# EFFECTS OF USING CHICKPEAS (*CICER ARIETINUM* L.) AS AN ALTERNATIVE PROTEIN AND ENERGY SOURCE: LAMB GROWTH AND MEAT QUALITY

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## Background

The main objective of farmers located in the Mediterranean regions is to promote the use of local feedstuffs in order to reduce costs for animal feeding. Corn and soybean, the major ingredients of concentrates for lambs fattened according to intensive rearing systems, in this area are largely imported because of adverse climatic and agronomic conditions. Furthermore, they are largely spread as GMO feeds which use in animal feeding is in contrast to the recent EU agricultural policy towards "organic" local feedstuffs production and livestock husbandry systems. Among local feedstuffs, legume seeds such as peas (*Pisum sativum*), faba bean (*Vicia faba* var. *minor*), chickpeas (*Cicer arietinum*) could be alternative to corn and soybean meal, representing a powerful local protein and energy source. Among these legumes, chickpeas has a significant protein and starch content ranging, respectively, from 20 % to 28 % DM and around 50 % D.M. With respect to other legumes seeds the use of chickpeas was studied in swine (Visipanich et al., 1989; Batterham et al., 1990) showing comparable productive performance than diet based on soybean, and in rabbit (Alicata et al., 1991) where associated to higher biological value protein sources preserved growth performances.

## Objectives

The purpose of this study was to evaluate the effects of partial and total replacement of soybean meal with chickpeas on lamb growth and slaughter performances, and on physical and chemical characteristics of meat.

## Methods

Twenty-seven male Barbaresca lambs, weaned at 60 days of age, were divided into three groups of 9, according to live weight, and stalled into three collective boxes. From the 60th to 67th day of age the lambs were gradually adapted to the experimental diets. Soybean meal and chickpeas were present in the diets in the following proportions: 13-0 % as feed basis (control); 7-20 % (chickpeas 20); 0-42 % (chickpeas 42);. The diets had similar protein (16.26 %, 16.39% and 16.64 % D.M. basis, ) and NDF (26.26 %, 24.07 % and 24.63 % D.M. basis) contents, respectively for control, chickpeas 20 and chickpeas 42 groups. All the three diets were ground and pelletted and supplied *ad libitum*. The lambs were individually weighed once weekly before feed supply. One lamb from chickpeas 42 was removed from the experiment because of health problem. The lambs were slaughtered, by throat cut after captive bolt stunning, at 132 days of age, following a 12 h-fasting period (water was allowed). At the abattoir, slaughter weight, empty body weight, hot carcass weight and net dressing percentage were measured. The hot carcasses were assessed for fatness using a 15-point scale according to Dransfield et al. (1990) and then stored in a refrigerated room set to 4°C. At 24 h *post mortem* on carcasses, at level of the caudal region, subcutaneous fat colour was measured according to C.I.E.L*a*b* system and fat subjective firmness was evaluated using a 9-point scale (1= being the most firm….. 9= being the most oily). Carcasses were then split into two sides and from each right side the hind leg was separated to determine the tissutal composition. On the *longissimus lumborum* muscle, ultimate pH and colour CIE (L*a*b*) (light source: $D_{65}$), measured on 3-cm thick muscle slices bloomed for 2 hours in a plastic tray and over wrapped with a polyethylene film at 4°C, were evaluated. Chroma (C*) and Hue angle (H*) were also calculated. On *l.d* samples (thoracic portion) vacuum-packed and aged for 96 hours at 4°C, cooking losses and Warner-Bratzler shear force were measured. On samples of *l.d.* muscle excised at 24 h *post mortem* and stored at – 24°C, moisture, fat and ash were assessed, after thawing for 24 h at 4°C, according to A.O.A.C. (1995) while protein was calculated by difference. All the data were analysed according to ANOVA.

## Results and discussion

The growth performances were similar among groups with a slightly ($p=0.11$) higher average daily gain showed for control and chickpeas 20 groups than chickpeas 42. The empty body weight, carcass weight and net dressing percentage were comparable among groups. Carcass classification did not significantly discriminate the three groups and showed a nearly "abundant" fatness according to high slaughter weight (around 30-35 kg) (Chestnutt, 1994). The caudal fat lightness (L*), redness (a*) and yellowness (b*) were not affected by diet treatment. Low lightness values associated to high redness (usually below 5 in white fat carcasses) identified brown-red subcutaneous fat carcasses which often came from animals fed on concentrate, as reported by Prache et al. (1990). These Authors justified the red-brown discoloration as an effect of softness on light reflectivity or as an excess in heme pigment concentration or as peroxydation of insaturated fatty acids. The caudal fat firmness did not differentiate groups and showed an intermediate value between firm and soft fat (table 1). The hind leg dissection did not show significant difference among groups with regard to tissutal composition (table 2). The meat ultimate pH was comparable among groups and showed a regular trend for glycolysis *post mortem*. The meat from control and chickpeas 20 groups was in tendency ($p=0.14$) lighter in colour than that from chickpeas 42. There was a significant ($p<0.05$) correlation between muscle ultimate pH and lightness as expected. Redness (a*), yellowness (b*), Chroma (C*) and Hue angle (H*) were not significantly different among treatments. Water-holding capacity expressed as drip losses was slightly ($p=0.12$) higher in chickpeas 20 and chickpeas 42 than in control one while cooking losses were not different. All the three groups showed comparable WBS values which indicated tender meat according to Devine et al. (1993). Chemical analyses did not discriminate the two groups with regard to moisture, ash, fat and protein (table 3).

## Conclusion

The total or partial substitution of soybean meal with chickpeas did not affect growth and slaughter performances and preserved a good quality of meat.

## Pertinent literature

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Table 1 - Growth and slaughter performances.

| | Treatment | | | SEM | p-value |
|---|---|---|---|---|---|
| | Control | Chickpeas 20 | Chickpeas 42 | | |
| Final weight, kg | 35.24 | 34.00 | 30.23 | 1.210 | 0.23 |
| Average daily gain, g/d | 285.24 | 279.69 | 220.32 | 13.70 | 0.11 |
| Feed intake, g DM/d | 1112 | 1046 | 877 | | |
| Feed conversion index, g DM/g gain | 3.90 | 3.74 | 3.98 | | |
| Empty body weight, kg | 31.98 | 30.88 | 27.56 | 1.060 | 0.23 |
| Carcass weight, kg | 16.88 | 16.22 | 14.64 | 0.578 | 0.29 |
| Net dressing, % | 52.77 | 52.55 | 52.94 | 0.490 | 0.95 |
| Carcass fatness, score | 10.11 | 9.56 | 9.25 | 0.368 | 0.65 |
| Caudal fat lightness, L* | 64.90 | 66.86 | 64.78 | 0.992 | 0.64 |
| Caudal fat redness, a* | 7.71 | 7.23 | 7.53 | 0.215 | 0.66 |
| Caudal fat yellowness, b* | 9.23 | 8.56 | 8.54 | 0.224 | 0.37 |
| Caudal fat Chroma, C* | 12.05 | 11.23 | 11.44 | 0.284 | 0.48 |
| Caudal fat Hue angle, H* | 50.29 | 50.01 | 48.44 | 0.655 | 0.50 |
| Caudal fat firmness, score | 4.22 | 3.89 | 4.50 | 0.299 | 0.73 |

Table 2 - Hind leg dissection.

| | Treatment | | | SEM | p-value |
|---|---|---|---|---|---|
| | Control | Chickpeas 20 | Chickpeas 42 | | |
| Leg weight, kg | 2.47 | 2.32 | 2.07 | 0.092 | 0.21 |
| Lean, % leg wt. | 60.06 | 61.96 | 62.88 | 0.785 | 0.34 |
| Fat, % leg wt. | 16.70 | 15.80 | 15.30 | 0.747 | 0.76 |
| Bone, % leg wt. | 23.24 | 22.24 | 21.82 | 0.477 | 0.49 |
| Lean/fat | 3.87 | 4.08 | 4.49 | 0.251 | 0.62 |
| Lean/bone | 2.60 | 2.80 | 2.95 | 0.079 | 0.19 |

Table 3 - Physical and chemical characteristics of meat.

| | Treatment | | | SEM | p-value |
|---|---|---|---|---|---|
| | Control | Chickpeas 20 | Chickpeas 42 | | |
| pH | 5.55 | 5.55 | 5.57 | 0.011 | 0.60 |
| Lightness, L* | 50.41 | 49.37 | 45.98 | 0.942 | 0.14 |
| Redness, a* | 17.08 | 16.26 | 16.39 | 0.465 | 0.75 |
| Yellowness, b* | 7.53 | 8.11 | 7.96 | 0.319 | 0.75 |
| Chroma, C* | 18.69 | 18.22 | 18.23 | 0.531 | 0.92 |
| Hue angle, H* | 23.58 | 26.32 | 25.64 | 0.603 | 0.14 |
| Drip losses, % | 1.88 | 2.03 | 3.01 | 0.240 | 0.12 |
| Cooking losses, % | 22.46 | 24.19 | 23.54 | 0.850 | 0.71 |
| WBS, kg/cm$^2$ | 6.30 | 5.82 | 4.92 | 0.392 | 0.37 |
| Moisture, % | 74.13 | 74.59 | 75.15 | 0.210 | 0.14 |
| Fat, % | 2.15 | 2.46 | 1.67 | 0.199 | 0.28 |
| Protein, % | 22.21 | 21.52 | 21.57 | 0.196 | 0.28 |
| Ash, % | 1.52 | 1.43 | 1.61 | 0.052 | 0.37 |