Potassium in the diet did not have a significant affect on either the blood serum or muscle tissue potassium concentrations This would suggest that the primary influence of dietary potassium to K^{40} counting is the effect on potassium in the gastrointestinal tract and not on the potassium concentration of fluids within the animals cells.

Analyses of these data also suggests that there are important animal to animal differences in potassium concentrations of the muscle and blood. It would appear that this is a major source of variation that affects the precision of K^{40} estimates of fat-free lean. Since K^{40} counting is done under the assumption that intracellular potassium concentrations are relatively constant, any variation that does exist between animals would cause K^{40} estimates of fat-free lean to differ to some extent from the exact value for that animal and may be a limiting factor to the precision of K^{4} estimates of fat-free lean in live animals.

The Ribonucleic And Deoxyribonucleic Acid Content Of Three Bovine Muscles At Various Post-Mortem Periods

J. J. Guenther

Story in Brief

The RNA and DNA concentration of mature bovine psoas major longissimus dorsi and biceps femoris muscles was determined at 0 hour (immediately post-mortem), 23 hours and 93 hours post-mortem. Result showed a significant ($P < .01$) difference in RNA concentration betwee test muscles which ranked biceps > longissimusi > psoas in the order o RNA content. RNA appeared to be directly related to in vivo activit and tenderness of the muscles. Also significant ($P < .01$) was the difference in RNA concentration at various times post-mortem. In general, the highest RNA concentration was observed at 23 hours and the lowest a 93 hours post-mortem.

No significant difference was noted between test muscles in DNA concentration; however, post-mortem aging caused a significant ($P<.01$) decrease in muscle DNA. RNA content was greater than DNA and the RNA-DNA ratio increased with post-mortem aging, suggesting greater DNase activity. The magnitude of the RNA-DNA ratio appeared to be directly related to in vivo muscle function.

Introduction

The role of nucleic acids in protein synthesis has been fairly well established. Deoxyribonucleic acid (DNA) is found in the nucleus of the cell and since skeletal muscles are multinucleated, DNA concentration should be greater in skeletal muscle than in mononucleated tissue. As he genetic information of a gene resides in the base sequence of the DNA molecule, DNA determines the specific structure of the Ribonucleic acid RNA) produced by the cell, acting as a template.

RNA is contained mainly in the cell cytoplasm or muscle sarcoplasm and is associated with protein synthesis. Actual protein synthesis is believed to occur in the microsomes which are dispersed in the sarcoplasm and RNA directs the synthesis of the specific protein. It might be surmised that the very active muscles would contain more RNA than less active muscles.

Most studies in this area have been conducted on the tissue of various organs of laboratory animals such as mice, guinea pigs, etc. Thus, little is known regarding the quantitative amounts of nucleic acids in the skeletal muscle of the bovine. The purpose of this study was to determine the amount of DNA and RNA in certain bvoine skeletal muscles which were elected on the basis of their in vivo activity. Also, it was desired to assess the efficiency of the Schneider Hot Acid Extraction Method in quantitatng nucleic acids from bovine muscle. Finally, various post-mortem "agng" periods were imposed to determine if nucleic acid quantity were affected by RNase and DNase activity.

Materials and Methods

Duplicate 40 gram samples were obtained from the longissimus dorsi, psoas major and biceps femoris muscles of a freshly killed, 900 lb. Hereford steer. The steer had been fed exclusively for show purposes. The samples were packaged and frozen at -20°F. Additional samples were taken from the above muscles at 23 hours and 93 hours post-mortem. During this time the carcass was held in a cooler at 34°F.

At the appropriate time, the samples were removed from the freezer, allowed to temper at 32° F. for one hour, then diced and blended into a homogenous paste via a Sorvall omni-mixer. This operation was done a 34°F. The method of Schneider (1964) was used to extract the nuclei acids from duplicate 1 gram aliquots of the muscle homogenate.

The orcinol colorimetric test of Ceriotti (1955) was used in th quantitation of RNA. It is pointed out, however, that increased repeatibility was obtained if the samples were heated for 20 minutes at 212°F in an autoclave, rather than in the water bath as used in the abov method. The concentration of RNA was calculated from the formula RNA (mg/g sample) = O. D. x K. x D. F.; where O. D. = optica density (B & L Spectronic 20, 660mμ); K=O.D./1 mg RNA as calculate from the RNA standard; and D. F. = dilution factor required to put th 0.3 ml. aliquot on a 10 ml. basis.

The diphenylamine reaction of Siebert (1940) as modified by Burto (1956) was used to determine DNA. Again, the samples were heated fo 10 minutes at 212°F. in an autoclave rather than in the water bath. Th concentration of DNA, in mg/g sample, was calculated in the sam manner as that of RNA except that a 3 ml. aliquot was used for DNA an the dilution factor was thus altered.

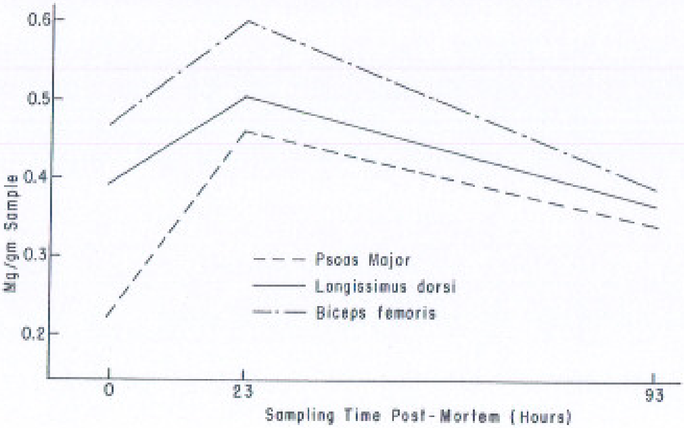
Results and Discussion

The analysis of variance for RNA concentration of the muscl sampled at 0, 23 and 93 hours post-mortem is given in Table 1. Thes results show a highly significant difference ($P < .01$) in RNA conten due to muscle and aging period. The mean values for RNA concentratio are presented graphically in Figure 1. Over all sampling periods, th Biceps, Longissimus and Psoas muscles averaged 0.486, 0.421 and 0.34 mg RNA per gm sample, respectively. These data suggest that the RN concentration of a particular muscle is related to the in vivo activity an function of the muscle. In this regard, the Biceps femoris, which had th highest concentration of RNA, is a very active muscle, used primarily t transport the animal. On the other hand, the Psoas, which had the lowe RNA concentration, is a relatively inactive muscle. While the Longiss mus dorsi, which was intermediate in RNA concentration, is considere

Table 1. Analysis of Variance For Ribonucleic Acid Content

Source	d.f.	Mean Square
TOTAL	17	------
Muscle	2	.03170**
Aging Period	2	.04985**
Muscle x Aging period	4	.00555
Duplicates (Error)	9	.00176

**$P < .01$.



igure 1. **The influence of muscle and aging period on RNA concentration**

be more active than the Psoas but less active than the Biceps femoris. is also interesting to note that in tenderness these three muscles would nk as they did in RNA content.

It can be observed in Figure 1 that the RNA content of all muscles as greatest at the 23 hour sampling period and lowest, except for the soas, at the 93 hour period. The increase in RNA concentration observ- l at 23 hours post-mortem was attributed to a general increase in ex- actibility of nucleic acids at this time. While the decrease in RNA ntent between the 23 and 93 hour periods was believed to be a result of NA hydrolysis by inherent ribonucleases.

The analysis of variance of the DNA data is shown in Table 2 and e mean values are plotted in Figure 2. No significant differences were tained between the three muscles in DNA concentration. However, a ghly significant ($P < .01$) change in DNA could be attributed to the fect of aging period. Overall, the Longissimus, Psoas and Biceps muscles eraged 0.232, 0.226 and 0.219 mg DNA per gm sample, respectively. ith respect to the 0, 23 and 93 hour sampling periods the muscles aver- ged 0.257, 0.261 and 0.160 mg. DNA per gm sample, respectively.

As with the RNA results, DNA concentration, except for the Psoas uscle, increased between the 0 and 23 hour periods. However, all uscles sampled at 93 hours showed a decrease in DNA when compared that obtained immediately post-mortem. Reasons for these changes ould be as stated for the RNA data, except that deoxyribonuclease tivity would be responsible for the lowered DNA levels at the 93 hour st period.

Table 2. Analysis of Variance For Deoxyribonucelic Acid Content

Source	d.f.	Mean Square
TOTAL	17	------
Muscle	2	.00030
Aging Period	2	.01954**
Muscle x Aging Period	4	.00074
Duplicates (Error)	9	.00154

**$P < .01$.

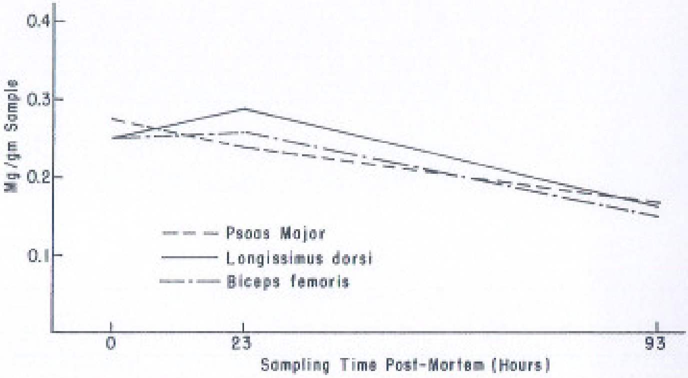


Figure 2. The influence of muscle and aging period on DNA co centration

In comparing the RNA and DNA results, it was noted that RN concentration, except for the Psoas muscle at 0 hours, was greater tha DNA concentration (Table 3). Also, the RNA to DNA ratio increase as aging time post-mortem was extended, suggesting that DNase activit was greater, relatively, than RNase activity. Finally, the magnitude o this ratio appeared to be directly related to in vivo muscle function.

Table 3. RNA - DNA Ratio

	Sampling Period		
Muscle	0 Hour	23 Hour	93 Hour
Psoas Major	0.82[1]	1.92	2.04
Longissimus Dorsi	1.57	1.75	2.26
Biceps Femoris	1.87	2.32	2.55

[1] Mg RNA/Mg DNA.

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Variation In Shear Tenderness Data

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Story in Brief

The inherent variation in shear tenderness data of longissimus dorsi muscle from the right and left sides of the bovine was assessed. Four right and three left L. dorsi muscles from seven, 1100 lb., choice grade steers comprised the experimental material for the study.

Results indicated considerable random variation in steak shear valves both along and across L. dorsi muscles and that shear value varied differently within each side, especially in the lumbar portion of the muscle. Overall, the right L. dorsi muscles averaged 1.6 lbs. greater shear force han did the left muscles. All muscles were more tender nearer the medial ide.

Data suggest that the most efficient experimental design, to test the nfluence of various treatments on beef tenderness, would be the Latin square in which the treatment and control are alternated between muscles from the right and left sides. Results also indicate that to make valid inferences as to treatment influence on beef tenderness, it is neces-