EXAMINATION OF CORELATIVE RELATION BETWEEN CONTENTS OF MUSCLE, FAT AND BONE TISSUES IN BEEF 9-10-11 RIB CUTS AND SECTION SURFACE OF THE SAME TISSUES ON THE 11th RIB CUTS

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INTRODUCTOIN

Portion, disposition and mutual relation of muscle, fat and bone tissue in beef carcasses is of extrem importance regarding comercial judgement and clasification of carcasses, turnover of raw beef meat and its most complete using in processing. It is certain that amounts and relations of particular tissues could be best established by total dissection of carcass, but this is long, hard and at the first place very expensive treatment. For this reason noticable efforts are made so that this problem is solved indirectly, by establishing portion of muscle, fat tissue and bones in carcass is estimated by their exactly established portion in some basic part or cut. There is quite a number of papers writen on that subject in literature and as the object of total dissection most often "three-rib" cut at the 9-10-11th rib is used (Hankins and Howe, 1946; Crown and Damon, 1960; Ramsey et all., 1966; Brackelsberg et all., 1968; Bergstrom, 1976) or the 7-8-9th rib (Martin, 1966; Bergstrom, 1976). Results of our earlier examinations, established by dissection of beef carcasses and cuts of the 9-10-11th rib, indicate positive, high and statisticaly significant corelative dependence (p < 0,01) between parts of tissues in "three-rib" cuts and whole carcasses: muscle tissue- r=0,914; fat tissue - r=0,825;

bones - r=0,969; (Radovanovi
1983). Results similar to ours we
established by previosly mention
authors which used dissection
same cut (the 9-10-11th rib)
evaluation of beef carcasses.
However, independantly from main
accepted opinion that results
dissection of "three-rib"
(the 9-10-11th rib) represent so
indicator of the portion of parti
cular tissues in beef carcass
still there are efforts in order
find some simplier method so th
exactiness of evaluation of comp
sition of beef carcasses is
diminished. Within the frame
these efforts, we started in th
work from the presumtion th
quantities of muscle, fat tiss
and bones in cut of the 9-10-11
rib have a adequat numeri
exposurees of their surfaces
some sections of this cut. Becau
of this we decided to examin
there are any, and of what inte
sity, corelative relations betwe
contents of basic tissues in be
9-10-11th rib cut and surfa
section of those tissues on cut
the 11th rib. Eventual existence
intense corelative relations be
ween mentioned parameters
could point out possibility of pr
diction of beef carcasses compo
tion by using surface section
basic tissues on the cut of 11
rib, as well as directions
further examinations in this fie

MATERIALS AND METHODS

Examination was performed on
"three-rib" cuts (9-10-11th rib)
from chilled beef carcasses
three weight groups: light (up
180 kg); medium (180-230 kg)
heavy (230-280 kg). All carcas
used in examination were
"domestic dappled cow" (YUGOS
SIMENTAL) in type of "baby bee
male, age to 18 months.
Cut from the 9-10-11th rib
separated from right side
chilled carcasses, cut from cran
edge of the 9th rib and cau

edgeof the 11th rib, and cut parallely with spine (normally on the ribs) so that 1/3 of higher part of ribs was left on the cut. Section surface of musle tissue, fat tissue and bones on the cut of the 11th rib was scethed on transparent paper, after that the disection was performed on "three-rib" cut and dividing of muscle, fat and bone tissues. Every tissue was separately weighed and mass expressed in grams, while establishing of the surfaces of particular tissues on the transparent paper was done by method of computer digitalisation and obtained values were expressed in cm².

RESULTS

Table 1. presents average values established for weight of "three-rib" cuts and particular tissues that were obtained by dissection of "three-rib" cuts in three weight groups of beef carcasses.

fat tissue. Thus, related to the light weight group, increase of the average bone weight separated from "three-rib" cut of medium heavy carcasses is 27,32%, muscle tissue 31,24 % and fat tissue 52,54%; in heavy group increase of average weight of the basic tissues is more explicit: 53% for bones, 76,61% for muscle tissue and average content of fat tissue is for 2,5 times greater.

Similar tendency are also expressed for the average section surfaces of muscle, fat tissue and bones of the 11th rib cut (tabl.2).

Namely, it is noticed that the increase of carcass weight and the "three-rib" cut, have the least influence on the average bone surface and the most on fat tissue.

Thus, related to light weight group, the increase of the average section surface of the bones on the 11th rib cut of the medium of heavy beef carcasses is only 1,7%, of

TABL. 1.: RESULTS OF DISECTION OF BEEF 9-10-11th RIB CUT

Weight of chilled carcass	Average value	Weight (gr)			
		Three-rib cut	Muscle tissue	Fat tissue	Bones
LIGHT (< 180kg)	x (n=30)	1.769	1.146	236	366
MEDIUM (180-230 kg)	x (n=30)	2.348	1.504	360	466
HEAVY (230-280 kg)	x (n=30)	3.250	2.024	610	560

It is noticed that with the increase of the weight of the carcasses the average weight of "three-rib" cut regularly getting greater, as well as average weight of all tissues separated by dissection. So, related to the light weight group, average weight of"three-rib" cut of the medium weight carcasses is greater for 32,73 %, and in the group of heavy carcasses increase is 83,73 %. Increase trend of the average weight of separated tissues, with increase of carcass weight, is the smallest for the bones and the greatest for

musle tissue 26,48% and of fat the 33,64%. In heavy weight group, related to light group, increase of average values is even more expressed: 15,67% for bones, 63,51% for musles and 86,44% for fat tissue. Consenquently to such tendencies shown for the section surfaces of particular tissues, by increaseing weight of chilled carcasses total average section surface in the region of the 11th rib is also increased. In this way, related to the light carcasses, average surface of the cut of the medium

Weight of chilled carcass	Average value	Surface (cm²)			
		Three-rib cut	Muscle tissue	Fat tissue	Bones
LIGHT (< 180 kg)	x (n=30)	110,59	55,55	38,64	16,40
MEDIUM (180-230 kg)	x (n=30)	138,58	70,26	51,64	16,68
HEAVY (230-280 kg)	x (n=30)	181,84	90,83	72,04	18,97

weight carcasses is 25,31% bigger and in heavy carcasses group increase amounts to 64,43%.

The results presented in tabl. 1 and 2 and analyses of expressed tendencies clearly point out that by increasing of chilled beef carcasses weight, which is by the way obligatory criteria when commercially judging and evaluating them, all the average values established for the weight and surface on the "three-rib" cut are regularly increased.

Mutual diferences of average values, in all the investigated cases are statisticaly significant on the level p<0,01. Also, knowledge is comfirmed that by increasing of the carcass weight, now the "three-rib" cut too, the least is increased content of bones and the most of separable fat tissue; increase of the muscular weight is also significant but the obtained values are in between datas for two already mentioned tissues. Almost the same tendencies are shown for the section surfaces of particular tissues on the 11th rib cut, by wich, though indirectly, connection of previous data and those established by weighing tissue masses separated by disection of "three-rib" cut.

Research results of corelative dependance between weight of particular tissues on the "three-rib" cut as independantly variable and the section surfaces of the correspon dant tissues on the 11th rib cut as dependantly variables, we presen in the tabl. 3.

In the first place, it is notice that between weight of "three-rib cut and total surface of the 11th rib cut, there is positive, very high and statistically significan corelative dependance (p<0,01) Also, for all three weight groups and in genera, accordingly independ dant from the weight of chilled carcasses, very high determination quotients (r^2) were established respectively very low values quo tients of undetermination $(1-r^2)$ were Similar dependances were investigated established for each muscles tissue. Thus, for the weight within light and medium weight groups, high (0,885 and 0,843), an within heavy weight group, very high corelative dependance (0,974) High corelative dependance for obtained for the separable weight tissue as well and in all of weight groups: light 0,856, medium 0,841 and heavy 0,861. Finaly, for the dependance bones high corelative dependance was established within light weight group (0,875), and very high within medium (0,979) and heavy weight group (0,999). All obtained corela tion quotients are positive and statisticaly significant (p<0,01)

TABL. 3.: CORELATIVE DEPENDANCES BETWEEN WEIGHT OF MUSCLE, FAT AND BONE
TISSUES (gr) - ESTABLISHED BY DISSECTION OF BEEF 9-10-11TH RIB
CUTS - AND SURFACES OF THE SAME TISSUES (cm²) MEASURED ON THE
CRANIAL SIDE OF THE 11TH RIB CUT

Weight of chilled carcass	Calculated indicators	Three-rib cut	Muscle tissue	Fat tissue	Bones
LIGHT (< 180 kg)	r_{xy}	0,9847	0,8853	0,8557	0,8749
n=30	r^2_{xy}	0,9696	0,7837	0,7322	0,7654
	$1 - r^2_{xy}$	0,0304	0,2163	0,2678	0,2346
MEDIUM (180-230 kg)	r_{xy}	0,9689	0,8426	0,8486	0,9796
n=30	r^2_{xy}	0,9387	0,7099	0,7201	0,9596
	$1 - r^2_{xy}$	0,0613	0,2901	0,2799	0,0404
HEAVY (230-280 kg)	r_{xy}	0,9983	0,9744	0,8615	0,9989
n=30	r^2_{xy}	0,9966	0,9494	0,7421	0,9978
	$1 - r^2_{xy}$	0,0034	0,0506	0,2579	0,0022
T O T A L - n = 90 (independant from the carcass weight)	r_{xy}	0,9978	0,9397	0,9335	0,8859
	r^2_{xy}	0,9956	0,8830	0,8714	0,7848
	$1 - r^2_{xy}$	0,0044	0,1170	0,1286	0,2152

* All the corelative quotients are statisticaly significant (p< 0,01).

d.f.=28 $t_{0.05}=2,048$ $t_{0.05}=1,990$
                                   d.f.=88
           $t_{0.01}=2,763$ $t_{0.01}=2,638$

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CONCLUSION

On the basis of the research re-
sults, established in the conditi-
ons of our experiment, esential
conclusions may be drawn:

1. As the weight of the chilled
carcass is increased, weight of the
"three-rib" (the 9-10-11th) cut is
regulary increasing as well as the
weight of all tissues separated by
their dissection: muscles, fat
tissue and bones.
Also biger weight of the chilled
carcass reflects on increase of
section surface of all observed
tissues on the 11th rib cut.

2. Within all three observed weight
groups, as well as independently
from the carcas weight from which
"three-rib" cut comes, quantity of
separated muscle, fat tissue and
bones is in positive, high
(0,90 < r > 0,75) or very high
(r > 0,90) and statisticaly signifi-
cant corelative dependance (p<0,01)
with the section surface of the
corespondant tissue on the 11th rib
cut.

3. According to our results, section
surface of each tissue on the 11th
rib cut could be indicator of their
portion in "three-rib" cut, even in
the whole beef carcass. Condition
for this is establishing through
consequent investigations, separate-
ly for each tissue, relation between
section surface of particular tissue
and its quantitative representation
in the 9-10-11th rib cut and whole
carcass.

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