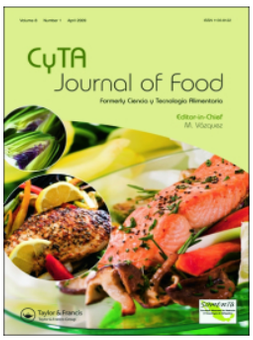

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From the fatty acid content perspective, is it healthier to eat a hindquarter or a forequarter cut? Angus steers in pasture or concentrate systems

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ABSTRACT

In this study, *Biceps femoris* (BF) and *Triceps brachii* (TB) of Aberdeen Angus steers, from the hindquarter and forequarter, respectively, were compared from their fatty acid composition, lipid health, and lipid enzyme activity indices points of view. For this, ten animals were produced in a pasture system and ten were finished in a concentrate-based system. TB presented a significantly higher intramuscular fat, saturated C14:0, C14:1, C16:1, CLA, and MUFA content. BF presented a significantly higher LA, ARA, EPA, DPA, DHA, PUFA, total n-6, and n-3 content, and a significantly higher PUFA/SFA ratio. Significant differences between muscles were found regarding lipid enzyme activity indices, but not concerning atherogenic and thrombogenic indices. Also, meat from different feeding systems was compared, where meat from pasture presented a better fatty acid composition regarding cardiovascular health aspects. In conclusion, BF presented a better composition in the most nutritionally relevant fatty acids, with exception of CLA.

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Red meat; fatty acid; health index; enzyme activity; pasture; concentrate

PALABRAS CLAVE
carne bovina; ácido graso; índice de salud; actividad enzimática; pastura; concentrado

Desde la perspectiva del contenido en ácidos grasos, ¿es más saludable comer un corte del cuarto trasero o del cuarto delantero? Novillos Angus en sistemas a pastura o concentrado

RESUMEN

Se comparó la composición en ácidos grasos, índices de salud y de actividad de enzimas lipídicas de los músculos *Biceps femoris* (BF) y *Triceps brachii* (TB) de novillos Aberdeen Angus, del cuarto trasero y delantero, respectivamente. Diez animales fueron producidos en un sistema pastura y otros diez terminados a base de concentrado. TB presentó un contenido significativamente mayor de grasa intramuscular, de C14:0, C14:1, C16:1, CLA y ácidos grasos monoinsaturados. BF presentó un contenido significativamente mayor de LA, ARA, EPA, DPA, DHA, PUFA, n-6 y n-3, y una mayor relación PUFA/SFA. Los músculos presentaron diferencias significativas en los índices de actividad de enzimas lipídicas, pero no en los índices aterogénico y trombogénico. La carne de animales en pastura presentó una mejor composición en ácidos grasos, en relación a la salud cardiovascular. En conclusión, BF presentó una mejor composición en ácidos grasos desde el punto de vista nutricional, exceptuando el CLA.

1. Introduction

In the past 30 years, there has been great concern about the increase in chronic diseases such as obesity and cardiovascular diseases. These diseases may be prevented by limiting the intake of fat (Stajic et al., 2011). In current dietary guidelines, a reduction in saturated fatty acid consumption (less than 10% of energy intake per day) is recommended as a key part of a healthy diet for the prevention of cardiovascular diseases (Kang et al., 2020). Human consumption of saturated fatty acids of 12–16 carbon atoms increase blood total cholesterol concentration and the LDL/HDL ratio, while polyunsaturated fatty acids (PUFA) tend to decrease LDL-cholesterol levels, and monounsaturated (MUFA) ones are probably neutral concerning the level of serum cholesterol (Hooper et al., 2018; Stajic et al., 2011). The impact of fat intake on the cardiovascular health in humans can be estimated through the calculus of atherogenicity (AI) and thrombogenicity (TI) indices, which include those fatty acids that could affect the change of serum cholesterol (Attia et al., 2015; Stajic et al., 2011; Ulbricht & Southgate, 1991). The current nutritional recommendations strongly encourage an increase in the intake of n-3 PUFA, in particular, eicosapentaenoic acid (EPA, 20:5n-3) and docosahexaenoic acid (DHA, 22:6n-3) (Costa et al., 2013; ISSFAL, 2019). Dietary n-3 PUFA have anti-inflammatory, immunomodulatory and potential anticancer activity (Huerta-Yépez et al., 2016; Khadge et al., 2018) and are beneficial for many diseases, including cystic fibrosis, type II diabetes, dysmenorrhea, schizophrenia, and cardiovascular disease (Huerta-Yépez et al., 2016).

In contrast, the n-6 PUFA, especially arachidonic acid (ARA), which are much more abundant in our daily diet, are associated with many adverse effects on the human body, including cancer promotion. For instance, a high intake of n-6 has been found to correlate with a high risk of breast, prostate, and colon cancer incidence in many

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animal and human studies, and the ratio of n-6 to n-3 was suggested to be a predictor of cancer progression (Huerta-Yépez et al., 2016; Song et al., 2018).

The negative effects of fats on human health overshadow the benefits associated with the consumption of ruminant-derived fat. Recent research, shows that n-3 PUFA, rumenic acid [RA; *cis*(*c*)9, *trans*(*t*)11–18:2], the main natural isomer of conjugated linoleic acid (CLA) and its precursor vaccenic acid (VA; *t*11-18:1) have many properties that seem to promote human health and wellbeing (Chikwanha et al., 2018).

In Uruguay, cattle for meat production has always been based on free access to pasture system, but in the last few years feedlot production system based on a 30–40% roughage and 60–70% concentrate, has increased considerably. This fact leads to cattle production with different carcass and meat quality attributes. Both the amount of grass and duration of rearing on pasture has been shown to influence the potential to enrich 18:3 n-3, 20:5 n-3, and 22:6 n-3 in the bovine muscle (Alfaia et al., 2009; French et al., 2000; Noci et al., 2005). Conversely, feeding concentrates for a 2-month finishing period was shown to lower the proportion of n-3 and increase the abundance of n-6 PUFA (Aldai et al., 2011). Compared with finishing on high-concentrate diets, rearing of cattle or lambs on forage-based systems is often associated with a decrease in muscle 16:0 and total SFA, and higher cis-9 18:1 concentrations (Aldai et al., 2011; Alfaia et al., 2009; Scollan et al., 2006; Sinclair, 2007). In this sense, information about the fatty acid composition of beef meat produced in Uruguay from these different production systems was generated (Cabrera & Saadoun, 2014; Realini et al., 2004). However, it is not easy to find information about lipid health indices, such as the atherogenic and thrombogenic indices in meat produced by those feeding systems. Informed consumers generally consider meat finished on pasture, healthier than meat finished on grains (Cabrera & Saadoun, 2014; Van Elswyk & McNeill, 2014).

Besides, beef meat cuts from the hindquarter are commercially more valuable than cuts from the forequarter, so a higher retail price of the former cuts should be associated with a higher quality product. This work aimed to investigate if a hindquarter muscle (*Biceps femoris*) is healthier than a forequarter muscle (*Triceps brachii*) considering their fatty acid profile, as well as their calculated cardiovascular lipid health and lipid enzyme activity indices.

2. Materials and methods

2.1. Meat samples and animal diets

The two muscles, *Triceps brachii* (TB) and *Biceps femoris* (BF) were selected from twenty Aberdeen Angus steers (24–-30 months old) slaughtered in an authorized abattoir of Uruguay (Solis, BPU-NH group). After 36 hours *postmortem*, both muscles were kept frozen at −20 °C, until analysis determinations. Both muscles integrate typical cuts of the local Uruguayan meat market. Animals were raised in two different feeding systems that take place in Uruguay (*Pasture* and *Concentrate*) established for meat export. *Pasture* group (n = 10) was produced on natural and improved pastures consisting of tall fescue (*Festuca arundinacea*), white clover (*Trifolium repens*), and birdsfoot trefoil (*Lotus subbiflorus*), the last 130 days before slaughtering. These animals reached a mean live weight of 479.8 kg. *Concentrate* group (n = 10) was fed with natural and improved pastures (the same as in *Pasture* system) and afterward received a diet based on roughage:concentrate (30:60, on dry matter basis) consisting of whole plant sorghum silage and silo wet grain sorghum, soybean hulls, and wheat bran, minerals sources, urea and ionophore, the last 90 days before slaughter. These animals reached a mean live weight of 502.4 kg. Pasture-fed animals take longer than concentrate-fed animals to reach the weight required by the market.

2.2. Determination of total lipid content and fatty acid composition

For the intramuscular lipid extraction, the procedure of Folch et al. (1957) was performed. Briefly, 4 grams of meat were homogenized with 100 ml of chloroform: methanol (2:1) in a Virtis 45 at 35000 rpm for 1 min and then filtered to a separating funnel. After obtaining the dry lipids, they were dissolved in hexane and submitted to methylation with methanolic KOH according to Ichihara et al. (2010). The fatty acid analysis was performed by gas chromatography following the procedure described by Eder (1995). A Clarus 500 (Perkin Elmer Instruments, USA) split/splitless chromatograph with a fused-silica CPSIL-88 of 100 m capillary column, FID detector, and CPG grade hydrogen as carrier gas (flow rate: 1 ml/min) was used. A temperature of 250 °C was established for the injector and FID detector. Fatty acids methylated esters (FAMEs) were determined comparing the retention time to fatty acids standards (Sigma Corp., USA) and individual FAME were quantified as a percentage of total detected FAMEs. Total intramuscular fat content was expressed as grams per 100 g muscle.

2.3. Calculation of lipid health indices

Lipid health indices were calculated based on the data of intramuscular fatty acids. The atherogenic index (AI) indicates the relationship between the sum of the main saturated (proatherogenic) and the unsaturated (antiatherogenic) fatty acids and was calculated as [C12:0 + 4*(C14:0) + C16:0]/[(ΣPUFA) + (ΣMUFA)]. The thrombogenic index (TI) estimates the potential to form clots in the blood vessels, determined by the relationship between the prothrombogenic (saturated) and the antithrombogenic fatty acids (sum of MUFA and PUFA) and was calculated as [C14:0 + C16:0 + C18:0]/[(0.5*ΣMUFA) + (0.5*n-6) + (3*n-3) + (n-3/n-6)]. Both indices were calculated as described by Ulbricht and Southgate (1991).

2.4. Calculation of lipid enzyme activity indices

The desaturase, elongase, and thioreductase enzyme activities were estimated by relating the amount of the specific substrate to the corresponding product of the respective enzyme (Del Puerto et al., 2017). The activity of stearoyl-CoA desaturase (Δ9-desaturase) was estimated by calculating the ratios 16:1 n-7 to 16:0, 18:1 n-9 to 18:0, 16:1 n-7 + 18:1 n-9 to 16:0 + 18:0. The sum of Δ5 desaturase + Δ6 desaturase was used as an index to estimate long-chain n-6 and n-3 formation starting from the corresponding precursors C18:2n-6 and C18:3n-3 (Dal Bosco et al., 2012). The elongase activity was estimated as the ratio of 18:0 to 16:0 and the thioesterase as the ratio of 16:0 to 14:0 (Haug et al., 2014).

2.5. Statistical analysis

Data on total fat content, intramuscular fatty acid composition, lipid health indices, and lipid enzyme activity indices were reported as mean ± standard error of the media (SEM). The software used was the NCSS, 2007 (329 North 1000 East, Kaysville, UT 84037), and the level of significance was established at $P < .05$. Data were analyzed with an analysis of variance using the General Linear Model (GLM) procedure with feeding systems and muscle type as fixed effects and *post hoc* Tukey-Kramer test. Also, a one-way ANOVA was used to compare feeding systems in each muscle.

3. Results and discussion

TB muscle presented a significantly higher total intramuscular fat content ($P = .0001$) and a significantly higher saturated C14:0 content ($P = .01$), an atherogenic fatty acid (Table 1). However, the level of C16:0, another known atherogenic fatty acid, is not different between the two muscles. CLA content was significantly higher in TB than BF ($P = .002$). CLA is a beneficial fatty acid detected (mainly its c9-t11 isomer), which has been shown to possess significant anticarcinogenic properties (Enser, 2001; Lock & Bauman, 2003). Besides, TB presented a lower content of C18:2 n-6 ($P = .0001$), ARA ($P = .0001$), DPA ($P = .0007$), EPA ($P = .02$), and DHA ($P = .001$) fatty acids compared to BF. The last two fatty acids are often suggested as important to prevent the occurrence of cardiovascular disease in humans (Harris et al., 2008; Ramprasath et al., 2015). These results suggest that BF muscle presents a better fatty acid composition regarding human health.

Regarding the lipid health indices reported in Table 2, no differences between muscles were found in SFA content and n-6/n-3 ratio. Besides, the values obtained for the n-6/n-3 ratio in both muscles were close to recommendations (4–5/1) by FAO-WHO (2010). The balance between n-6 and n-3 PUFA is an important determinant in decreasing the risk for cardiovascular disease and in the prevention of atherosclerosis (Song et al., 2018). Furthermore, TB presented a higher MUFA content ($P = .004$), a lower PUFA content ($P = .003$), lower sums of n-6 ($P = .0001$), and n-3 ($P = .007$) fatty acids content, and a lower PUFA/SFA ratio ($P = .002$) than BF muscle. With regards to the atherogenic and thrombogenic indices, no significant differences were found between both muscles. Indices results showed that BF is better from the cardiovascular human health viewpoint than TB, mainly due to its higher PUFA content. Despite that the PUFA/SFA ratio is higher in BF muscle, the value obtained does not reach the advised value of 0.45 as recommended by FAO-WHO (2010).

When feeding systems were compared (pasture vs concentrate), considering the results of both muscles, concentrate feeding generated a significantly higher intramuscular fat content in meat ($P = .003$) (Table 1). This result was also found by other authors (Fruet et al., 2018; Mezgebo et al., 2017; Realini et al., 2004) and it is explained by the fact that feeding grains increase the availability of net energy and glucose for fat synthesis and further deposition of lipid in the muscle (Scollan et al., 2006). Otherwise, no feeding effect

Table 1. Total fat content (g/100 g muscle) and fatty acid composition (g/100 g fatty acids) in *Triceps brachii* (TB) and *Biceps femoris* (BF) muscles of Aberdeen Angus steers produced in pasture and concentrate.
Tabla 1. Contenido total de lípidos (g/100 g de músculo) y composición en ácidos grasos (g/100 g de ácidos grasos) en los músculos *Triceps brachii* (TB) y *Biceps femoris* (BF) de novillos Aberdeen Angus producidos en pastura y concentrado.

	Muscles				Signification	
	Triceps brachii		*Biceps femoris*		Main effects	
	Pasture	Concentrate	Pasture	Concentrate	Muscle	Feeding
Total fat (%)	3.25 ± 0.29	7.29 ± 1.28	1.51 ± 0.50	1.80 ± 0.18	0.0001 TB>BF	0.003 C > P
Fatty acids (g/100 g fatty acids)						
C12:0	0.09 ± 0.05	0.12 ± 0.05	0.07 ± 0.02	0.06 ± 0.00	NS	NS
C14:0	2.74 ± 1.03	3.81 ± 0.93	1.96 ± 0.47	1.99 ± 0.14	0.01 TB>BF	NS
C15:0i	0.26 ± 0.09	0.21 ± 0.04	0.23 ± 0.05	0.12 ± 0.01	NS	0.02 P > C
C15:0ai	0.29 ± 0.09	0.21 ± 0.04	0.28 ± 0.06	0.14 ± 0.00	NS	0.01 P > C
C14:1	0.53 ± 0.20	0.95 ± 0.24	0.24 ± 0.07	0.34 ± 0.02	0.01 TB>BF	0.02 C > P
C15:0	0.68 ± 0.23	0.64 ± 0.11	0.73 ± 0.16	0.42 ± 0.01	NS	NS
C16:0i	0.23 ± 0.03	0.20 ± 0.02	0.22 ± 0.04	0.16 ± 0.01	NS	0.008 P > C
C16:0	25.0 ± 3.64	29.6 ± 2.32	26.5 ± 2.82	25.5 ± 0.57	NS	NS
C16:1	4.24 ± 1.04	5.20 ± 0.44	3.24 ± 0.36	3.19 ± 0.09	0.002 TB>BF	NS
C17:0	1.18 ± 0.18	1.15 ± 0.03	1.22 ± 0.03	0.96 ± 0.01	NS	0.02 P > C
C17:1	1.06 ± 0.06	0.86 ± 0.07	0.95 ± 0.33	0.96 ± 0.01	NS	NS
C18:0	15.2 ± 1.99	11.9 ± 1.17	16.0 ± 1.14	14.1 ± 0.26	NS	0.007 P > C
C18:1 c9	40.1 ± 3.22	39.8 ± 2.67	36.2 ± 1.56	40.1 ± 0.31	NS	NS
C18:2 n6 LA	3.28 ± 0.63	2.15 ± 0.14	5.47 ± 0.31	5.91 ± 0.06	0.0001 BF>TB	NS
C20:0	0.11 ± 0.08	0.05 ± 0.02	0.08 ± 0.05	0.09 ± 0.02	NS	NS
C18:3n6	0.03 ± 0.02	0.07 ± 0.11	0.04 ± 0.01a	0.02 ± 0.01b	NS	NS
C20:1	0.17 ± 0.11	0.18 ± 0.05	0.14 ± 0.06	0.18 ± 0.00	NS	NS
C18:3 n3ALA	0.71 ± 0.14a	0.21 ± 0.02b	0.90 ± 0.31	0.41 ± 0.01	NS	0.0001 P > C
CLA (c9-t11)	0.59 ± 0.13a	0.35 ± 0.04b	0.27 ± 0.07	0.30 ± 0.00	0.002 TB>BF	0.05 P > C
C20:4n6 ARA	0.50 ± 0.18	0.28 ± 0.09	1.02 ± 0.17	1.39 ± 0.06	0.0001 BF>TB	NS
C20:5n3 EPA	0.07 ± 0.04	0.01 ± 0.01	0.12 ± 0.04	0.05 ± 0.00	0.02 BF>TB	0.003 P > C
C22:5 n3 DPA	0.03 ± 0.02	0.05 ± 0.02	0.07 ± 0.03	0.19 ± 0.01	0.0007 BF>TB	0.003 C > P
C22:6 n3 DHA	0.26 ± 0.16	0.10 ± 0.04	0.48 ± 0.18	0.57 ± 0.03	0.001 BF>TB	NS
Unidentified	2.61 ± 0.16	1.85 ± 0.37	3.54 ± 0.35	2.88 ± 0.11	– -	– -

Values are means ± SEM (n = 10). i: iso; ai: anteiso; LA: linoleic acid; ALA: alfa-linolenic acid; CLA: isomer c9t11 of conjugated linoleic acid; ARA: arachidonic acid; EPA: eicosapentaenoic acid; DPA: docosapentaenoic acid; DHA: docosahexaenoic acid; P: pasture; C: concentrate; NS: not significant. Different letters show significant differences ($P < 0.05$) between feeding systems in each muscle.
Los valores son medias ± EEM (n = 10). i: iso; ai: anteiso; LA: ácido linoleico; ALA: ácido alfa-linolénico; CLA: isómero c9t11 del ácido linoleico conjugado; ARA: ácido araquidónico; EPA: ácido eicosapentaenoico; DPA: ácido docosapentaenoico; DHA: ácido docosahexaenoico; P: pastura; C: concentrado; NS: no significativo. Letras diferentes indican diferencias significativas ($P < 0.05$) entre sistemas de producción en cada músculo.

Table 2. Lipid health indices in *Triceps brachii* (TB) and *Biceps femoris* (BF) muscles of Aberdeen Angus steers produced in pasture and concentrate.
Tabla 2. Indices de salud lipídicos en los músculos *Triceps brachii* (TB) y *Biceps femoris* (BF) de novillos Aberdeen Angus producidos en pastura y concentrado.

	Muscles				Signification	
	Triceps brachii		*Biceps femoris*		Main effects	
	Pasture	Concentrate	Pasture	Concentrate	Muscle	Feeding
SFA	45.86 ± 3.25	47.87 ± 2.30	47.35 ± 2.47	43.53 ± 0.45	NS	NS
MUFA	46.06 ± 2.09	47.05 ± 2.10	40.75 ± 1.51	44.75 ± 0.20	0.004 TB>BF	0.03 C > P
PUFA	5.47 ± 1.32a	3.23 ± 0.44b	8.37 ± 1.08	8.84 ± 0.15	0.003 BF>TB	NS
Σn-6	3.81 ± 0.83	2.51 ± 0.32	6.53 ± 0.48	7.32 ± 0.10	0.0001 BF>TB	NS
Σn-3	1.07 ± 0.36a	0.37 ± 0.09b	1.57 ± 0.54	1.22 ± 0.05	0.007 BF>TB	0.02 *P* > C
n6/n3	3.67 ± 0.46	6.88 ± 0.88	4.53 ± 1.57	5.98 ± 0.19	NS	0.002 C > P
PUFA/SFA	0.12 ± 0.04	0.07 ± 0.01	0.18 ± 0.03	0.20 ± 0.01	0.002 BF>TB	NS
AI	0.71 ± 0.20	0.90 ± 0.17	0.71 ± 0.14	0.63 ± 0.03	NS	NS
TI	0.99 ± 0.25	1.29 ± 0.20	1.01 ± 0.22	0.92 ± 0.03	NS	NS

Values are means ± SEM (n = 10). SFA: saturated fatty acids; MUFA: monounsaturated fatty acids; PUFA: polyunsaturated fatty acids; AI: atherogenic index; TI: thrombogenic index; P: pasture; C: concentrate; NS: not significant. Different letters show significant differences ($P < 0.05$) between feeding systems in each muscle.
Los valores son medias ± EEM (n = 10). SFA: ácidos grasos saturados; MUFA: ácidos grasos monoinsaturados; PUFA: ácidos grasos poliinsaturados; AI: índice aterogénico; TI: índice trombogénico; P: pastura; C: concentrado; NS: no significativo. Letras distintas indican diferencias significativas ($P < 0.05$) entre sistemas de producción en cada músculo.

was observed for the atherogenic fatty acids C14:0 and C16:0 (Table 1), for SFA, total n-6, PUFA, and PUFA/SFA ratio (Table 2). Meat derived from pasture system presented a significantly higher C18:3 n-3 ALA (P = .0001), CLA (P = .05), EPA (P = .003), total n-3 (P = .02), and a lower DPA (P = .003) and MUFA (P = .03) content, as well as a significantly lower n-6/n-3 ratio (P = .002) than meat derived from concentrate system. In this sense, there are some studies (Fruet et al., 2018; Mezgebo et al., 2017; Realini et al., 2004) which found similar results and conclude that pasture-fed cattle present generally a higher C18:3 n-3, total n-3, CLA and a lower MUFA content and n-6/n-3 ratio, in the intramuscular fat of meat. The higher presence of the n-3 fatty acids in ruminant meat has been associated with the high levels of C18:3 n-3 fatty acids present in grasses (Body & Hansen, 1978; Engle & Spears, 2004; French et al., 2000; Shorland, 1961).

As shown in Table 2, no differences between feeding systems were observed for the atherogenic and thrombogenic indices. On behalf of these results, the meat coming from steers produced in the pasture system has a better fatty acid profile regarding human health, mainly due to its higher CLA and n-3 fatty acids content and lower n-6/n-3 ratio, which are beneficial.

When feeding systems were compared in each muscle, the C18:3 n-6 content was significantly higher ($P < .05$) in BF from steers produced in pasture, and the C18:3 n-3 ($P < .05$), CLA ($P < .05$), total PUFA ($P < .05$) and total n-3 ($P < .05$) content were higher in TB muscle from steers produced in pasture compared to concentrate diet.

The *de novo* fatty acid synthesis yields 16:0 as the end product that can serve as a substrate for further elongation or desaturation (Shingfield et al., 2013). When lipid enzyme activity indices were calculated, some significant differences were found between the muscles studied (Table 3). TB presented a higher Δ9-desaturase C14:0 (P = .0001), C16:0 (P = .0002) and C18:0 (P = .0001), which reflects the higher content of C14:1 (P = .01) and C16:1 (P = .002). No significant differences between muscles were found for C18:1 content. TB also presented a significantly lower Δ5+ Δ6 desaturase and thioesterase indices compared to BF. As the Δ5+ Δ6 desaturase index represents a tool to estimate the ability to synthesize long-chain fatty acids from precursors, it explains why BF presents a higher total PUFA content and particularly, EPA, DPA, and DHA.

When comparing meat from different feeding systems some differences were found in the lipid enzyme activity indices. Meat from the concentrate system presented a significantly higher Δ9-desaturase C14:0 (P = .0001) which reflects the higher C14:1 content (P = .02) found in meat from this system and a significantly higher Δ9-desaturase C18:0 (P = .0001). The elongase activity index was significantly higher in meat from the pasture system (P = .05), which agrees with the fact that the C18:0 content was higher (P = .007) in meat coming from this feeding system.

Table 3. Lipid enzyme activity indices in *Triceps brachii* (TB) and *Biceps femoris* (BF) muscles of Aberdeen Angus steers produced in pasture and concentrate.
Tabla 3. Indices de actividad de enzimas lipídicas en los músculos *Triceps brachii* (TB) y *Biceps femoris* (BF) de novillos Aberdeen Angus producidos en pastura y concentrado.

Muscles					Signification	
Triceps brachii			*Biceps femoris*		Main effects	
	Pasture	Concentrate	Pasture	Concentrate	Muscle	Feeding
Δ9 desaturases						
C14:0	16.2 ± 0.09	19.9 ± 0.10	10.9 ± 0.28	14.6 ± 0.12	0.0001 TB>BF	0.0001 C > P
C16:0	14.3 ± 0.83	14.9 ± 0.05	10.9 ± 0.03	11.1 ± 0.03	0.0002 TB>BF	NS
C18:0	72.5 ± 0.58	77.0 ± 0.32	69.3 ± 0.35	74.0 ± 0.12	0.0001 TB>BF	0.0001 C > P
C16:0+ C18:0	52.4 ± 1.30	52.0 ± 1.11	48.1 ± 1.01	52.2 ± 0.18	NS	NS
Δ5+ Δ6 desaturases	17.0 ± 2.52	15.6 ± 2.12	20.7 ± 1.51	25.9 ± 0.29	0.004 BF>TB	NS
Elongases	0.62 ± 0.10	0.41 ± 0.04	0.61 ± 0.06	0.55 ± 0.01	NS	0.05 *P* > C
Thioesterases	9.76 ± 1.41	7.99 ± 0.82	13.8 ± 1.00	12.9 ± 0.37	0.001 BF>TB	NS

Values are means ± SEM (n = 10). P: pasture; C: concentrate; NS: not significant.
Los valores son medias ± EEM (n = 10). P: pastura; C: concentrado; NS: no significativo.

4. Conclusions

From the results obtained in this work, we can conclude that the fatty acid profile is better, from the cardiovascular human health viewpoint, in a hindquarter muscle like *Biceps femoris*, than in a forequarter muscle such as *Triceps brachii*, of Aberdeen Angus steers. Therefore, it is reasonable to pay a greater price for a hindquarter than for a forequarter muscle. Also, we can conclude that the pasture system, for bovine meat production, is more recommended regarding the fatty acid composition of meat products. Indeed, meat produced in those systems presents higher contents of beneficial fatty acids, such as CLA and n-3, compared to concentrate finishing systems.

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Disclosure statement

The authors declare that they have no conflicts of interest.

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