

Preliminary results on the influence of amaranthus seeds on carcass and meat quality of fatteners

J.L. Sokół, B.K. Bobel, M. Fabijańska and M. Bekta

*Department of Animal Nutrition and Feed Science,
Warsaw Agricultural University
Rakowiecka 26/30, 02-528 Warszawa, Poland*

ABSTRACT

In an experiment with 3 groups of fatteners, the effect of amaranthus seeds on some indices of slaughter evaluation and qualitative traits of *M. longissimus dorsi* was studied. Amaranthus seeds were given in the mixtures in the amount of 25% in the form of a fine meal or expandate ("Popping"). It was found that irrespective of the form of administration, this amount of amaranthus in the mixtures had no significant effect on chemical composition, physico-chemical and sensory properties of meat or carcass quality (backfat layer, loin eye area).

KEY WORDS: amaranthus seeds, fatteners, meat quality

INTRODUCTION

Despite difficulties in cultivating amaranthus, there are real perspectives for increased interest in this plant, especially because of the search for new sources of food, diversification of diets, and management of the land becoming available as the result of overproduction of the most popular crop plants. This creates a chance of utilizing amaranthus in human nutrition and animal feeding. Amaranthus seed has a high nutritional value, thanks to good-quality protein (Becker, 1989; Nalborczyk, 1995) and substantial content of polyunsaturated fatty acids (Becker et al., 1981; Prakash and Pal, 1992), among others. Moreover, these seeds are characterized by good digestibility of basic feed components and a desirable effect on lipid profile indices (Danz and Lupton, 1992; Schnetler and Breene, 1994; Grajeta, 1997).

Some of the results of our earlier studies on fatteners (Bobel, 2000) pointed to a beneficial effect of amaranthus seed on the blood lipid profile, particularly cho-

lesterol level and polyunsaturated fatty acids content. Changes in the blood lipid profile may therefore also affect the quality of meat.

The objective of this part of the study was to examine the effect of amaranthus seed in the form of meal or expandate on some physico-chemical and sensory properties of meat and on selected indices of carcass quality.

MATERIAL AND METHODS

The experiment was conducted on 24 crossbred pigs [(Polish Large White x Landrace) x (Duroc x Pietrain)], divided by analogs into 3 groups, (4 barrows and 4 gilts in each group). The animals were fed mixtures without amaranthus seeds (group I, control) or with a 25% content of these seeds, given in the form of meal (group II) or a commercial expandate sold under the brand name of "Popping" (group III), (Table 1). All mixtures had a similar crude protein content. They differed, however, in lysine and metabolizable energy contents (about 10%). The mixtures were given twice a day, mixed with water (1:1). During the entire fattening period, from 27 kg to 105 kg of body weight, one medium-protein mixture was used and its daily ration was increased every 2 weeks on average.

The experiment was completed with the slaughter of animals during which samples of *M. longissimus dorsi* were collected (from 4 barrows from each group) for chemical and physico-chemical analyses and sensory evaluation. Dry matter and crude ash (Skulmowski, 1974) and crude protein and ether extract (Tecator,

TABLE 1
Composition and nutritive value of experimental mixtures, %

	Group – mixture		
	I	II	III
Barley meal	55.00	30.00	30.00
Wheat meal	30.00	30.00	30.00
Concentrate T	15.00	15.00	15.00
Meal from amaranthus seeds	-	25.00	-
Expandate from amaranthus seeds "Popping"**	-	-	25.00
1 kg of the mixture contained			
ME, MJ**	11.85	12.46	12.66
crudeprotein, g	161	159	161
lysine, g	7.10	8.03	8.03

* popping – product, produced after expanding of amaranth seeds (parameters of the process are covered with the trade secret of the company "Szarlat"

** energetic value of the mixtures was calculated based on the regression equations of Hoffman and Schiemann (1993)

respective applications) contents were determined. Physico-chemical evaluation of meat included determination of water holding capacity and thermal drip (Collective Paper, 1997), and pH (PN-77/A-82058, 1997); organoleptic evaluation covered colour, aroma, taste and consistency (Baryłko-Pikielna, 1975).

One day after slaughter of the animals, the layer of backfat in five points and the area of the cross-section of *M. longissimus dorsi* after the last rib (from the equation: width x height x 0.8) was calculated on all right half-carasses.

The results were statistically elaborated using the Statgraphics Plus program.

RESULTS

No significant differences were found in the selected indices of slaughter analysis among groups (Table 2). It should be noted, however, that in group II fatteners (25% of meal from amaranthus seeds in the mixture), the backfat layer was somewhat thinner and the loin eye area was somewhat greater. No significant differences in the evaluation of chemical composition in respect to physico-chemical and sensory traits of the meat were found either (Table 2). A lower

TABLE 2
Some results of slaughter analysis, chemical composition, sensory evaluation and of physico-chemical traits of *longissimus dorsi* muscle

Specification	Group – mixture					
	I		II		III	
	x	SD	x	SD	x	SD
Backfat layer mean from 5 measurements, mm	23.82	3.88	21.21	3.01	23.88	2.82
Loin eye area, cm ²	46.86	5.08	51.26	4.92	44.32	7.68
Chemical composition of meat, %						
dry matter	25.62	0.28	26.60	0.46	26.55	0.28
crude ash	0.94	0.15	1.15	0.30	1.05	0.11
crude protein	23.16	0.51	22.68	0.63	22.84	0.65
ether extract	1.00	0.16	1.39	0.32	1.75	0.58
Water holding capacity, %	1.20	2.18	0.80	3.70	-0.53	1.75
Thermal drip, %	3.48	0.46	2.75	1.26	3.80	1.10
pH	5.50	0.08	5.38	0.10	5.48	0.05
Colour	4.80	0.14	4.88	0.36	4.70	0.29
Aroma	4.68	0.21	4.68	0.26	4.58	0.25
Taste	4.73	0.00	4.68	0.05	4.60	0.19
Consistency	4.73	0.17	4.63	0.15	4.30	0.14

water holding capacity was, however, observed in meat derived from fatteners that received the mixtures with amaranthus meal or expandate. The meat of these fatteners also contained somewhat more dry matter and ether extract than that from the control animals. Besides, a smaller thermal drip was found in the loin of fatteners from group II (meal from amaranthus seeds in ration). The remaining parameters of meat evaluation, i.e., pH, aroma, taste and consistency were very equalized in all groups.

DISCUSSION

In the discussed studies, no significant effect of amaranthus seeds (irrespective of the form of administration) on the analyzed indices of carcass quality or qualitative traits of *longissimus dorsi* muscle were found. In our earlier studies on the use of amaranthus seeds in the amount of 10, 20 and 30% in complete feed for fatteners, in the form of meal or extrudate (Bobel, 2000), no significant effects on slaughter traits of the fatteners were observed either. Also, Antczak et al. (1999) did not notice any differences in fatness and meatiness when fatteners received 5 or 10% of amaranthus seed meal in the rations. In the opinion of Brzóska et al. (2000), the musculature of animals is mainly affected by breed and the level of feeding. In the discussed studies, these factors did not differ much. The animal material included the same crossbreeds in all groups and the administered feeds differed only about 10% in respect to energy and lysine.

Also, no significant effect of amaranthus seeds on the chemical composition of *longissimus dorsi* muscle was found, which confirms the earlier studies conducted by Bobel (2000). It is known that the quality and quantity of fat in the feed given to animals sometimes has a significant influence on the chemical composition of meat and fat (Potkański and Pospiech, 1998). In the opinion of Brzóska et al. (2000), *M. longissimus dorsi* constitutes 11% of the muscles in a half-carcass and contains from 2.4 to 4.2 % of fat. Potkański and Pospiech (1998) report that according to Polish standards fat content in *M. longissimus dorsi* varies from 1.5 to 2.5%. In our studies, the quantity of fat was within the above limits.

The content of intramuscular fat affects the marbling of meat and its taste values (juiciness, firmness and tenderness) and it may have a significant meaning for sale to defined customers (Potkański and Pospiech, 1998). In the sensory evaluation of meat (*M. longissimus dorsi*) no significant differences were observed, although a slightly lower water holding capacity of the meat from fatteners that received amaranthus in the diets was found. Also, Petkov et al. (2000) studied the physico-chemical properties of meat (thermal drip, water holding capacity and colour) and did not find any significant differences when 5 or 10% amaranthus seed meal was added.

CONCLUSIONS

The seeds of amaranthus given to fatteners at a level of 25% of diets in the form of meal or expandate did not significantly affect meat (*M. longissimus dorsi*) or carcass qualities. Nevertheless, it seems that further studies on their dietetic values in pig feeding should be continued due to the growing interest of dieticians in these seeds as a “functional food”.

REFERENCES

- Antczak K., Petkov K., Kortz J., Łukaszewski Z., 1999. Effect of ground seeds of Amaranth in complete mixtures for fatteners on feed conversion rate and carcass quality. *Ann. Warsaw Agr. Univ. – SGGW, Anim. Sci. No. 36*, 105-110
- Baryłko-Pikielna N., 1975. *Outline of Sensory Analysis of Food*. WNT, Warszawa (Poland)
- Becker R., 1989. Preparation, composition, and nutritional implications of amaranth seed oil. *Cereal Food World 34*, 950-953
- Becker R., Wheeler E.L., Lorenz K., Stafford A.E., Grosjean O.K., Saunders R.M., 1981. A compositional study of amaranth grain. *J. Food Sci. 46*, 1175-1180
- Bobel B.K., 2000. Evaluation of feeding value of amaranth seeds (*Amaranthus ssp.*) in fatteners' feeding (in Polish). PhD Dissertation, Warsaw Agricultural University, Warszawa (Poland)
- Brzóska F., Koreleski J., Hubert E., 2000. Environment and the quality of food of animal origin (in Polish). *Ann. Anim. Sci., Kraków 4*, 17-61
- Collective Paper, 1997. *Practical Exercises in Food Technology. Meat and Egg Technology* (in Polish). Warsaw Agricultural University Press, Warszawa, pp. 5-16
- Danz R.A., Lupton J.R., 1992. Physiological effects of dietary amaranth (*A. cruentus*) on rats. *Cereal Food World 37*, 489-494
- Grajeta H., 1997. Nutritional value and applications of amaranth (*Amaranthus*). *Bromat. Chem. Toxicol. 30*, 17-23
- Nalborczyk E., 1995. *New Crops. Amaranthus*. Warsaw Agricultural University Press, Warszawa (Poland)
- Petkov K., Antczak K., Łukaszewski A., Kortz J., Karamucki T., 2000. Effect of the addition of amaranth seed meal in full-ration mixtures for fatteners on meat quality. *Proceedings of Conference of XXIX Scientific Session: Feeding of Animals as Factor Modifying Transformations in the Trophic Chain: Feed – Animal - Man*. Rogów (Poland)
- Polish Standard, 1977. *Meat and Meat Products. Determination of pH of Meat* (in Polish)
- Potkański A., Pospiech E., 1998. Effect of addition of feed fats on the quality of animal raw materials. In: POLAGRA (Editor). *Feed Industry as a Chance for Quality Improvement of Animal Raw Materials*. Poznań, Vol. 6, pp. 135-148
- Prakash D., Pal M., 1992. Seed protein, fat and fatty acid profile of *Amaranthus species*. *J. Sci. Food Agr. 58*, 145-147
- Schnetzler K.A., Breene W.M., 1994. Food uses and amaranth product research: A comprehensive review. *Amaranth biology, chemistry and technology*. Parades-Lopez O., CRS INC. Pres, Boca Raton. 9, 155-184
- Skulmowski J., 1974. *Methods for Determination of Feed Composition and Quality* (in Polish). PWRiL, Warszawa (Poland)

STRESZCZENIE

Wpływ skarmiania nasion amarantusa na jakość tuszy i mięsa tuczników – wstępne wyniki

W doświadczeniu na 3 grupach tuczników badano wpływ nasion amarantusa na niektóre wskaźniki oceny rzeźnej oraz cechy jakościowe mięśnia najdłuższego grzbietu (*M. longissimus dorsi*). Nasiona amarantusa podawano w mieszankach w ilości 25% w postaci drobnej śruty lub ekspandatu („Popping”). Stwierdzono, że ta ilość amarantusa w mieszankach, niezależnie od formy w jakiej były podawane, nie miała istotnego wpływu na skład chemiczny oraz cechy fizykochemiczne i sensoryczne mięsa, ani na grubość słoniny oraz powierzchnię oka pęłdewicy.

REFERENCES

- Amarak K., Farkow K., Kozak J., Lukaszewski T., 1997. Effect of ground seeds of Amaranth in complete mixture for fattening feed conversion rate and carcass quality. *Ann. Warsaw Agr. Univ. - Anim. Sci. Ser. B*, 104-110.
- Bartko-Bielinska M., 1973. *Quality of Meat and Meat Products*. WNT, Warszawa (Poland).
- Baxter R., 1989. Evaluation, composition, and nutritional importance of amaranth seed oil. *Cereal Food World* 34: 273-277.
- Chaker A., Wheeler E.J., Lewis K., Stafford A.E., Grogan O.K., Saunders R.M., 1981. A comparative study of amaranth grain. *J. Food Sci.* 46: 1175-1180.
- Choi B.K., 1966. Evaluation of feeding value of amaranth seeds (Amaranthus sp.) in fattening. *Indonesian Agricultural Journal*. *Wangsa Agricultural University, Wamawa (Poland)*.
- Chojacki T., Kozłowski J., Babon E., 2000. Improvement and the quality of food of animal origin (in Polish). *Acta Anim. Sci. Kraków* 4: 1-21.
- Colvetecy J., 1977. *Animal Nutrition in Food Technology*. Meat and Egg Technology (in Polish). *Warsaw Agricultural University Press, Warszawa*, pp. 3-16.
- Janak A., Lupton J.K., 1992. Physiological effects of dietary amaranth (*Amaranthus*) on rats. *Czech Food World* 37: 459-474.
- Grzyba H., 1992. Nutritional value and application of amaranth (*Amaranthus*). *Humani. Czech Journal* 30: 17-22.
- Kaluzny E., 1992. *New Group Arguments*. Warsaw Agricultural University Press, Warszawa (Poland).
- Kozak J., Amarak K., Lukaszewski T., Kozak J., Kuzmowski T., 2009. Effect of the addition of amaranth seed meal in the diet mixture for fattening on meat quality. *Proceedings of XXIX Scientific Session Faculty of Animal Husbandry and Veterinary Medicine in the Polish-Lithuanian Post-Animal - Vilnius (Poland)*.
- Polish Standard 1277. *Meat and Meat Products*. Determination of fat in meat (in Polish).
- Polonski A., Popowski E., 1982. Effect of addition of feed mix on the quality of animal raw material. *Prace Naukowe Instytutu Zoologii i Hodowli Zwierząt Uniwersytetu Warszawskiego*, 15: 152-157.
- Przybyl D., Puzo M., 1972. Seed protein, fat and dry matter profiles of *Amaranthus sp.* *J. Sci. Food Agr. Sci.* 142-147.
- Schwarz A.A., Haines W.M., 1974. Food use and animal product research: A comparative review. *Amaranth: biology, chemistry and technology*. *Handbook of Amaranth*, CRC Press, Boca Raton, 2: 183-184.
- Skalski J., 1974. *Methods for Determination of Feed Composition and Quality* (in Polish). *PWRiL, Warszawa (Poland)*.