

Studies on Intravitaly-Determined Interrelationships Between the Activity of Asparagine and Alanine Aminotransferases in Blood Serum and the Fattening Growth and Meat Yield of Pigs

Maria Koćwin-Podsiadly, G. Adamska-Jarecka, J.A. Matuszak and B. Jabłońska

Institute for Breeding and Technology of Animal Production, Department of Pig and Horse Breeding, Academy of Agriculture, Szczecin (Poland)

Summary. As part of studies on early intravital indices of fattening growth and meat yield, an attempt was made to determine the interrelationship between the activity level of asparagine and alanine aminotransferases during early growth (4 months) and meat yield, (determined on six months) old animals, and the fattening growth of pigs.

The material for this investigation was comprised of 91 pigs of the Polish Landrace breed and 66 pigs of the Large-White Polish breed from the state breeding farm at Lubiana.

The conclusions of the research are as follows:

1. A significant positive correlation was found between the activity of AspAT and average 'live' growth rate ($r = 0.276$), and a highly significant positive correlation was found between the activity of this enzyme and a performance testing selection index ($r = 0.354$) in the case of the Large-White Polish breed.
2. A highly positive correlation coefficient between the activity of alanine aminotransferases and the mean 'live' rate of growth ($r = 0.347$) was found in the Polish Landrace breed.
3. It is suggested that the AspAT level in the Large-White Polish breed and the ALAT level in the Polish Landrace breed may be used as a criterion of selection at early stages of growth (4 months) to predict meat and fattening output.

Key words: Pigs — Enzymes — Fleshiness — Fattening growth

Introduction

Many researches have studied the relationship between the activity of aminotransferases and the morphotic composition of the carcass as well as indexes of performance (Suszkow 1971; Smirnow 1967; Smirnow et al. 1968; Smisek 1969; Derewiński 1970; Łuckij 1971; Koćwin 1976).

Since the purpose of pig breeding is to obtain plenty of meat and only a thin layer of back-fat, the investigations have, on one hand, been concentrated on nitrogen enzyme changes directed towards anabolism at an early stage of animal growth and, on the other hand, on the growth rate and the thickness of back-fat determined on the live animal. Selection of pigs with high daily gains insure that a breed, intended for meat production will more quickly attain the required slaughtering weight. Such pigs should have a thin layer of back-fat since the simultaneous selection for thin back-fat permits the elimination from the breeding stock those pigs which attain high growth rate due to excessive accumulation of fat tissue.

Such a selection will result in pigs which will produce more meat. They will also show a better utilization of their feedstuffs.

As a continuation of previous studies (1976, 1976, 1976) where early indexes for fattening growth and meat production were obtained, this work was undertaken to determine the interrelation between the level of activity of asparagine (AspAT) and alanine (ALAT) aminotransferases during early growth (4 months) and the fattening rate — determined in practice on the live animal at an age of 6 months, and meat production.

Material and Methods

The material for this investigation comprised 91 Polish Landrace pigs (pbz) and 66 pigs of the Large-White Polish breed (wbp) from the state breeding farm at Lubiana.

All specimens were nearly the same age (4 months \pm 2 weeks, and sex, sows only), and were randomly selected.

The animals were kept under the same conditions with respect to location and feeding. The blood for the analyses was taken at age 4 months \pm 2 weeks from the anterior vena cava. Weight and back-fat thickness were determined two months later, at 6 months of age.

Chemical analyses were repeated three times. The activity level of AspAT and ALAT in the blood serum was determined by Reitman's and Frankel's method.

Fattening growth and meat utility of gilts were determined on the live animals. Fattening growth was evaluated accordingly to 'live' rate of growth as described by Stahl (1955) and the meat utility according to a selection index of performance testing (Duniec et al. 1975).

The thickness of back-fat was measured by an ultrasonic apparatus of the type USM-2F.

The selective index was calculated for the Large-White Polish breed only.

Statistically significant differences for AspAT and ALAT activity and 'live' growth rate were determined according to methods described by Mudra (1958).

The correlation and regression coefficients between the activity of AspAT and ALAT and 'live' growth rate within breeds and the selective index of performance testing for the Large-White Polish breed were calculated from formulas given by Snedecor (1956).

Results and Discussion

Considerable differences in the activity level of AspAT and ALAT in the blood serum of pigs was observed (Table 1).

Similar high individual variabilities of these indexes were also obtained by Suszkov (1971) and Derewiński (1970). The same observation was also made from studies performed on other farming animals. Kojłataj (1966), while investigating poultry, obtained a variability exceeding 30%. Guskiewicz (1972), in investigating the level of activity of some enzymes in various cattle breedings, found similar variations.

Differences with respect to breed for level of AspAT and ALAT activity and 'live' growth rate, are shown in Table 2. With respect to rate of growth, the examined pig breeds differed significantly.

A similar result was obtained by Czarnecki (1976), who found that pigs of the Polish Landrace breed attained the same slaughtering weight three days earlier than the Large-White Polish breed. Within a weight range of 30-80 kg, pigs of the Large-White Polish breed grow faster.

Such results suggest the possibility for faster growth of Polish Landrace pigs during the initial period of growth as compared to the Large-White Polish breed.

Table 1. Average values of activity of asparagine and alanine aminotransferases in blood serum, 'live' rate of growth and a selective index for pigs of the wbp and pbz breeds

Breed	No.	AspAT activity 4 months age	ALAT activity 4 months age	'Live rate of growth to 6 months age	Selective index of performance testing
pbz	\bar{X}	13.40	15.20	432.40	—
	S	11.65	6.34	46.21	
wbp	\bar{X}	12.75	14.01	379.47	92.54
	S	5.03	6.88	25.62	12.68

\bar{X} = arithmetic mean, S = standard deviation

Table 2. Differences between breeds in activity of aminotransferases and 'live' range of growth

Trait	Breed	\bar{X}	S	n	Sd	Difference between the means
Activity of asparagine aminotrans- ferase	pbz	13.40	11.65	91	1.52	0.65
	wbp	12.75	5.03	66		
Activity of alanine aminotrans- ferase	pbz	15.20	6.34	91	1.05	1.19
	wbp	14.01	6.88	66		
'Live' rate of growth g/day	pbz	432.40	46.21	91	6.27	52.93 ^a
	wbp	379.47	25.62	66		

^a difference highly statistically different ($P \geq 0.01$) \bar{X} = arithmetic mean, S = standard deviation, n = quantity, Sd = the denomination for the 'T' test

Table 3. Correlations between the blood biochemical indexes and meat yield and fattening growth of pigs

Breed	Correlated features	no.	r	b
	AspAT activity and 'live' rate of growth	66	0.276 ^a	1.407
Large-White	ALAT activity and 'live' rate of growth	66	0.018	0.072
Polish breed	AspAT activity and selective index	66	0.354 ^b	0.892
	ALAT activity and selective index	66	0.132	0.265
Polish Land-race	AspAT activity and 'live' rate of growth	91	0.184	0.729
	ALAT activity and 'live' rate of growth	91	0.347 ^b	2.33

^a statistically significant correlation coefficient ($P \geq 0.05$)

^b statistically significant highly correlation coefficient ($P \geq 0.01$)

r = correlation coefficient, b = regression coefficient

The breeds do not differ essentially in activity levels of AspAT and ALAT. Different results were obtained by Derewiński (1970). However, his studies were done on USSR breeds and not on Polish ones.

The correlation and regression coefficients calculated in this work are shown in Table 3. In the Large-White Polish breed, the coefficient of correlation between AspAT activity and mean 'live' growth rate was positive and statistically significant ($r = 0.276$) and the coefficient of correlation between activity of this enzyme and the index of performance testing was also positive and significant ($r = 0.354$). A statistically significant and positive correlation between the activity of ALAT and mean 'live' growth rate ($r = 0.347$) was found in the Polish Landrace breed.

The correlation coefficients between the aminotransferases and the indexes of fleshiness and fattening growth are in agreement with other work. Smirnov (1968) obtained a positive correlation between the activity of AspAT and ALAT and the absolute weight gain of pigs when fed by the mother. The coefficients were 0.392 for AspAT and 0.580 for ALAT.

Smisek et al. (1969), in their investigations, calculated the interrelation between the activity of aminotransferase (GOT) and intensity of growth in Large-White breed ($r = 0.533$).

Gilman et al. (1973), working on the activity of aminotransferases in the blood serum and its relation to efficiency of pig fattening, obtained a positive correlation of 0.600 between the activity of these enzymes and the in-

dexes of fleshiness. The author proposed that early selection of pigs at age 3-4 months, based on the activity of aminotransferases in the blood serum, could contribute to an increase in meat content and to an increase in fat content.

Positive and statistically significant coefficients of correlation between the activity of asparagine and alanine aminotransferases and indexes of fleshiness (0.435 for AspAT, and 0.636 for ALAT) and between the AspAT activity and mean 'live' growth rate (0.460), were also calculated in the research of Koćwin (1976) and Koćwin et al. (1976).

Conclusions

1. A significant positive correlation was found between the activity of AspAT and mean 'live' growth rate ($r = 0.276$) as well as between the activity of this enzyme and a testing selective index ($r = 0.354$) in the Large-White Polish breed.
2. A positive correlation coefficient between the activity of alanine aminotransferases and mean 'live' growth rate ($r = 0.347$) was found in the Polish Landrace breed.
3. It is suggested that the AspAT level in the Large-White Polish breed and ALAT level in Polish Landrace breed may be useful as a criterion of selection, at an early stage of growth (4 months) to predict future meat and fattening performance.

Literature

- Czarnecki, R.: Badania nad związkiem długości ciąży z cechami użytkowymi u trzody chlewnej. *Zesz. Nauk. AR w Szczecinie* 47, 175-184 (1976)
- Derewiński, B.B.: Aktywność transaminaz w surowodzie krwi swinej rozlicznych porod. *C-ch Białogija* 5, 100-103 (1970)
- Duniec, H.; Kostyra, T.; Różycki, M.; Steindel, B.: Tabele do obliczania indeksów selekcyjnych loszek ocenianych przyżyciowo, 1975
- Gilman, Z.; Medred'ka, M.: Aktywność transaminaz surowodki krwi, swinej i ceswiaz's odkarmocnej i miasnej produktownosci. *Swinowodstwo* 6, 30-31 (1973)
- Guszkiewicz, A.: Poziom AspAT, ALAT, aldolazy oraz zasadowej i kwaśnej fosfotazy w surowicy krwi niektórych ras bydła i ich mieszańców. PAN, Inst. Genetyki i Hodowli Zw., Jastrzębiec, Ph. D 1972
- Koćwin, M.: Wskaźniki biochemiczne krwi a cechy użytkowe trzody chlewnej. Cz.I. Poziom aktywności aminotransferazy asparaginowej i alaminowej w surowicy krwi świń w różnym wieku i jego związek z dzielnością tuczną i użytkownością mięsą tych zwierząt. *Zesz. Nauk. AR Szczecin* 56, 87-99 (1976)
- Koćwin, M.; Czarnecki, R.; Piech, H.: Temat jw. Cz.III. Poziom kwasu rybonukleinowego w leukocytach i limfocytach krwi a wskaźniki użytkowności mięsnej świń. *Zesz. Nauk. AR Szczecin* (1976, in press)

- Koćwin, M.; Piech, H.: Temat jw. Cz.IV. Badania związku między aktywnością aminotransferazy asparaginowej i alaninowej w surowicy krwi a wskaźnikami użytkowości mięsnej świń. Zesz. Nauk. AR Szczecin (in press)
- Koćwin, M.: An interrelation between the level of blood the fattening growth and the meat utility of pigs. *Theor. Appl. Genet.* **47**, 87-95 (1976)
- Koźłataj, A.: Zjawisko heterozji u zwierząt. Collective work. Warszawa: PAN 1971
- Łuckij, B.: Isledowanie neketorych fermentow azotostowo miatabolizma u sielskochozjastwiennyh żiwotnych. *Dokl. WASCHNiL* **6**, 31-33 (1971)
- Mudra, A.: *Statistische Methode für landwirtschaftliche Versuche.* Berlin-Hamburg: Parey 1958
- Reitmann, S.; Frankel, S.: *Am. J. Clin. Path.*, **28**, 56 (cit. after Krawczyński J., 1972: Diagnostyka enzymologiczna w medycynie praktycznej. Metodyka badań. PZWIL Warszawa)
- Smirnow, O.K.: Aktywnost neketorych fermentow krwi u swinej i krolikow raznych porod. *Materiały Konf. Mol. Ucz. VIŻ a WSOOrd. Lenina Trudnowo Krasnowo Znamieni Nauczno-Issl. Inst. Żiw. Dubrowicy*, 87-94 (1967)
- Smirnow, K.O.; Karlikow, D.W.: Aktywnost syworotocznych fermentow u krwi swinej. *Swinowodstwo* **22** (3), 36-37 (1968)
- Smisek, V.; Pavel, J.; Buchta, S.: Studium wstachu aktiwity neketorych enzymu krewnim seru k intenwite rustu a k jatecne hodnete prasat plemene bilche uslechtilehe a Landrace. *Akta Universitatis Agriculturae Fakultas Agronomika*, **17** (4), 769-773 (1969)
- Snedecor, G.W.: *Statistical Methods*, 5. ed. Iowa State Univ. Press 1956
- Stahl, W.: Uwagi o kontroli użytkowości trzody chlewnej. *Post. Nauk. Roln.*, No. 2 (1955)
- Suskow, V.S.: Vezrastnaja i zmienciwosti i swiaz syworotocznych fermentow z morfologiczeskim sostawom t'us u swinej. *Zbornik Nauc. Rabot. VIŻ Dubrowicy* **24**, 56-58 (1971)

Received March 3, 1978

Accepted August 25, 1978

Communicated by L.D. Van Vleck

Dr. M. Koćwin-Podsiadły
Institute for Breeding and Technology
of Animal Production
Department of Pig and Horse Breeding
Academy of Agriculture
71-460 Szczecin (Poland)