

## Acceptability of chevon from kids, yearling goats and mature does of indigenous South African goats: A case study

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### Abstract

Consumer sensory evaluations of oven-roasted goat and sheep *m. longissimus dorsi* samples were conducted in two series to determine the acceptability of chevon from indigenous South African goats to consumers. Chevon samples were from goat carcasses of known description. In series I, castrate and female goats and female sheep, all with 2 – 6 permanent incisors, were compared. Castrate males were significantly heavier and yielded heavier carcasses than the female goats. Nonetheless, the two groups did not differ significantly in carcass and meat characteristics. Cooking losses from mutton samples were significantly higher than losses from chevon from female goats only. In series II, male kids (milk teethed), old does (8 permanent teeth) and sheep (2 – 6 permanent teeth) were compared. Does were heavier at slaughter, but the mean carcass weight did not differ significantly from that of the kids. There were no significant differences between the does and kids in carcass tissue composition and sarcomere lengths. The pH<sub>u</sub> of does was significantly higher than that of kids. Cooking losses from mutton and chevon samples in series II did not differ significantly. Amongst the consumer characteristics, level of education was the most important determinant of consumer acceptance of the sensory attributes and intended frequency of consumption in both series. Population group was a significant factor in the judgement of the more diverse meats of series II only. Sensory evaluations indicate that all meat types were highly acceptable to the consumers who on average were willing to eat any of the meats at least once a week. The study indicated that chevon from indigenous South African goats is acceptable to consumers and may be as acceptable as mutton, provided that the meat is from goats of about two years of age or younger.

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**Keywords:** Chevon, indigenous goats, consumer sensory evaluation, acceptability, consumer preferences

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### Introduction

Most of the earlier sensory studies of chevon employed trained taste panels and generally showed that chevon and chevon products were of high quality (Breukink & Casey, 1989; Schönfeldt *et al.*, 1993a; b; Tshabalala *et al.*, 2003). These findings are in line with objective evaluations of the meat, which have consistently proved that it can be of satisfactory quality (e.g. Smith *et al.*, 1978; McKeith *et al.*, 1979; Swan *et al.*, 1998; Kannan *et al.*, 2001). Trained sensory panels function as laboratory instruments, and hence their deductions usually match results of instrumental evaluations of chevon quality. Notwithstanding these objective reports, acceptance of chevon to 'untrained' consumers of the meat is also important (Lawless & Heymann, 1998). Therefore, while laboratory methods can provide precise and reliable information concerning technical and sensory attributes (intensity scores), only consumers can provide information about the acceptability of the meat (Muñoz & Chambers IV, 1993). Thus, in the present study, sensory evaluation of chevon samples was conducted by consumer panels, in order to determine the acceptability of chevon from indigenous South African goats. The evaluations of the chevon samples were carried out in comparison to mutton, which is more readily available and better known in the South African meat market. The study may also render valuable information in terms of the potential development of the presently small chevon market in South Africa.

## Materials and Methods

Fifteen each castrated and female goats with 2 – 6 permanent incisors, approximately one to two years old (Horgan *et al.*, 1988; Singh & Saini, 1998), were used in series I of comparisons. Six male kids with no permanent incisors and nine mature does with full- mouth of permanent incisors were used in the second series of comparisons (series II). In each of the series, chevon samples taken from the *m. longissimus dorsi* (LD) were compared to mutton LD samples, cut from 12 loins of ewes with 2 - 6 permanent incisors. The loin samples were obtained from a commercial retailer, from carcasses that were hung in the chillers for 48 h. The samples were vacuum-packed and stored frozen at -20 °C for sensory analysis.

The young goats ( $\leq$  six permanent incisors) were selected because they are the ideal age at which goats should be sold, and the mature does because they are the most commonly available group at most goat markets (Simela *et al.*, 1999).

The management of the experimental goats up to and during slaughter, sampling and techniques for determining ultimate pH ( $pH_u$ ), sarcomere lengths and glycolytic potential are described by Simela *et al.* (2004a; b). Cold carcass weight was measured 24 h post-mortem, after chilling. Total lean, bone and carcass fat were determined by total dissection of the right half carcass. Intramuscular fat was determined using the conventional Soxhlet extraction procedure of the AOAC (1990).

A panel of 193 consumers from Potchefstroom, in the North-West Province, who had previously eaten and had no objections to chevon and lamb/mutton, was recruited on a voluntary basis through telephonic or personal contact. The profile of the panel in terms of population category (black or white), gender (male or female), age (21 – 30, 31 – 40, >40 years old) and level of education (primary, secondary, tertiary) was recorded (Table 1). There were 84 consumers in series I and 109 in series II of analyses. No Asiatic groups were included in the study, because the goats had not been slaughtered according to some of their religious requirements. In each series, two 15-minute sessions were conducted once a week under controlled conditions in a sensory evaluation laboratory.

**Table 1** Distribution of the consumers' category, gender, age and level of education within the first and second series of sensory analysis

		Series I	Series II
Number of consumers per series		84	109
% per population category	Black	48%	77%
	White	52%	32%
% per gender group	Female	55%	38%
	Male	45%	62%
% per age group	21-30 years	44%	37%
	31-40 years	23%	31%
	> 40 years	33%	32%
% per level of education group	Primary	11%	29%
	Secondary	23%	38%
	Tertiary	67%	33%

The goat and sheep LD samples were oven-roasted at 165 °C to an internal temperature of 73 °C, cut into 4 mm thick slices, and while still warm, randomly allotted and served coded to the consumer panel. The samples were evaluated in sequence according to an incomplete balanced block design. Three sensory tests were conducted in sequence. First the panellists rated the acceptability of flavour, aroma and tenderness on a

five-point hedonic scale, ranging from “extremely acceptable” (5), “acceptable” (4), “neutral” (3), “not acceptable” (2) to “extremely unacceptable” (1) (Scholtz & Bosman, 2005). The five-point scale used in this study is balanced, having an equal number of positive and negative categories such as the 9-point hedonic scale and is often used in consumer studies to accommodate different language groups (Bosman *et al.*, 1997; Scholtz & Bosman, 2005).

Secondly, a preference test followed, in which the consumers had to indicate whether or not they preferred one of the meat samples to the other, and if so, which one. The advantage of this non-forced preference test was that there may be consumers who do not have a preference between the samples, thus enabling them to indicate that they equally liked or disliked the samples (Lawless & Heymann, 1998).

Finally, the panellists indicated their consumption intent for each sample using a five-point food action scale with response categories “eat it very often – everyday” (score 5), “eat it often – once a week” (4), “eat it occasionally – once a month” (3), “eat it only when no other food is available” (2) and “never eat it” (score 1). Panellists rinsed their mouths with water before and between tasting the samples (Scholtz & Bosman, 2005).

Comparisons of carcass and meat quality characteristics were made between the goat groups in each of the two series using Wilcoxon’s ranked sum test (BMDP, 1983). The Kruskal-Wallis’ test (BMDP, 1983) was used to compare cooking losses of the mutton and chevon samples in each of the series.

The main effects of gender, age, population category and level of education on the consumers’ acceptance of aroma, tenderness, flavour and overall acceptability were tested, using multifactorial analysis of variance (ANOVA) by means of the General Linear Models (GLM) procedure in SAS (SAS, 1996). Overall acceptability was calculated as the average of the acceptability ratings of the three sensory attributes for each consumer. ANOVA procedures were also used to compare the sensory acceptability ratings and overall acceptability of each meat type. Where the F-test was significant, Tukey’s test was used for the comparison of means.

Kruskal-Wallis’ test was also used to compare consumption intent scores of different consumer categories as well as for the different meat types within each category. Spearman’s correlations between hedonic scores and consumption intent were computed. Multiple comparisons of proportions were performed to compare preference for each of the meats within each series (Miller, 1981). Stepwise discriminant analysis was performed to determine the sensory acceptability attributes that drove preference.

## Results

In series I (Table 2), castrated goats with 2 – 6 permanent teeth were heavier at slaughter ( $P = 0.017$ ) and yielded cold carcasses that were 2.45 kg heavier ( $P = 0.047$ ) than the females. During chilling, carcasses of the castrates lost about 0.57% less weight than those of the females ( $P = 0.038$ ). The two sex groups, however, did not differ ( $P > 0.05$ ) in terms of any other carcass characteristic, sarcomere length, glycolytic potential or pH<sub>u</sub>.

In series II (Table 3), does were 34% heavier than the kids at slaughter ( $P = 0.007$ ). However, because the does dressed out 6.23% less than the kids ( $P = 0.002$ ) and lost 0.51% more weight during chilling ( $P = 0.029$ ), there were no significant differences ( $P > 0.05$ ) between the carcass weights of the two groups. The mean cold carcass weight was  $16.13 \pm 2.77$  kg.

The separable tissue proportions of the carcasses of does and kids were similar ( $P > 0.05$ ). Both groups had high pH<sub>u</sub> values ( $> 5.8$ ), but the mean for the does was 0.21 units higher ( $P = 0.015$ ) compared to that of the kids, although the glycolytic potential of the LD muscles did not differ significantly.

Mean percentage cooking losses from mutton, chevon from female goats and chevon from castrated goats in series I were  $22.6 \pm 4.94\%$ ,  $16.2 \pm 5.48\%$  and  $19.1 \pm 4.98\%$ , respectively. Losses from mutton samples were significantly higher than the losses from chevon samples taken from female goats ( $P = 0.019$ ). In series II, percentage cooking losses from mutton, chevon from does and chevon from kids were  $26.15 \pm 4.4\%$ ,  $20.2 \pm 5.02\%$  and  $22.4 \pm 6.21\%$ , respectively. These values did not differ significantly ( $P > 0.05$ ).

The effects of consumer gender, age and level of education on the acceptability of the sensory attributes for series I are presented in Figure 1. Since black and white consumers in series I did not differ in their acceptance of the sensory attributes ( $P > 0.05$ ), the effects of population category are not presented in Figure 1. The black and white consumers rated all the attributes as “acceptable”, with mean hedonic scores ranging between  $3.8 \pm 0.8$  and  $4.0 \pm 1.0$ . Female consumers awarded higher scores ( $P < 0.05$ ) than male

**Table 2** Physical characteristics of 2 – 6 teeth castrate and female South African indigenous goats, used in sensory evaluations (Means  $\pm$  s.d.)

Characteristics	Castrates	Females	P-value
	N = 15	N = 15	
Carcass:	Means $\pm$ Standard deviations		
Slaughter weight (kg)	36.97 $\pm$ 5.76	31.93 $\pm$ 4.35	0.017
Cold carcass weight (kg)	15.53 <sup>a</sup> $\pm$ 2.98	13.08 <sup>b</sup> $\pm$ 2.81	0.047
Weight loss during chilling (%)	2.52 <sup>a</sup> $\pm$ 0.75	3.09 <sup>b</sup> $\pm$ 0.84	0.038
Total lean %	63.66 $\pm$ 3.50	63.37 $\pm$ 2.95	0.967
Total bone %	20.75 $\pm$ 2.09	21.58 $\pm$ 2.59	0.431
Total carcass fat %	14.78 $\pm$ 4.95	14.26 $\pm$ 4.17	0.481
Intramuscular fat %	4.07 $\pm$ 1.00	4.03 $\pm$ 1.73	0.683
24-hr sarcomere lengths ( $\mu$ m)	1.85 $\pm$ 0.11	1.81 $\pm$ 0.22	0.772
Glycolytic potential ( $\mu$ mol/g)	110.89 $\pm$ 26.08	97.97 $\pm$ 16.55	0.102
Ultimate pH	5.89 $\pm$ 0.14	5.86 $\pm$ 0.11	0.678

Means with different superscripts 'a' or 'b' differ significantly (P < 0.05)

**Table 3** Physical characteristics of South African indigenous goats' kids and does, used in the sensory evaluations (means  $\pm$  s.d.)

Characteristics	Kids	Does	P-value
	N = 6	N = 9	
Carcass:	Means $\pm$ Standard deviations		
Slaughter weight (kg)	30.50 $\pm$ 5.78	40.94 $\pm$ 3.29	0.007
Cold carcass weight (kg)	14.61 $\pm$ 2.68	17.16 $\pm$ 2.46	0.112
Weight loss during chilling (%)	1.03 <sup>b</sup> $\pm$ 0.47	1.54 <sup>a</sup> $\pm$ 0.38	0.029
Total lean%	58.22 $\pm$ 6.13	56.37 $\pm$ 3.43	0.596
Total bone %	19.12 $\pm$ 1.73	18.09 $\pm$ 2.62	0.216
Total carcass fat %	21.84 $\pm$ 7.07	24.50 $\pm$ 2.70	0.680
Intramuscular fat %	4.38 $\pm$ 1.61	6.74 $\pm$ 2.97	0.189
24hr Sarcomere lengths ( $\mu$ m)	1.84 $\pm$ 0.24	1.87 $\pm$ 0.15	0.860
Glycolytic potential ( $\mu$ mol/g)	89.75 $\pm$ 14.60	81.73 $\pm$ 24.68	0.596
Ultimate pH	5.92 <sup>b</sup> $\pm$ 0.10	6.13 <sup>a</sup> $\pm$ 0.15	0.015

Means with different superscripts 'a' or 'b' differ significantly (P < 0.05)

consumers for the acceptability of tenderness, flavour and hence overall acceptability (Figure 1 (i)). Scores by female consumers for these three attributes were in the “acceptable” range (4), while those by males were in the neutral or “neither acceptable nor unacceptable” range (3). Acceptance of aroma and overall acceptance by the 21 to 30 years old group were lower (P < 0.05) compared to ratings by the older consumers

by at least 0.3 units in each case (Figure 1(ii)). Mean scores for tenderness and flavour were not affected by the age of the consumers ( $P > 0.05$ ). Mean scores for flavour ranged from  $3.8 \pm 1.0$  to  $4.1 \pm 1.0$  and tenderness scores between  $3.8 \pm 0.9$  to  $4.0 \pm 0.9$ . Consumers with up to primary level of education generally awarded high scores to acceptability attributes (Figure 1(iii)). The mean scores ranged from  $4.4 \pm 0.8$  for aroma,  $4.2 \pm 0.9$  for tenderness to  $4.5 \pm 1.0$  for flavour, and hence  $4.4 \pm 0.7$  for overall acceptability. The scores were higher ( $P < 0.001$ ) than those awarded by consumers with a tertiary level of education for aroma ( $3.6 \pm 0.8$ ), flavour ( $3.8 \pm 0.9$ ) and overall acceptability ( $3.8 \pm 0.7$ ). The group with primary level of education differed significantly from that with secondary level of education in the rating of flavour ( $4.0 \pm 0.7$ ) and overall acceptability ( $3.8 \pm 0.7$ ) only.

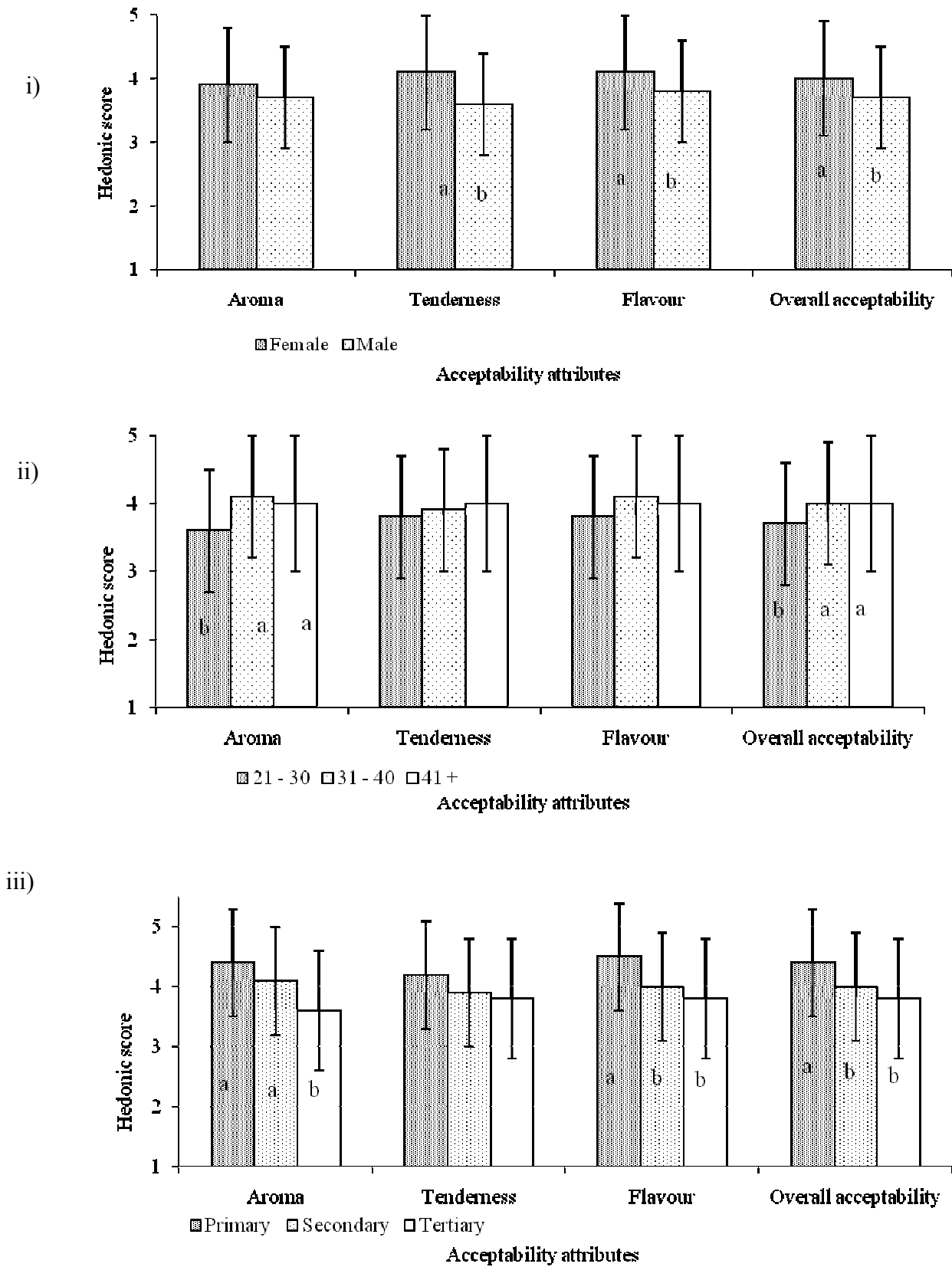
The majority of consumers (60.7%) in series I indicated that they would eat any of the meats as frequently as once a week or more. Ratings for the intended frequency of consumption were affected by age ( $P = 0.028$ ) and level of education of the consumers ( $P = 0.0001$ ). A smaller proportion (51.3%) of consumers between 21 and 30 years of age would consume any of the meats at least once a week compared to 68.4% of the 31 to 40 year olds and 67.8% of the consumers over 40 years old. A high proportion of consumers with a primary level of education (81.5%) would consume any of these meats at least once a week. This proportion declined with increase in the level of education to 73.7% of those with secondary and 53.0% of those with tertiary education. A sizeable proportion of those with tertiary education (35.1%) would consume any of these meats occasionally (about once a month).

In series II, acceptability ratings of sensory attributes varied with population, gender, age and level of education categories of the consumers (Figure 2). Black consumers (Figure 2(i)) awarded higher acceptability scores for all the sensory attributes than white consumers ( $P < 0.05$ ). The difference was large (+0.5) and highly significant between the mean tenderness scores and smaller between mean flavour and mean aroma (+0.2) acceptability scores. Mean overall acceptability scores between the two groups differed by 0.3 ( $P = 0.004$ ).

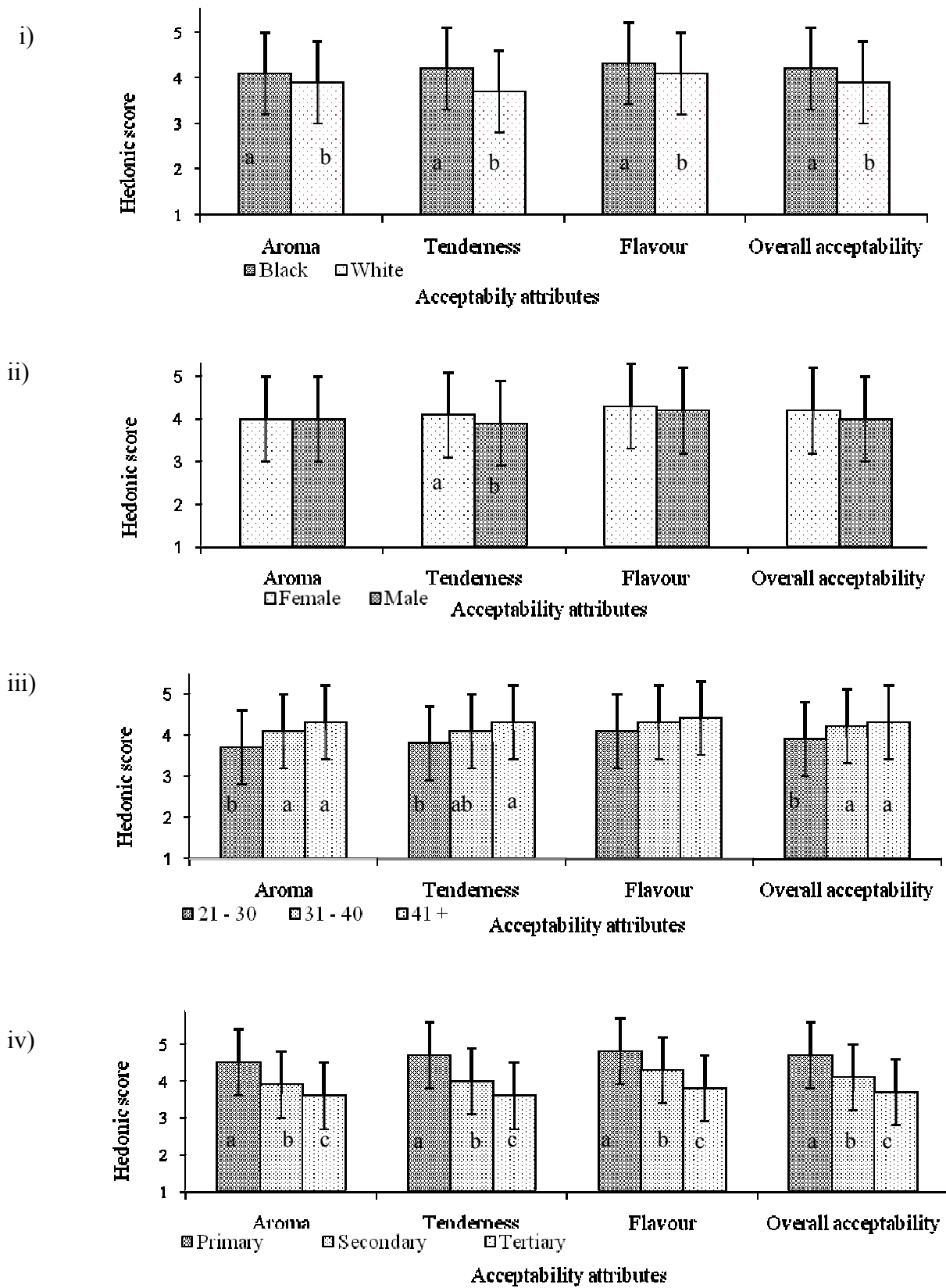
As in series I, tenderness acceptability scores of female consumers in series II were also higher ( $P = 0.020$ ) than those of male consumers (Figure 2(ii)). However, there were no differences in the acceptability ratings of aroma, flavour and overall acceptability ( $P > 0.05$ ). As in series I, consumers who were between 21 and 30 years old, generally rated acceptability of the sensory attributes lower than the older groups (Figure 2(iii)). The younger group's ratings for aroma and overall acceptability were at least 0.3 units lower ( $P < 0.001$ ) than the ratings by the groups above 30 years old. Acceptability ratings for tenderness differed between the 21 to 30 years old and over 40 years old groups only by 0.5 units. There were, however, no consumer age effects ( $P > 0.05$ ) on the ratings for flavour acceptability. Level of education (Figure 2(iv)) was highly significant in the acceptability ratings of all sensory attributes in series II. Consumers with tertiary education awarded the lowest acceptability scores for each attribute ( $3.6 \pm 0.9$  for aroma,  $3.6 \pm 0.9$  for tenderness,  $3.8 \pm 0.8$  for flavour and overall acceptability of  $3.7 \pm 0.7$ ). These means were 0.3 to 0.5 lower than the ratings by consumers with secondary level of education, whose scores were in turn 0.5 to 0.7 lower than those of consumers with primary level of education.

All consumer attributes affected the food action ratings for frequency of consumption in series II. More black (82.2%) than white consumers (62.5%) indicated that they would eat any of these meats at least once a week ( $P = 0.0001$ ). A higher proportion of male consumers (80.9%) would also eat any of these meats as frequently as weekly or more, compared to females (69.1%). The older the consumers, the higher the intended frequency of consumption ( $P < 0.0001$ ) was. The frequencies for once a week or more were 70.8%, 73.6% and 85.7%, respectively, for consumers who were 21 - 30 years old, 30 - 40 years old and older than 40 years. Conversely, the higher the level of education, the lower the intended frequency of consumption for all the meats ( $P < 0.001$ ) was. Virtually all consumers with primary level of education (94.8%) would consume any of these meats at least once a week. Amongst consumers with secondary and tertiary level of education, respectively 78.9% and 57.4% of them would consume any of these meats at least once a week. In the latter case, 35.2% of consumers would eat any of these meats occasionally (once a month). There were no effects of consumer gender, age, population group and level of education ( $P > 0.05$ ) on preference for any of the three types of meat presented to consumers in each series.

In series I, there was a tendency to rate the tenderness of mutton more acceptable ( $P = 0.055$ ) than that of chevon from either the castrates or female goats (Table 4). However, there were no significant differences in the acceptability of aroma and flavour of chevon and mutton to consumers ( $P > 0.05$ ). Consequently there



**Figure 1** The effect of consumer i) gender, ii) age and iii) level of education on the ratings of sensory attributes of meat samples employed in series I of sensory evaluations. (Hedonic scores for aroma, tenderness, flavour and overall acceptability range from 5 (extremely acceptable) to 1 (extremely unacceptable) (Bars within a graph with different letters ‘a’ or ‘b’ differ significantly (P <0.05)).



**Figure 2** The effect of consumer i) population category, ii) gender, iii) age and iv) level of education on the ratings of sensory attributes of meat samples employed in series II. (Hedonic scores for aroma, tenderness, flavour and overall acceptability range from 5 (extremely acceptable) to 1 (extremely unacceptable) (Bars within a graph with different letters 'a', 'b' or 'c' differ significantly ( $P < 0.05$ )).

**Table 4** Acceptability of, consumption intent and preference for chevon from 4 to 6 teathed castrated and female goats compared to mutton from ewes of similar age

	Castrated goats	Female goats	Mutton	s.e.	P-value
Acceptability of aroma <sup>x</sup>	3.9	3.7	3.9	0.096	0.474
Acceptability of tenderness <sup>x</sup>	3.8	3.8	4.1	0.100	0.055
Acceptability of flavour <sup>x</sup>	4.0	3.9	3.9	0.106	0.536
Overall acceptability <sup>x</sup>	3.9	3.8	4.0	0.080	0.305
Consumption intent <sup>y</sup>	3.8	3.8	3.8	0.119	0.886
Proportion of preference <sup>z</sup>	0.2	0.2	0.4		

<sup>x</sup> Hedonic scores ranged from 5 (extremely acceptable) to 1 (extremely unacceptable).

<sup>y</sup> Food action ratings ranged from eat it daily (5), once a week (4), once a month (3), when no other food is available (2), to never (1).

<sup>z</sup> Eighteen percent of the consumers did not prefer any of the meat above the others.

were no differences in the overall acceptability of the three meat types ( $P > 0.05$ ). Neither were there any differences in the intended frequency of consumption ( $P > 0.05$ ). Mean ratings for the acceptability of each of the sensory attributes for consumption intent were high. The ratings averaged between 3.7 and 4.0 for aroma, tenderness, flavour and overall acceptability. The ratings imply that the consumers found each of the three meat types 'acceptable' and would eat any of them as often as once a week.

Acceptability of all sensory attributes correlated positively with consumption intent in series I ( $P < 0.001$ ). The Spearman's correlation coefficients for aroma, tenderness, flavour and overall acceptability with consumption intent were, respectively 0.41, 0.44, 0.48 and 0.55.

In series I, there were no differences ( $P > 0.05$ ) in the preference for any of the meat types. The proportions of consumers by preferred meat type were 34% for mutton, 24% for chevon from female goats and 24% for chevon from castrated goats. Eighteen percent preferred none of the meats above the others.

**Table 5** Acceptability of, consumption intent and preference for chevon from male kids and old does compared to mutton from 4 – 6 permanent teathed ewes

	Kids	Old does	Mutton	s.e.	P-value
Acceptability of aroma <sup>x</sup>	3.9 <sup>b</sup>	3.9 <sup>b</sup>	4.2 <sup>a</sup>	0.091	0.013
Acceptability of tenderness <sup>x</sup>	4.1	4.0	4.2	0.093	0.305
Acceptability of flavour <sup>x</sup>	4.2	4.2	4.4	0.086	0.050
Overall acceptability <sup>x</sup>	4.1 <sup>ab</sup>	4.0 <sup>b</sup>	4.3 <sup>a</sup>	0.076	0.033
Consumption intent <sup>y</sup>	4.1 <sup>ab</sup>	4.0 <sup>b</sup>	4.3 <sup>a</sup>	0.081	0.021
Proportion of preference <sup>z</sup>	0.2 <sup>ab</sup>	0.1 <sup>b</sup>	0.4 <sup>a</sup>		

<sup>a,b,c</sup> Means in the same row with different superscripts differ significantly ( $P < 0.05$ ).

<sup>x</sup> Hedonic scores ranged from 5 (extremely acceptable) to 1 (extremely unacceptable).

<sup>y</sup> Food action ratings ranged from eat it daily (5), once a week (4), once a month (3), when no other food is available (2), never (1).

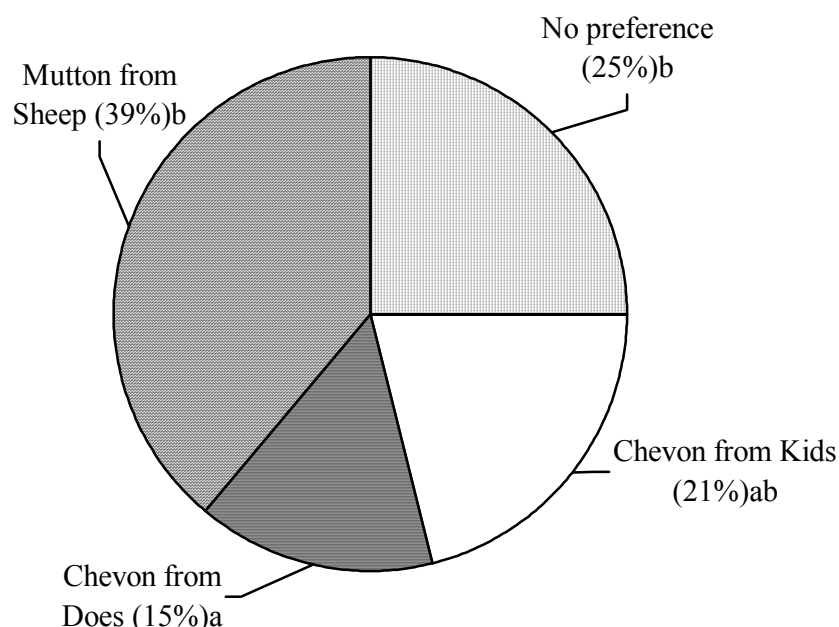
<sup>z</sup> Twenty five percent of the consumers did not prefer any of the meat above the others.



For samples in series II (Table 5), consumers rated aroma of mutton more acceptable than that of chevon from the old does and kids ( $P = 0.013$ ). There was a strong tendency ( $P = 0.05$ ) for the flavour of mutton to be more acceptable than that of chevon. However, there were no differences ( $P > 0.05$ ) between the samples for the acceptability of tenderness. Overall, mutton was more acceptable than chevon from old does but not that from kids ( $P = 0.039$ ). Ratings of the acceptability of all the sensory attributes did not differ between the does and kids ( $P > 0.05$ ).

Intended frequency of consumption was affected by meat type in series II ( $P = 0.017$ ). Consumers would eat mutton more often than chevon from old does, but not more often than chevon from kids. Consumption intent for chevon from kids and that from does did not differ ( $P > 0.05$ ). Ratings of sensory attributes indicated that all the meats were acceptable. Most consumers would eat each of the meat types as often as once a week.

The Spearman's correlation coefficients for aroma, tenderness, flavour and overall acceptability with consumption intent were, respectively 0.52, 0.51 0.56 and 0.62 in series II of sensory analyses. In both series, the acceptability of flavour had a stronger correlation with consumption intent than either tenderness or aroma. In series II, preference for mutton and chevon from kids did not differ ( $P > 0.05$ ), but consumers preferred mutton above chevon from old does ( $P < 0.05$ , Figure 3). Twenty five percent of the consumers neither liked nor disliked any of the meats more than the others.



**Figure 3** Distribution of consumer preferences for different meat types. (Preferred meat types with different letters 'a' or 'b' differed significantly).

**Table 6** Classification of preferences for chevon from 2 – 6 teethed castrated and female goats and mutton from sheep of similar age, using discriminant variables\*

Group	% correctly classified	Number of preferred samples correctly classified			
		Castrates goats	Females goats	Sheep	None
Castrates goats	55.0	11	3	2	4
Females goats	70.0	0	14	2	4
Sheep	64.3	3	2	18	5
None	53.3	3	3	1	8

\* The discriminant variables were acceptance of tenderness of chevon from female goats, acceptance of flavour of chevon and acceptance of mutton aroma.

Stepwise discriminant analysis, to determine the variables that influenced preference in order of importance, was highly significant in both series and validity of back classification for these attributes was good. In series I, tenderness of chevon from the female goats was the most discriminating acceptance variable along with acceptance of flavour of both chevon types and of the aroma of mutton. Using the four variables, 61.4% of the samples could be correctly classified (Table 6).

In series II, aroma of chevon from kids was the most discriminating acceptance factor, along with aroma of chevon from does, tenderness of chevon from does and mutton, and flavour of mutton. The five variables could be used to correctly classify 67% of the samples (Table 7).

**Table 7** Classification of preferences for chevon from milk-teethed male kids and old does and mutton from 2 - 6 teethed sheep, using discriminant variables\*

Group	% correctly classified	Number of preferred samples correctly classified			
		Kids	Does	Sheep	None
Kids	52.2	13	4	3	4
Does	62.5	2	10	0	4
Sheep	65.1	7	2	30	5
None	74.1	3	2	2	20

\* The discriminant variables were acceptance of aroma of chevon from does, tenderness of chevon from does and mutton and flavour of mutton.

In both series, no single attribute was identified as influencing preference for any of the samples. This could be due to the fact that all the sensory acceptance attributes of all the samples were rated as highly acceptable on the scale and that the differences in acceptability between the samples were very small.

## Discussion

Consumer level of education was clearly the most influential factor on consumer acceptance of the sensory attributes and consumption intent in the present study. This factor may be equated to level of income to some extent (Dawkins *et al.*, 2000) and possibly to the degree of experience with various types of foods. The findings imply that highly educated consumers are more particular about accepting sensory attributes than groups with a lower level of education. Age and gender were statistically important, but population category was relevant only in series II of analysis, where the meat types were markedly different in quality.

Generally all sensory attributes were highly acceptable, with mean acceptability scores that ranged between 3 and 4. Consumption intent was considerably high too, with all groups reaching a median food action rating of 4.0, which denoted that consumers in either series would eat any of the meat types at least once a week.

The 2 - 6 teeth castrated male and female goats had similar carcass and meat quality attributes. In line with that, consumers found meat samples from either sex group equally acceptable to the extent that preferences for the chevon from the two sources were equal. Except for a slight tendency for the tenderness of mutton to be rated more acceptable than that of chevon, chevon of goats with 2 - 6 permanent teeth compared very well to mutton in terms of acceptability of the sensory attributes, consumption intent and preference by the consumers. Differences between mutton and chevon in tenderness are often reported (e.g. Pike *et al.*, 1973a; Griffin *et al.*, 1992; Schönfeldt *et al.*, 1993a; Tshabalala *et al.*, 2003). The differences have been ascribed to caprine muscles tending to have a coarser structure with thicker myofibres than ovine muscles (Gaili *et al.*, 1972; Gaili & Ali, 1985). Secondly, because the meat is much leaner, the sensation of tenderness due to intramuscular fat content is limited for chevon (Schönfeldt *et al.*, 1993a). However, aside from the slight difference in acceptability of tenderness between mutton and chevon in the present study, both meat types were equally acceptable to consumers when sheep and goats of similar age were compared.

The second series comparison was designed to include goats that should be used in the chevon market

(milk-teethed goats of about one year old) and those that commonly dominate the market (old, culled does). All the goats that were used in series II of sensory evaluation were conditioned on the University Farm prior to slaughter and hence were in good body condition. This is reflected in the high body weights of the kids despite the fact that they were only between six and nine months old, and the high fat content of the two groups.

High  $pH_u$  values seem typical of chevon, particularly from old goats (Hogg *et al.*, 1992; Husain *et al.*, 2000; Kannan *et al.*, 2001) and are linked to a low glycolytic potential, a consequence of pre-slaughter stress. Simela *et al.* (2004a) showed that goat carcasses with a  $pH_u$  greater than six had 87  $\mu\text{mol/g}$  or less glycolytic potential, which is the range in which the does fell (Table 1).

The comparative sensory acceptability evaluation of chevon from kids, does and mutton clearly indicated that chevon from old does was less acceptable to the consumers than mutton. The findings corroborate studies which employed trained sensory panels and showed that chevon from older goats is not of acceptable eating quality (Pike *et al.*, 1973b; Smith *et al.*, 1978). These findings most likely expound the negative perceptions that prevailed on the quality of chevon produced under commercial slaughter conditions in Zimbabwe during the 1990s. Most of the chevon supplied to the urban markets of Zimbabwe was slaughtered through large commercial abattoirs and sold through retail outlets. Some 60% of the slaughtered goats were old does (Hatendi, 1993; Simela, 1996). At the abattoirs, all goat carcasses were graded according to a government gazetted schedule with four grades; Super, Choice, Standard and Inferior (Government of Zimbabwe, 1995). Super and Choice grades were reserved for well-finished young goats, but most of the old females tended to grade Standard or Inferior. A survey of the retail outlets indicated that the retailers preferred to receive and sell chevon from carcasses of the top two grades, because they felt that the carcasses kept well and were less prone to dehydration. Low grade carcasses were said to dry and darken quickly. However, because the market was dominated by the less desirable old goats, some retailers viewed goats as yielding small, low grade carcasses and the meat as smelly. Therefore they would not sell chevon. Chevon production in Zimbabwe in the 1990s is thus a classic example of how the supply of inappropriate animals in the goat market could affect consumer perceptions. It is probably for the same reason that some South African consumers described chevon as stringy, smelly and tough (USAID/South Africa and ARC-ANAPI, 1998).

Other cases where chevon was found unacceptable, were when it came from very young/small animals. Examples are the studies Smith *et al.* (1978) where 3 to 5 month old kids yielded meat that was perceived to be tougher, less juicy and less flavourful than chevon from yearling goats. Tshabalala (2000) found that patties from indigenous goat kids (11 kg cold carcass weight) were less tender and less juicy (sensory scores of less than 4.4 on a 1 to 9 intensity scale) than patties from the heavier Boer goat kids (13.5 kg cold carcass weight) and lamb (20 kg cold carcass weight).

It is noteworthy that in both series of the present study, differences only occurred between chevon and mutton and not between the two types of chevon (Figures 3 to 5). This highlights the uniqueness of chevon and emphasises previous reports that it is not interchangeable with mutton on sensory attributes (Pike *et al.*, 1973a; Schönfeldt *et al.*, 1993a; b; Swan *et al.*, 1998). Despite the differences, most consumers would eat either chevon or mutton as often as once a week at least.

Within the goat species, sex and age seem to have little impact on the meat quality, and hence the lack of differentiation between the sex and age groups in the sensory evaluations in the present study. Gaili *et al.* (1972) reported similar findings when comparing acceptability of sensory attributes of chevon from milk teethed kids and older goats. The lack of differences could be attributed to indigenous goats not having been especially selected for meat production. As such, most of the changes with age during their growth and development are geared towards survival rather than meat production. Maximum saleable portions are reached at a very early stage in growth and development in goats, whereas such differentiation may continue to the two-tooth stage in sheep (Norman, 1991).

From the current findings regarding the sensory acceptability of the different meats, it is evident that chevon from indigenous South African goats is an acceptable meat in the market and can be as acceptable as mutton, provided that the meat is from young goats of about a year to two years old (milk-teethed to 6 permanent incisors). One aspect that may undermine the acceptability of chevon to South African consumers is the consumers' general lack of exposure to the meat, which was demonstrated by the USAID-ARC survey of 1998. However, given the positive results of the current study and of the trained-panel sensory evaluations (Breukink & Casey, 1989; Schönfeldt *et al.*, 1993a; b; Tshabalala *et al.*, 2003), as well as the fact that the

USAID-ARC study showed that a large proportion of the sampled population were willing to try out chevon from indigenous South African goats once it had been drawn to their attention, there is a potential to develop a market for chevon in South Africa.

### Conclusion

The study indicated that chevon from indigenous South African goats is acceptable to consumers and may be as acceptable as mutton, provided that the meat is from goats of about two years old or younger. The findings imply that there is a good potential to develop a commercial, formal market for chevon in South Africa.

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