Production and Meat Quality of Water Buffaloes

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ABSTRACT - Information of several sources and/or estimates with reasonable degree of basis will be presented, obtained close to Universities, Research Institutions, Extension Departments and Companies that work with the water buffalo meat chain.

INTRODUCTION

According to estimates of the FAO (2016), the world-wide population of buffaloes is around 195 million heads, being that 97.5% since contingent are placed in developing countries (India, China and Pakistan).

The statisticians of the buffaloes breeding in the world are contradictory and many times sub-estimated. Brazil and the neighboring countries, present substantial growth, breaking frontier, producing and reproducing in the places where other species, of ruminants, do not present satisfactory animal production index.

The worldwide production of buffalo meat is 3.72 million tons (FAO, 2016), where India, Pakistan, China and Egypt) detach as the main producers, situated in the Orient. In the Occident, what everything indicates, the Brazil appears as the first producer of buffalo meat and, given its territorial extension, allied to the favorable conditions of climate and soil, it has everything to exhibit, the medium and long term, the main production of buffalo meat, in quantitative terms as well as qualitative.

The pasture production systems reveal each time more competitive, not only for the low costs of production, but also for the possibility to offer meat produced in the forage, transforming forage grasses in animal protein in a system where if it values the social evolvement, preserve the environment and is related with animal welfare (Pineda, 2000a, b). According to the author, the cattle breeders cannot be indifferent to the transformations that are occurring in the world and that affect them directly.

THE BUFFALO AS MEAT PRODUCER

Our CNPq research group “UNESP-Botucatu-BÚFALOS” works approximately has twenty years with the research line "Buffalo Meat Production", to consolidate the buffalo as real option for production of meat in the country.

Always searching to work with the most different systems of finishing (pasture, half-feedlot and feedlot), using animals of different genetic groups (purebred and crossbreeding) and sexual conditions (entire, castrated and heifers); the our group of research aims to subsidize all the links of the productive chain of the buffalo meat, since

the producer until the final consumer, with information that make possible greater insertion of the buffalo as producing of meat in our way.

The results on the carcass and meat characteristics of buffaloes, created in different conditions of handling and systems of feeding are, same times, contradictory. Therefore, it must to have care if comparing resulted of studies led in different experimental conditions.

The estimate of the yield of the carcass and the primary and commercial cuts, for occasion of slaughter, is of importance to complement the evaluation of the performance of the animal during its development (Jorge & Fontes, 1997b; Jorge, 1999).

The carcass yield of buffaloes from different genetic groups suffers direct influence from the weights of the head, skin and gastrointestinal tract. Such fact has been observed for diverse authors and according to Jorge et al. (1997b, c) the lowest carcass yield verified in buffaloes is a consequence, mainly, of the highest weights of skin and head, that arrives to cause a difference of up to 5% in the carcass yield of beef cattle.

The buffaloes presented satisfactory results how much to the yield of primary cuts of the carcass and can surpass beef cattle in the yield of determined cuts, what it contributes very to demystifying the species and clarifying the productive chain how much to its productive real potential (Jorge, 1999; Jorge, 2001).

Based in the slaughter live weights of 450 and 500kg, the Table 1 presents the main body components of the buffalo.

Table 1 – Body components of buffaloes slaughtered at 450 and 500kg of live weights.

Components	Slaughter Weight (SW)			
	450 kg SW		500 kg SW	
	(kg)	(%)	(kg)	(%)
Gastrintestinal Content	54.3	13.2	74.7	14.9
Empty Body Weight	390.7	86.8	425.3	85.1
Head + Foot + Skin	87.79	19.51	95.56	19.10
Heart + Liver + Spleen + Lungs	11.09	2.46	12.08	2.42
Gastrintestinal Tract	21.49	4.77	23.39	4.68
Carcass	222.5	49.44	247.2	50.00

Source: adapted Jorge (2001)

Table 2 - Weight and yield of primal cuts from carcass of buffaloes slaughtered at 450 and 500 kg of live weight.

Components	Slaughter Weight (SW)		Average Yield
	450 kg SW	500 kg SW	(%)
	(kg)	(kg)	
Full Shoulder	37.7	41.9	16.95
Full Chuck	51.4	57.1	23.12
Forequarter	89.1	99.0	40.07
Full Rump	45.8	50.9	20.59
Round Shank On	59.0	65.5	26.51
Pistola	104.8	116.4	47.10
Thin Flank	28.5	31.7	12.83
Hindquarter	133.3	148.1	59.93

Source: adapted Jorge (2001)

Table 3 - Weight and yield of Full Shoulder and its secondary cuts from carcass of buffaloes slaughtered at 450 and 500 kg of live weight.

Components	Slaughter Weight (SW)		Average Yield (%)
	450 kg SW (kg)	500 kg SW (kg)	
Full Shoulder	37.7	41.9	16.95
Meat Fat On	28.1	31.2	12.62
Bone	9.6	10.7	4.32
Shoulder	22.9	25.5	10.3
Shin	5.2	5.7	2.32

Source: adapted Jorge (2001)

Table 4 - Weight and yield of Full Chuck and its secondary cuts from carcass of buffaloes slaughtered at 450 and 500 kg of live weight.

Components	Slaughter Weight (SW)		Average yield (%)
	450 kg SW (kg)	500 kg SW (kg)	
Full Chuck	51.4	57.1	23.12
Meat Fat On	41.2	45.8	18.54
Bone	10.2	11.3	4.58
Chuck	15.1	16.8	6.80
Brisket Point End	11.3	12.6	5.10
Neck	14.8	16.4	6.64

Source: adapted Jorge (2001)

Table 5 - Weight and yield of Thin Flank and its secondary cuts from carcass of buffaloes slaughtered at 450 and 500 kg of live weight.

Components	Slaughter Weight (SW)		Average Yield (%)
	450 kg SW (kg)	500 kg SW (kg)	
Thin Flank	28.5	31.7	12.83
Meat Fat On	23.38	25.98	10.51
Bone	5.16	5.73	2.32
Flank	12.0	13.3	5.40
Rib	11.3	12.6	5.10

Source: adapted Jorge (2001)

Table 6 - Weight and yield of the Full Rump and its secondary cuts from carcass of buffaloes slaughtered at 450 and 500 kg of live weight.

Components	Slaughter Weight (SW)		Average Yield (%)
	450 kg SW (kg)	500 kg SW (kg)	
Full Rump	45.8	50.9	20.59
Meat Fat On	34.4	38.2	15.44

Bone	11.4	12.7	5.15
D-Rump	12.9	14.3	5.80
Tenderloin	5.9	6.5	2.64
Striploin	15.6	17.3	7.00

Source: adapted Jorge (2001)

Table 7 - Weight and yield of Round Shank On and its secondary cuts from carcass of buffaloes slaughtered at 450 and 500 kg of live weight.

Components	Slaughter Weight (SW)		Average Yield (%)
	450 kg SW (kg)	500 kg SW (kg)	
Round Shank On	59.0	65.5	26.51
Meat Fat On	46.7	51.9	21.00
Bone	12.2	13.6	5.50
Inside	14.2	15.8	6.40
Silverside	13.1	14.6	5.90
Eye Round	4.2	4.7	1.90
Thick Flank	10.9	12.1	4.90
Shank	4.2	4.7	1.90

Source: adapted Jorge (2001)

As summary of the previously described, buffalo slaughtered at 450 - 500 kg of live weight, respectively presents carcass weights of 222.5 – 247.2 kg, what it corresponds 173.8 - 193.1 kg (78.1%) of edible portion (Meat Fat On), values these comparable ones to the selected traditional beef cattle breed.

To invest in genetics, through improvement and selection programs, is an important alternative to get advantage of the activity, searching animals that are adapted to the environment conditions, precocious in the reproduction, at the same time good weight gain and that they have good carcass traits. The adoption of crossbreeding among animals of different buffalo breeds has been pointed as one of the best alternatives with respect to attainment of productive and adapted animals to the tropics (Jorge, 1999).

Table 8 - Averages of the physical composition (%) and relation among tissues of the carcass of buffaloes for genetic group and maturity [1]

Tissue	Genetic Group		
	MURRAH	JAFARABADI	MEDITERRANEAN
Muscle	55.61 a	54.61 a	55.60 a
Fat	29.16 a	28.60 a	29.65 a
Bone	15.23 b	16.79 a	14.75 b
	Relation among tissues		
Soft Tissue[2] / Bone	5.56 ab	4.96 b	5.78 a
Muscle / Bone	3.65 ab	3.25 b	3.77 a
Fat / Bone	1.91 a	1.70 a	2.01 a
Fat / Muscle	0.52 a	0.52 a	0.53 a
Tissue	Maturity (Slaughter Weight - SW)		
	400 kg SW	450 kg SW	500 kg SW

Muscle	56.33 a	54.75 a	55.75 a
Fat	27.17 a	29.12 a	30.21 a
Bone	16.50 a	16.13 a	14.04 b
	Relation among tissues		
Soft Tissue[2] / Bone	5.06 b	5.20 b	6.12 a
Muscle / Bone	3.41 b	3.39 b	3.97 a
Fat / Bone	1.65 b	1.80 ab	2.15 a
Fat / Muscle	0.48 a	0.53 a	0.54 a

[1] Means with different letters differ significantly at 5% level by Tukey test.
[2] Soft Tissue = Muscle + Fat.
Source: Jorge et al. (2003)

As it can be observed in Table 9, the author did not observe effect of interaction among genetic groups and slaughter weights for the studied characteristics. Thus being the effect was studied separately in the comparison of the averages. It did not have difference among genetic groups (MUR, JAF and MED) how much to the muscles ratios and tissue fat. On the other hand, Jafarabadi breed presented greater ratio of bones than Murrah and the Mediterranean. Animals MED presented greater ratio soft tissue / bone (ST/B) and Muscle / Bone (M/B), while the JAF presented lower ST/B and M/B. Such fact is explained by lower and greater ratio of bones in the carcass presented by MED and JAF, respectively. It did not observe difference among the maturities (slaughter weights) how much to the tissue fat ratio and of muscles, although if it has observed trend of bigger ratio of fat tissue and has occurred lower ratio of bones in the animals slaughtered at 500kg live weight. These animals presented greater ratio ST/B, M/B e F/B than animals slaughtered at 450 kg SW. These differences reflect, basically, the changes in the ratio of bones in the carcass, which decreased, of more accented way, with the increase of the live weight of what the ratio of muscles. These results are supported by classic works of Berg & Butterfield (1976) and Marple (1983), using beef cattle.

Chemical Composition and Buffalo Meat Quality

Jorge et al. (2005) working with Mediterranean buffaloes observed that buffalo meat presents an aspect considered attractive to the consumer. The meat tenderness measured by shear force (average of 3.55) was classified as very soft.

Table 9 - Color, texture and marbling of *longissimus dorsi* muscle from Mediterranean buffaloes slaughtered at different live weights (SW)

	Slaughter Live Weight (SW) (kg)				
Parameters	**450**	**480**	**510**	**540**	**Regression Equation**
Colour, points[1]	4.0 ± 0.2	4.0 ± 0.2	4.2 ± 0.1	4.3 ± 0.1	$\hat{Y}$ = 4.12
Texture points[2]	37 ± 0.3	3.8 ± 0.,3	4.0 ± 0.2	4.0 ± 0.2	$\hat{Y}$ = 3.87
Marbling, points	3.4 ± 0.2	4.7 ± 0.3	5.9 ± 0.2	7.2 ± 0.2	$\hat{Y}$ = -15.31 + 0.04163*SW
Shear Force (kgf)	4.1 ± 0.1	3.5 ± 0.2	3.2 ± 0.1	3.4 ± 0.2	$\hat{Y}$ = 3.55
Freezing Loss	7.1 ± 0.3	6.5 ± 0.2	5.9 ± 0.3	5.2 ± 0.3	$\hat{Y}$ = 16.2361 – 0.02034*SW
Cooking Loss	25.5 ± 0.4	27.2 ± 0.3	28.9 ± 0.3	30.64 ± 0.4	$\hat{Y}$ = -0.3113 + 0.05732*SW
Humidity (%)	72.2 ± 0.5	71.7 ± 0.4	71.7 ± 0.5	71.0 ± 0.4	$\hat{Y}$ = 71.6
Protein (%)	24.5 ± 0.3	25.1 ± 0.4	25.3 ± 0.4	25.2 ± 0.3	$\hat{Y}$ = 25.0
Ether Extract	2.18 ± 0.02	2.07 ± 0.03	2.34 ± 0.02	2.55 ± 0.03	$\hat{Y}$ = 2.28
Ash (%)	1.11 ± 0.02	1.13 ± 0.02	1.22 ± 0.01	1.23 ± 0.02	$\hat{Y}$ = 1.17

[1] Colour: 1 = dark e 5 = red. [2] Texture: 1 = very crude e 5 = very fine. [3] Marbling: 1 = traces e 18 = abundant. (JORGE et al, 2005).

Francisco et al. (2007) conducted study for evaluation the chemical composition and tenderness of *longissimus dorsi* muscle from Murrah buffaloes (non-castrated) slaughtered at different weights. Values obtained for tenderness are similar in the literature and has been proving that buffalo meat is tender (Table 10).

Table 10 – Means and standard deviations of the moisture, crude protein, fat, ash, calories, shear force of *longissimus dorsi* muscle from non-castrated Murrah buffaloes slaughtered at 450 and 500 kg live weight

Variable	Slaughter Weight (SW)	
	450 kg	500 kg
Moisture (%)	$74.88^{a} \pm 1.60$	$75.10^{a} \pm 1.00$
Crude Protein(%)	$20.76^{a} \pm .72$	$20.68^{a} \pm 1.01$
Fat (%)	$2.24^{a} \pm .69$	$1.92^{a} \pm .34$
Ash (%)	$1.27^{a} \pm .44$	$1.09^{a} \pm .54$
Calories (cal)	$131.08^{a} \pm .29$	$132.87^{a} \pm .06$
Shear Force (kgf)	$4.34^{a} \pm 5.98$	$3.54^{a} \pm 3.23$

P>.05 – Means followed by the same letter in the line, did not differ by F test. (Adapted: FRANCISCO et al., 2007)

The conclusion of the authors is that buffalo meat is an excellent alternative source of red protein of high biological value to feeding of Brazilian consumers, furthermore, more studies must be developed about quality of buffalo meat, to expand the knowledge on the traits being thus propitiated, better knowledge for the scientific community, demystifying the species mainly to the final consumer, who has another excellent red protein alternative of high biological value for their feeding.

CONCLUSIONS

The industries of red meat have to compete with other protein sources, especially poultry and pigs. To compete in this market, the buffalo breeding will have to improve still more its index of productivity, creating identity to its products and to care of the requirements of the consumers, with relation the alimentary security, product quality, animal welfare and respect to the environment.

When we speak in genetic selection of buffalo for quality of carcass, to clarify the subject is necessary. It does not only mean to select animals that show phenotypes which we believe that be related with a carcass of better quality. To select buffaloes with high potential of growth is necessary to weigh the animals, identifying itself thus those animals with high ponderal development. In the same way, for to select one better quality of carcass it is necessary to measure the carcass traits that determine its quality, identifying thus those animals that produce greater yield and quality of meat.

Front to many scientific and technological advances, which assist in the evaluation of highly productive animals the which they transmit its characteristics and qualities to its products, remains the question: Why the buffaloes cannot to enjoy the benefits of this important advance?

ACKNOWLEDGEMENTS

We are grateful to the CNPq (National Council for Scientific and Technological Development), FAPESP (São Paulo Research Foundation) and FUNDUNESP (Unesp

Development Foundation) for funding the our researchs and for their substantial support.

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