and solar energy.**

- **Combine EF with other footprint indicators such as water footprint, land footprint and carbon footprint.**

Thank you!

Questions?