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## RESEARCH ARTICLE

# Camel meat marketing and camel meat marketplace in the Algerian northern Sahara-case of the region of Souf

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## ABSTRACT

A field survey involving 62 camel butchers from Souf region the Algerian northern Sahara was implemented in order to establish a typology of camel butcher and collect data on camel meat marketing, the diversity in marketing practices and camel meat marketplace. The collected data allowed to identify 4 homogeneous groups of butchers well distinguished between them after cluster analysis. (specialized young camel butchers, non-specialized rural butchers, traditional non-specialized urban butchers, modern and old urban specialized butchers). The present study confirmed the predominance of beef meat compared to camel meat among consumers, camel meat consumption being less successful in its environment. In-depth studies on camel meat sector are mandatory to identify the bottlenecks invalidating the promotion of the camel meat consumption.

**Keywords:** Algeria; Butcher; Camel; Carcass; Consumption; Marketing; Meat; Northern Sahara; Slaughter; Souf

## INTRODUCTION

By its best use of pastoral areas in the Saharan territory, the dromedary camel is by excellence the only species adapted to the local ecological roughness and remains the only animal converting lean vegetation into vital products (Senoussi, 2011). At world level, camel meat consumption is growing in highly proportion that cattle or sheep meat (Faye, 2013) and participates to an important regional market (Alary and Faye, 2016). In North-Africa, camel meat sector is poorly investigated (Belkhir et al., 2013; Selmi et al., 2017) despite its local interest for the economy of remote areas. In Algeria, meat is the main speculation among camel products in Algeria (Benyoucef and Bouzegag, 2006) even if a growing interest for camel milk appeared (Faye et al., 2014). With a production estimated at 6000 tons/year in 2017 (FAOstat, 2019), camel meat represents 1.24% only of the total red meat consumed in the country. This proportion decreased since the independence as it was estimated 3% in 1962 (source, FAOstat, 2019). However, this part is more important in the desert wilayas of the country, and despite its interest for the food security of the local population, studies have mainly focused on sheep and beef excluding camel meat (Refik-Concina, 2014).

The butcher is the stakeholder who is dominating the sector of red meat (Mohamed Ali, 2016). He plays a pivotal role in controlling almost the entire meat circuit, and he is the main stakeholder intervening just before the consumer (Ouled Belkhir et al., 2013). The present paper aimed to contribute to a better knowledge of the current status of camel meat sector in Algeria. For achieving such purpose, the objectives of the present study aimed (i) to describe the national camel meat sector, (ii) to establish a typology of camel meat butcher and analyze the diversity in marketing practices, and (iii) to identify camel the meat marketplace in the Souf region of northern Algerian Sahara.

## MATERIAL AND METHODS

### Study area

The Souf region is located in the South-East of Algeria, 600Km of the capital Algiers on the northern borders of the Eastern Erg (33° to 34° N and 6° to 8° E). It is bordered to the east by the huge Tunisian Chott El-Djérid, to the north by Merouane, Melghir and Rharsa chotts, to the west by the chotts of Oued Rhigh and to the South by Ouargla (Voisin, 2004).

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The region is at an average altitude of 80 m, showing a notable decrease from south to north to be at 25 m below sea level in the Melghir chott, which occupies the bottom of the immense basin of the lower Sahara (Najah, 1971) (Fig. 1) (Kadri and Chaouche, 2018).

**Sampling and surveys**

The survey aimed to establish a typology of camel meat butcher and camel meat marketing, so, it was prepared, tested and readjusted after previously touched 7 butchers randomly selected.

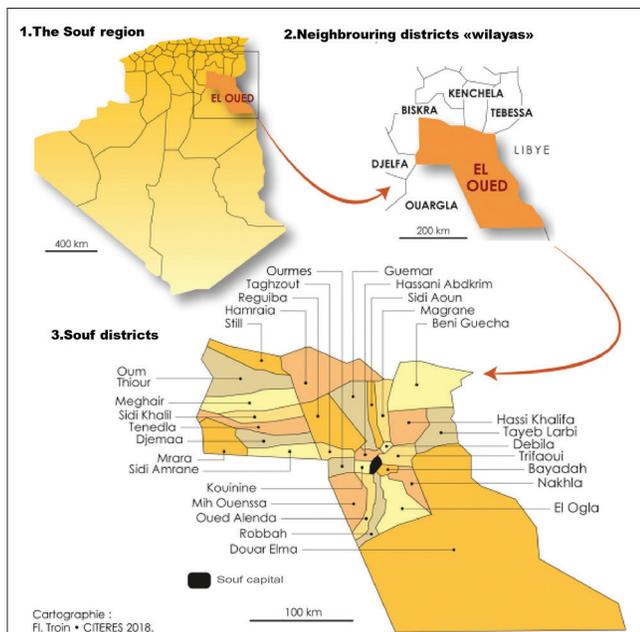
The survey involved 62 camel meat butchers, distributed over 11 municipalities of the study area (Table 1).

**Statistical analysis**

A multiple correspondence analysis (MCA) followed by a hierarchical clustering were used to rank the different groups

**Table 1: Distribution of the surveyed butchers.**

Municipalities	Number of butchers
Taleb Larbi	3
Douar Elma	1
Ben Guecha	3
Hassi Khalifa	8
Debila	8
Reguiba	3
Guemar	3
Mih Ouansah	5
El Magrane	1
El Rabah	11
El Oued	16
Total	62



**Fig 1.** Geographical location of the study area.

of butchers. Chi-square tests were applied to the contingency table of modalities to distinguish butchers' groups from each other. These analyses were carried out using Excel-stat software version 2016 (Addinsoft ©, 2016). variables used for the statistical analysis, are presented in (Table 2).

**RESULTS**

**Multiple correspondence analysis (MCA)**

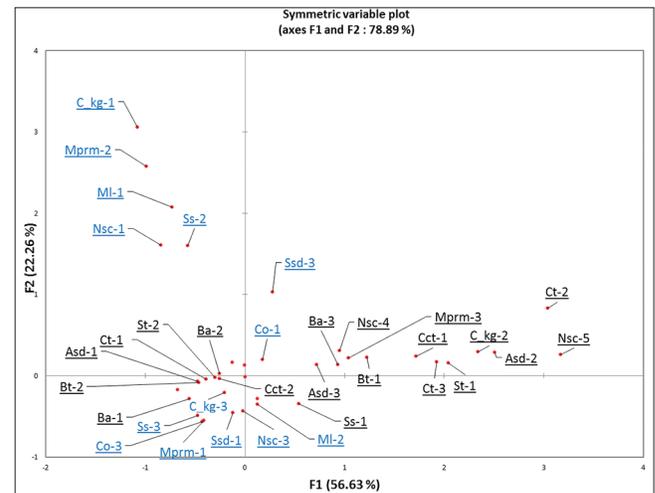
The first two axes of the multiple correspondence analysis explain 78.9% of the total variance. Thus, expressing the most important source of variation, the interpretation of the results was limited to these two first factors.

The factorial plan (1,2) presents the distribution of the modalities according to the dominant variability (Fig. 2). The first axis opposed:

- (i) To the right the butchers selling only camel meat (old butchers, livestock market is the main source of supply of live camels, controlled slaughter of all age categories of dromedaries, high number of carcasses marketed per week, modern carcass cutting, costs per kg of meat moderately high, a clientele consisting of households and restaurants).
- (ii) To non-specialized butchers on the left side (young butchers, selling other types of red meat beside camel meat, illegal slaughter of camel, marketing of carcasses of young camels, traditional carcass cutting, clientele consisting solely of households).

The second factor separated:

- (i) The non-specialized rural butchers, at the top of the factorial plan (1,2), described as butchers located in the rural Municipalities, the sheep meat taking first



**Fig 2.** Projection of the modalities of the variables contributing significantly to the first two factors on the factorial plan (1,2) of multiple correspondence analysis (MCA). In black, the variables associated to the first factor while in blue, the variables contributing to the second factor.

**Table 2: List of variables and modalities and percentages by modality used in the multivariate analysis**

Variable name	Code	Value	% by modality
Butcher age	Ba-1	Under 30 years	17.7
	Ba-2	30 to 50 years	56.5
	Ba-3	More than 50 years	25.8
Butcher type	Bt-1	Specialized butcher (only camel meat)	27.4
	Bt-2	Mixed butcher (camel meat with other type of red meat)	72.6
Municipality location	MI-1	Rural	14.5
	MI-2	Urban	85.5
Number of slaughtered camels per week	Nsc-1	Occasionally	14.5
	Nsc-2	Under one camel per week	8.1
	Nsc-3	1 to 2 camels per week	61.3
	Nsc-4	3 to 5 camels per week	14.5
	Nsc-5	More than 5 camels per week	1.6
Marketing place	Mp-1	Butchery	88.7
	Mp-2	Butchery + weekly markets	11.3
Most purchased variety of red meat	Mprm-1	Beef	58
	Mprm-2	Sheep meat	9.7
	Mprm-3	Camel meat	32.3
Supply sources of live camel	Ss-1	Market	41.9
	Ss-2	Rangeland	19.4
	Ss-3	Market and rangeland	27.4
	Ss-4	Own breeding	11.3
Age of slaughtered dromedary camel	Asd-1	Young	72.6
	Asd-2	Adult and Culling	8
	Asd-3	Young+ Adulte and culling	19.4
Consumer origin	Co-1	Aboriginal	67.7
	Co-2	Allochthonous	6.5
	Co-3	Aboriginal+allochthonous	25.8
Consumer Type	Ct-1	Household	83.9
	Ct-2	Restaurant	1.6
	Ct-3	Household and restaurant	14.5
Slaughtering type	St-1	Controlled	12.9
	St-2	Clandestine	87.1
Sex of slaughtered dromedary camel	Ssd-1	Male	69.4
	Ssd-2	Male and Female	30.6
Cost price per kg of meat	C_kg-1	340 à 490 DA	4.8
	C_kg-2	500 à 600 DA	9.7
	C_kg-3	610 à 775 DA	85.5
Cutting carcass type	Cct-1	Modern (boned meat, ground meat, sausage)	12.9
	Cct-2	Classical (mix of meat, fat and bone)	87.1

Ba: Butcher age; Bt : Butcher type; MI: Municipality location; Nsc: Number of slaughtered camels per week; Mp: Marketing place; Mprm: Most purchased variety of red meat; Ss: Supply sources of live camel ; Asd: Age of slaughtered dromedary camel; Co: Consumer origin; Ct: Consumer Type; St: Slaughtering type; Ssd: Sex of slaughtered dromedary camel; C\_kg: Cost price per kg of meat; Cct: Cutting carcass type

place as the most purchased variety of red meat. The other closed variables are occasional marketing of camel meat, rangelands as supply source of live camel, slaughtering both sexes, low cost per Kg of meat, Aboriginal customers.

- (ii) To the non-specialized urban butchers at the bottom of the factorial plan marketing 1 to 2 carcasses per week from male camels, at high cost per Kg of meat. In addition, livestock market and rangelands are sources of live camel supply, beef dominates commercialized red meat, the butchers are located in

urban cities, and their clientele is mixed (aboriginal and allochthonous).

#### **Automatic hierarchical classification (AHC)**

The hierarchical clustering applied on the 62 butchers allowed to identify 4 groups of camel butchers, which accounts for 57.9% of the total variance (Figs. 3 and 4).

Each butcher belonging to the same group are supposed to be similar and differs of the butchers belonging to another group. The group 4 (Figs. 3 and 4) appeared

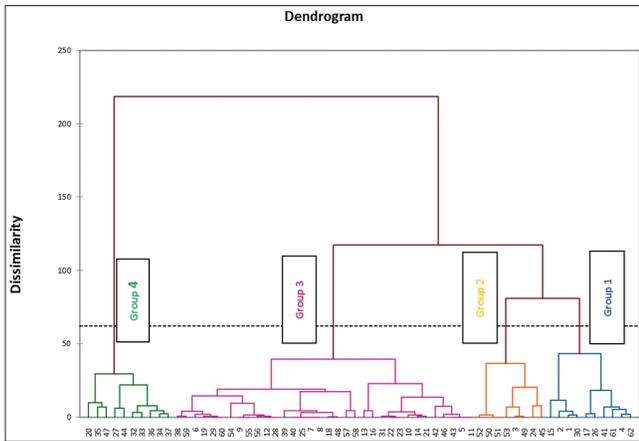


Fig 3. Butchers' groups from the hierarchical clustering

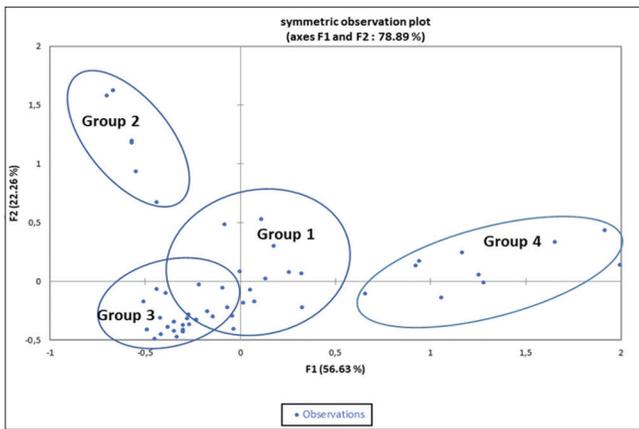


Fig 4. Projection of individuals from 4 groups on the factorial plan (1x2).

quite different than the 3 other groups. After building a contingency table crossing the new variable “group” with all descriptive variables, the chi-square tests were applied to identify the more explaining variables in each group of butchers. All the explaining variables were significant (Table 3). This allowed to identify homogeneous groups well distinguished between them. Finally, the four groups can be described as follows:

Group 1: They presented 16.1% of the respondents. The majority were selling only camel meat. They are mainly located in the urban cities and their age exceeds 30 years old. They get their supplies of live camel, mainly on rangelands or from their own farms. The clandestine slaughter of young camels of both sexes escaped health control. One to 2 carcasses were sold weekly and the clientele was represented by aboriginal households. They were dropped in their butchery or on table at the weekly market of the city, selling pieces of meat-bone mixture (classical cutting) (Fig. 5). The cost per kg of meat was between [610 -775 DA]. The butchers of this group are specialized young camel butchers.

Table 3. Characteristics of 4 groups of butchers

Variable	Modalities	Group 1%	Group 2%	Group 3%	Group 4%
Ba	1	0	12.5	29.4	0
	2	40	75	64.7	30
	3	60	12.5	5.9	70
Bt	1	80	0	0	90
	2	20	100	100	10
MI	1	20	87.5	0	0
	2	80	12.5	100	100
Nsc	1	0	75	8.80	0
	2	0	12.5	11.8	0
	3	80	12.5	70.6	50
	4	20	0	8.80	40
	5	0	0	0	10
Mp	1	60	87.5	94.1	100
	3	40	12.5	5.9	0
Mprm	1	0	25	97.1	10
	2	0	75	0	0
	3	100	0	2.9	90
Ss	1	10	12.5	44.1	90
	2	40	87.5	2.9	0
	3	20	0	44.1	0
	4	30	0	8.80	10
Asd	1	60	75	97.1	0
	2	0	0	0	50
	3	40	25	2.9	50
Co	1	60	75	58.8	100
	2	20	0	5.9	0
	3	20	25	35.3	0
Ct	1	100	100	100	0
	2	0	0	0	10
	3	0	0	0	90
St	1	0	0	2.9	70
	2	100	100	97.1	30
Ssd	1	50	0	97.1	50
	3	50	100	2.90	50
C_kg	1	0	37.5	0	0
	2	0	0	0	60
	3	100	62.5	100	40
Cct	1	0	0	5.90	60
	2	100	100	94.1	40

Ba: Butcher age; Bt : Butcher type; MI: Municipality location; Nsc: Number of slaughtered camels per week; Mp: Marketing place; Mprm: Most purchased variety of red meat; Ss: Supply sources of live camel ; Asd: Age of slaughtered dromedary camel; Co: Consumer origin; Ct: Consumer Type; St: Slaughtering type; Ssd: Sex of slaughtered dromedary camel; C\_kg: Cost price per kg of meat; Cct: Cutting carcass type

Group 2: they present 12.9% of the surveyed butchers; they are middle aged (30 to 50 years) and are mainly located in the rural cities of the study area, selling other type of red meat beside camel meat where ovine meat occupied the first place. For most of them, camel slaughtering was occasional and was achieved out of the slaughterhouse; They usually buy young dromedaries (male and female), mainly from the rangelands, while meat was marketed in their butcheries through traditional carcass cutting. The cost per kg of camel meat varies usually between 610 -775 dinars. Their

clientele consists only of households which, in most cases, are indigenous. They are non-specialized rural butchers.

Group 3: the most abundant type with 54.8% of approached butchers. They were non-specialized butchers where beef occupies for almost all the first place among purchased red meat. They were located only in the urban cities of the study area; livestock market and rangeland were their main sources of supply of live camel. The majority were middle aged (30 to 50 years), They generally slaughtered between 1 to 2 heads per week and market the meat exclusively in their butcheries. They slaughtered in almost all cases the young camel and sales were intended for aboriginal consumers. The fundamental feature of this group lies in the clandestine slaughter while the cost per kg of camel meat varies between 610 to 775 DA. However, almost of the whole group carry out the traditional carcass cutting in which meat was sold as mix of meat, fat and bone (Fig. 6). They are traditional non-specialized urban butchers.

Group 4: They represent 16.1% of the approached butchers and, almost all were selling only camel meat. They

were located only in the urban cities of the study area. They were old butchers; the majority having over 50 years old. The livestock market was their main source of supply of live camels (Fig. 7). They slaughtered many animals at the slaughterhouse (generally between 3 to 5 heads per week). Meat marketing was carried out only in their butcheries by proceeding at same time, modern and traditional carcass cutting (Fig. 8); the marketed meat originates mainly from adult and culling camels. The clientele consisted of either households or aboriginal restaurants. The cost per kg of meat generally varied between [500 and 600 DA]. They are modern and old urban specialized butchers.

## DISCUSSION

This first analysis is limited to the butcher typology. It could not allow to describe all the camel meat sector, but it allowed



Fig 5. Camel butcher on the weekly market in Souf region.



Fig 6. Camel traditional carcass cutting.



Fig 7. Livestock market.

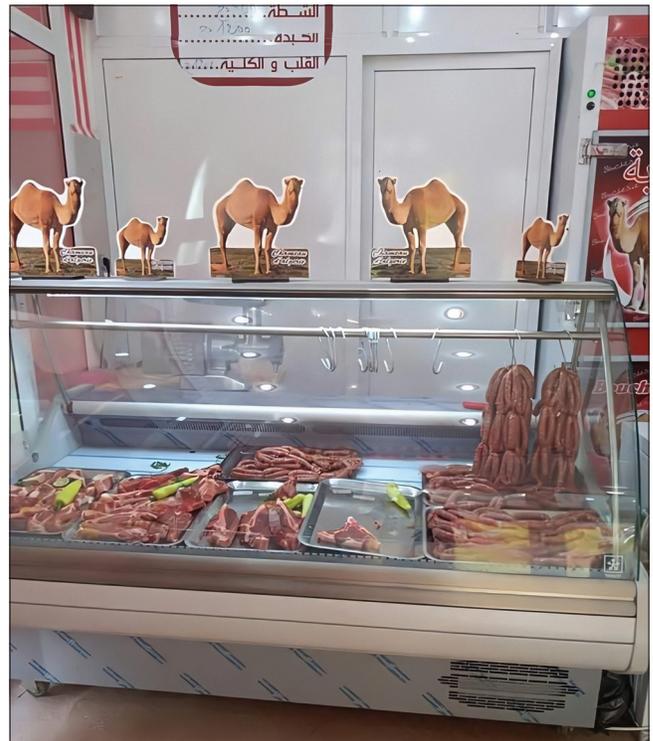


Fig 8. Camel meat Modern butchery

to approach camel meat marketing, the diversity in marketing practices and camel meat marketplace in Souf region.

Regarding sex of camel sold, males are dominating as reported by Oulad Belkhir et al. (2013). According to the butchers, this difference is related to the carcass yield more. For almost all herders, females are kept for breeding purpose and they sell only males (Ben semaoune et al., 2019). Furthermore, Algerian authority prevents slaughtering female camel under 15 years old of age except those judged unproductive (DAS, 2018). For Kadim et al (2008), sex is an important factor in the determination of carcass yield. Females are fatter than males in both camels and other farm animals. In this context, Kadim et al (2008) reported that the proportion of fat in the carcass of female dromedaries is higher than that found in males.

The 4 types of camel butchers described here are significantly different in their practices and emphasized the diversification of marketing practices. The two main factors contributing to the classification of the butchers seem to be their specialization (camel or mixed meat selling) and their location (city or rural areas), the two factors being in relation with the age of the butcher. So, finally, two main types of butchers can be identified: the old urban butchers selling only camel meat and young non-specialized butchers. This disparity could be related to the changes in culinary habits of the local consumers mainly towards beef meat or young camel meat. Thus, each type of butcher is adopting a strategy to adapt their activities to the feeding habits changes. The young butchers face to the increasing demand of beef meat in the study area aim to secure their income of butcher activity by higher diversified source of meat. The predominance of beef meat in the regional market was confirmed by other studies (Oulad Belkhir et al., 2013) who indicated that the consumption of camel meat in the Northern Algerian Sahara remains insignificant compared to that of the cattle. Selmi et al (2017) observed also a marginal consumption of camel meat in Tunisia compared to that of small ruminants. At world level, camel meat represents 0.45% of the red meat consumed (Faye and Bonnet, 2012), but in camel countries, this proportion could vary between 0.01% (Senegal) to more than 60 % in Western Sahara/ South Morocco (Faye et al., 2013).

The butchers in the type 1, identified as specialized young camel butchers, were located mainly in the urban municipalities which has extension to the rural areas. For them supplying of live camel from rangelands gave them more chances to get animal with low prices compared to animal purchased from livestock market. Thus, rangelands were their sources of supply in live camel. Changing

in feeding habits could cause a decrease in camel meat demand which explain the low number of slaughtered camels per week. In the weekly markets occurring in these municipalities, butchers market their meat outdoor on tables.

They were keeping the traditional way of camel meat marketing (classical carcass cutting). Because of low numbers of slaughtered camel per week and in order to increase their earnings, butchers practice clandestine slaughters to avoid additional costs related to formal slaughters and sell the meat in their butcheries and in weekly markets. This group is the most sensitive to the changes in food habits because they have only one type of clientele who looking for meat originated from young camel carcass traditionally cut.

In group 4, the butchers defined as modern and old urban specialized butchers had obviously more experience in camel meat marketing. They slaughtered different age categories of dromedaries and practice different types of carcass cutting to attract and satisfy the maximum of camel meat consumers. This is explained by the high number of slaughtered heads per week and the diversity of their customers. This strategy allows them to resist to the changes in the culinary habits of local consumers and increase their gain from camel meat marketing. They were the oldest ones in camel meat marketing of the study area. They were located mainly in the capital of the province in the biggest popular markets. The capital of the province characterized by the presence of a large number of camel meat burger restaurants where consumers ate culled camel meat which explain the dominance of slaughtered culled animals in this group of butchers. Restaurants buy ground meat to prepare camel meat burger called commonly (*Chawata*) which is very popular meal for the aboriginal consumers (Fig. 9). In a second place, consumers with low-



Fig 9. Camel meat burger restaurant.

incomes buy meat of old dromedaries because the price compared to the young camel and other type of red meat is more attractive. Popular markets were their main source of supply in various products, cheap camel meat being one of such low-price product. These results corroborate those reported by Sadoud et al (2016) who indicated that old camels are consumed because of their attractive price compared to the youngest ones.

Butcherries of modern and old urban specialized butchers were located nearby Livestock market (3 Km) and the abattoir (2 km) which explain the existence of formal slaughter and livestock market as main source of supply in live camels. In addition, big carcass of adult and culled camels makes the slaughtering operation very hard to handle which push the butchers to take their animals to the abattoir.

The groups 2 (non-specialized rural butchers) and 3 (traditional non-specialized urban butchers) were young butchers more adapted to the changes in the culinary habits of the local consumers. Their essential benefit is based on the marketing of other types of red meat mainly beef which is the most preferred meat. For them, camel meat marketing is a secondary activity in order to cover different types of consumers of red meat, notably in rural areas where the interest for camel meat is maintained. For rural non-specialized butcher, consumers in rural area preferred sheep meat than other type of red meat because of its taste. For them camel meat was used only to prepare traditional meals cooked in certain occasions. In addition, slaughterhouses being not available in these areas, it explains the existence of clandestine slaughter. Livestock market being located in the province city far away from rural areas, butchers got their supplies of live camel mainly from rangelands. Almost all population was autochthone explaining the consumption of camel meat by aboriginal household. Regarding urban non-specialized butchers, they were spread over all the urban cities. These later having generally extension to rural area, the butchers can get live camel from livestock market or rangelands. Beef was preferred meat for urban consumers. According to the butchers, camel meat was purchased mainly to prepare traditional food specially (couscous). For these butchers, beef meat had organoleptic advantages explaining the preference by customers. The ratio meat/bone in camel meat is less than that in beef. Moreover, shrinkage during cooking is higher in camel than beef meat) as confirmed by the study of Mohamed Ali (2016) who indicated that camel meat has more bone and lose about 50% of its volume during cooking. In addition, the price of beef meat is lower than sheep meat by 300 DA but it is 100 DA more expensive than camel meat. However, the consumers found that camel meat was

expensive due to its higher part of bones and its cooking loss, and they preferred to pay for beef to get more meat and less shrinkage.

Despite the presence of slaughterhouses nearby butcherries of group 1 and 3, butchers practice informal slaughters to avoid additional costs. They found that young camel had small carcasses easier to handle during the slaughtering operations.

Slaughtering are achieved in abattoirs (G4), but many butchers proceed to illegal slaughtering (G1, G2, G3) as already emphasized by Adamou (2011). Slaughtering young camel in G1, G2, G3 is due to their customer's preferences. Indeed, those consumers prefer tender meat, easier to cook. Unlike that of aged camels, these results corroborate those reported by (Abdelhadi et al., 2013). Bone-containing meat is the most purchased and preferred by consumers in the different identified groups because of its reasonable price compared to modern carcass cutting these results corroborate those reported by (Sadoud et al., 2016). This explains the dominance of classical butchers (traditional carcass cutting). In the study area, Camel meat price depends on age and carcass cutting type. For traditional carcass cutting, young camel meat price was 150 to 200 DA more expensive than culling ones, meat of this latter being sold between 600 to 650 per Kg. Otherwise, meat without bones was sold 300 DA more expensive than meat with bone and fat. Ground meat and sausage come only from culling animal and they were sold 900 DA and 800 DA per Kg respectively.

The cost price of a Kg of camel meat is high in the category of butchers slaughtering young dromedaries compared to older animals, the meat of the latter being less sought by consumers and butchers, because considered as hard and low-quality meat. The ability of butchers to estimate the carcass weight of the live dromedary plays a leading role in determining the cost of meat (Mohamed Ali, 2016).

Moreover, butchers in types G1 and G4 could experience financial constraints related to the changes in culinary habits of the population, which can reduce their gain of camel meat marketing and could cause the disappearance of butchers selling only camel meat over time. At reverse, butchers G2 and G3 are less sensitive to these changes because their activity is based on the marketing of several types of red meat.

Consumption of camel meat for all identified butchers remains almost aboriginal and at the household level in the study area. These results corroborate those reported by Kamoun (2011) and Selmi et al (2017).

Group 1 (16.1%) – Group 2 (12.9%) – Group 3 (54.8%) – Group 4 (16.1%).

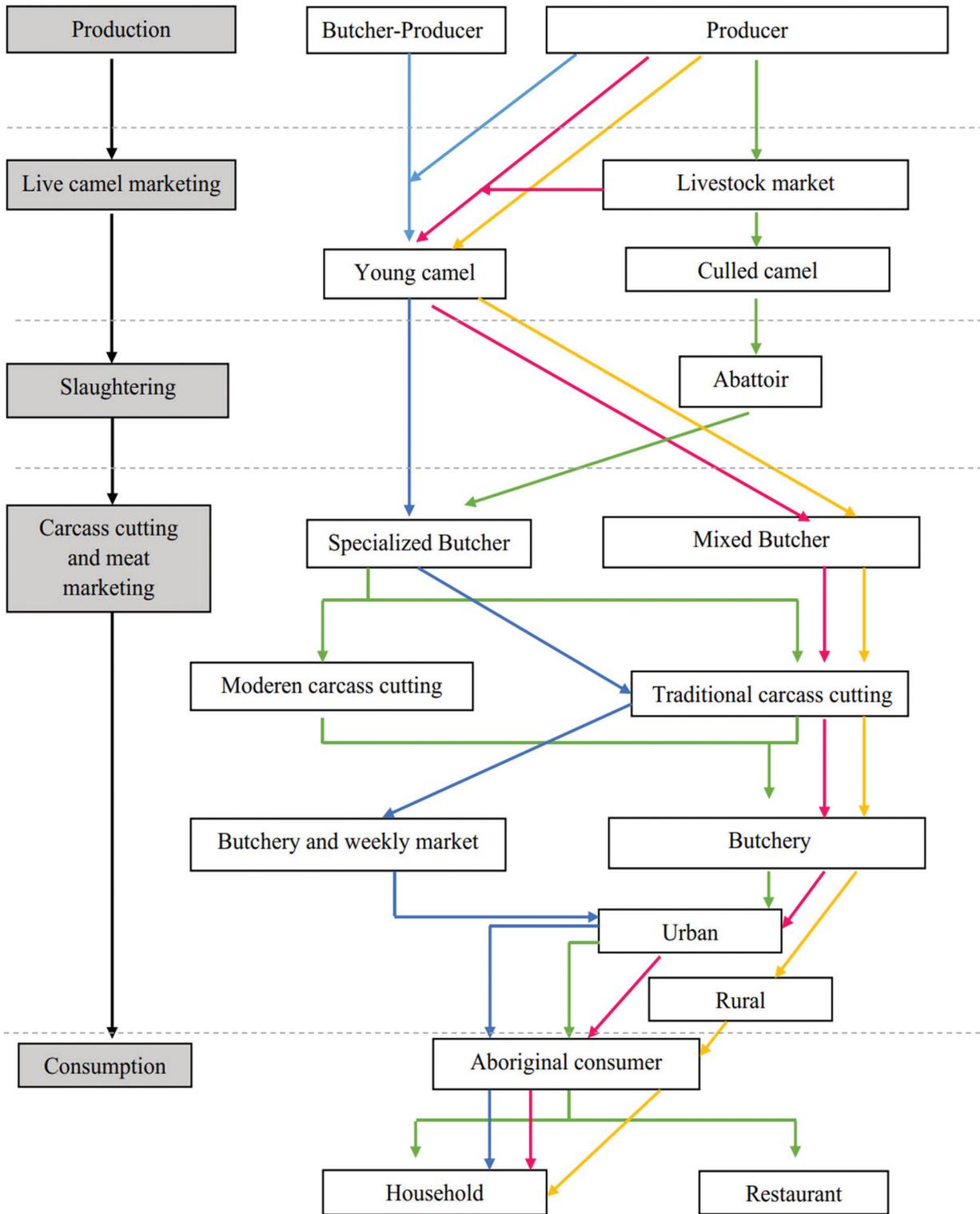


Fig 10. Different camel meat circuits in the Souf region according to the types of butchers

The place of each type of butcher in the camel meat commodity chain is described in Fig. 10.

## CONCLUSION

The survey achieved among the butchers of the Souf Region in Algeria allowed to clearly identify homogenous groups based on their marketing practices. Apparently, the age of the butcher was one of the determinant characters to explain their level of integration in the formal camel meat sector and their degree of specialization in the camel meat marketing. Camel meat, which is sometimes described as a meat of the future in the arid regions, remains however weakly commercialized, mainly for indigenous consumption, far away behind beef meat consumption. Moreover, studies relating to the camel meat sector, across these different segments, have to be implemented for better understanding the interactions between camel producers and consumers' expectations. A clear description of the camel meat sector organization and its functioning could to overpass the bottlenecks for promoting its consumption and give it its true place in its desert environment.

### Author contribution

BZ has achieved the survey, the statistical analysis and written the first draft of the paper, SA has supervised the field work and contribute to the writing, BF has contributed to the interpretation of the results and to the final writing of the paper.

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