

The Cost-Benefit Analysis of Early Weaned Piglets Fed with Different Protein Sources

Ferhan KAYGISIZ^{1,*}, Filiz AKDAĞ², Özkan ELMAZ³, Can KUTAY⁴

¹Department of Animal Breeding, Faculty of Veterinary Medicine, İstanbul University, 34320 Avcılar, İstanbul - TURKEY

²Department of Animal Breeding, Faculty of Veterinary Medicine, Ondokuz Mayıs University, Samsun - TURKEY

³Department of Animal Breeding, Burdur Faculty of Veterinary Medicine, Akdeniz University, 15100 Burdur - TURKEY

⁴Department of Animal Nutrition and Nutritional Diseases, Faculty of Veterinary Medicine, İstanbul University, Avcılar, İstanbul - TURKEY

Received: 14.04.2005

Abstract: This study was carried out to analyse the economic effects of early weaning and of feeding with diets containing different protein sources in early weaned piglets.

One hundred and fourteen piglets were used in this study. Fifty-four piglets were fed by suckling their mothers for 20 days and they weaned on day 21 and they were equally assigned to 2 experimental groups and 1 control group. Sixty piglets were fed by suckling their mothers for 27 days and they were weaned on day 28. These piglets were also assigned to 2 experimental groups and 1 control group. The first experimental groups were fed a sunflower seed meal diet and the second experimental groups were fed a soybean meal diet for 4 weeks. Both control groups were fed food waste after they were weaned. The 2 major groups with different weaning dates did not reveal any significant differences ($P > 0.05$) with respect to feed intake between groups. In spite of this, body weight gains were higher ($P < 0.05$) in the experimental groups compared to both control groups, while no significant differences ($P > 0.05$) were determined in the comparison between the experimental groups. The within-group comparisons of the major groups demonstrated higher ($P < 0.05$) body weight gain in the experimental groups weaned on day 28 compared to the control group.

Although average body weight and daily body weight gain in the control groups that were fed food waste were lower compared to the experimental groups, cost-benefit analysis of this study showed that the use of food waste, which costs only 1 YTL, was more profitable than other feeding methods.

Key Words: Piglet, weaning, feed intake, protein sources, economic analysis

Erken Sütten Kesim ile Birlikte Farklı Protein Kaynaklı Rasyonla Yapılan Domuz Beslemesinin Fayda-Maliyet Analizi

Özet: Araştırmada erken dönemde sütten kesilen domuzlarda, erken sütten kesim ile farklı protein kaynaklı rasyonlar verilerek gerçekleştirilen domuz beslenmesinin ekonomik analizi yapılmış ve sağlanan fayda ortaya konulmuştur.

Çalışmada 114 adet yavru domuz kullanılmıştır. Domuz yavrularının 54 tanesi doğumdan sonra ilk 20 gün anne sütü ile beslenmişler ve 21. günde annelerinden ayrılarak 2 deney 1 kontrol grubu oluşturulmuştur. Kalan 60 adet yavru ise 27 gün anne sütü ile beslenip 28. gün sütten kesilerek bu yavrulardan da 2 deney 1 kontrol grubu oluşturulmuştur. Sütten kesilen domuz yavrularına ait birinci deney grupları, protein kaynağı ayçiçeği tohumu küspesi olan yem; ikinci deney grupları ise protein kaynağı soya fasulyesi küspesi olan yem ile dört hafta boyunca beslenmişlerdir. Her iki kontrol grubundaki yavrular sütten kesildikten sonra yemek artıkları ile beslenmişlerdir. Sütten kesim zamanları farklı olan iki ana grubun yem alımı bakımından gruplar arası karşılaştırılmasında aralarındaki farklılığın önemsiz olduğu belirlenmiştir ($P > 0,05$). Buna karşın canlı ağırlık kazançları bakımından tüm deney gruplarının her iki kontrol grubuyla aralarındaki fark önemli ($P < 0,05$) bulunurken; deney gruplarının birbirleriyle arasındaki fark önemsiz ($P > 0,05$) bulunmuştur. Gruplar içi karşılaştırmada ise 28. günde sütten kesilen deney gruplarının kontrol grubuna oranla daha yüksek canlı ağırlık kazancına sahip olduğu belirlenmiştir ($P < 0,05$).

Yapılan ekonomik analiz sonucunda, her iki grupta da yemek artıkları ile besleme yapılan kontrol gruplarında canlı ağırlık artışı ve günlük ortalama canlı ağırlık artışı deneme gruplarına göre daha az olmasına karşın 1 YTL'lık yem masrafı karşılığında elde edilen gelirler açısından değerlendirildiğinde, yemek artıkları ile besleme yapılmasının diğer besleme şekillerinin tümüne göre daha karlı olduğu belirlenmiştir.

Anahtar Sözcükler: Domuz, sütten kesim, yemden yararlanma, protein kaynakları, ekonomik analiz

* E-mail: ferhan_64@yahoo.com

Introduction

In Turkey, the production of crossbred swine is limited and swine are fed waste material from the kitchen or food industry and bran or potato. This feeding method is carried out even during pregnancy and the post-natal period. However, new-born piglets are fed only milk until weaning and are weaned when 45 days old (1).

Body weight gain of piglets depends on several factors including genetics, care and nutrition conditions (2). There are many feeding methods for piglets to gain body weight during the first 45 days. Several studies were carried out to investigate the effects of alternative diets after early weaning (3-6) and feeding with concentrate feed in addition to sow's milk 3 weeks after birth on the performance of swine (7-10). As in all animal production activities, feed cost is of primary importance in swine production (11,12). Therefore, technical achievements in new practices should be accompanied by economic efficiency (13,14).

The present study was carried out as a comparative economic analysis of alternative diets in early weaned piglets with different protein sources.

Materials and Methods

The study was carried out at a commercial enterprise in İstanbul and 114 crossbred piglets weaned on different dates were used. A group of 54 piglets were fed by suckling their mothers until 20 days of age and another group of 60 piglets until 27 days. They were weaned on days 21 and 28, respectively. The group weaned on day 21 was assigned to 1 control group (G21_c) and 2 experimental groups (G21_{SFM}, G21_{SBM}). The group weaned on day 28 was also assigned to 1 control group (G28_c) and 2 experimental groups (G28_{SFM}, G28_{SBM}) at similar mean weights. Over 4 weeks, the experimental groups were fed a sunflower seed meal (SFM) diet or soybean meal (SBM) diets, whereas the control groups were fed food waste (FW).

Body weights of piglets were recorded weekly during the study. Each pig was given a restricted amount of feed (3% of the body weight/day) (14).

For economic evaluation, partial budget analysis was used, and the changes in expenditures and income were taken into consideration to compare the groups (15-17). The feed intake and body weight gain of each group were recorded.

Feed costs for the control and experimental groups and the sale price per unit body weight were based on the marketing price at the end of the study.

The compositions of the group diets are given in Table 1.

Results

The initial body weight, final body weight, average daily body weight gain, daily feed intake and feed conversion ratio of the groups are presented in Table 2.

As shown in Table 2, final body weight, average daily body weight gain and feed conversion ratios were 3821, 3677 and 3616 g; 31.21, 24.32 and 15.93 g; and 0.38, 0.27 and 0.17 for the groups weaned on day 21, respectively. Final body weight, average daily weight gain and feed conversion ratios were 5158, 4850 and 4164 g ($P < 0.05$); 59.36, 47.00 and 14.00 g ($P < 0.05$); and 0.58, 0.44 and 0.13 for the groups weaned on day 28, respectively.

When the feed conversion ratios of the 2 major groups (groups weaned on day 21 and groups weaned on day 28) with different weaning days are compared, differences between the groups were insignificant ($P > 0.05$). In spite of this, significant differences ($P < 0.05$) were demonstrated between all of the experimental groups (G21_{SFM}, G21_{SBM}, G28_{SFM} and G28_{SBM}) and both control groups, while the differences within the experimental groups were insignificant ($P > 0.05$).

Total feed intake, cost of feed, body weight gain and income from weight gain are presented in Table 3.

Feed consumption cost per piglet weaned on day 21 and fed a diet containing G21_{SFM}, G21_{SBM} and G21_c was 0.92, 1.15 and 0.13 YTL, respectively; income from body weight gain was 4.37, 3.41 and 2.23 YTL, respectively; profit per animal was 3.45, 2.26 and 2.10 YTL, respectively; income versus per unit feed cost (income:cost) was 4.74, 2.97 and 16.93 YTL, respectively.

For groups weaned on day 28, feed consumption cost per piglet fed G28_{SFM}, G28_{SBM} and G28_c was 1.15, 1.37 and 0.16 YTL, respectively; income from body weight gain was 8.31, 6.58 and 1.96 YTL, respectively; profit per animal was 7.16, 5.21 and 1.80 YTL, respectively; income versus per unit feed cost was 7.25, 4.80 and 12.49 YTL, respectively.

Table 1. Compositions of the group diets.

Ingredient (%)	Soybean meal (SBM)	Sunflower meal (SFM)	Control (FW) ^a
Soybean meal	21	-	-
Sunflower meal	-	26	-
Barley	20	10	-
Maize	40	50	-
Whole meal	5.2	3.5	-
Meat-bone meal	3.3	5	-
Wheat	5	-	-
Dicalcium phosphate	1.5	1.5	-
Salt	1	1	2.0
Vitamin and mineral premix ^b	1.5	1.5	-
Lysine	1	1	-
Methionine	0.5	0.5	-
Total	100.00	100.00	100.00
Calculated analysis			
Crude protein (%)	23	22.2	8
ME, kcal/kg	3200	3180	2460

^a: Food waste

^b: Composition of premix/kg: Vitamin A 10,000,000 IU, vitamin D₃ 1,500,000 IU, vitamin E 400,000 IU, vitamin K₃ 3000 mg, vitamin B₁ 2200 mg, vitamin B₂ 4500 mg, niacin 30,000 mg, vitamin B₅ 3000 IU, vitamin B₁₂ 15 mg, folic acid 1500 mg, biotin 100 mg, vitamin C 12,000 mg, Mn 80,000 mg, Zn 60,000 mg, Fe 30,000 mg, Cu 5000 mg, I 1000 mg, Co 200 mg, Se 150 mg

Table 2. The effects of different protein sources on performance in piglets weaned on day 21 and 28 (Mean ± SE).

Groups	Groups weaned on day 21 n = 54			Groups weaned on day 28 ¹ n = 60		
	G21 _{SFM}	G21 _{SBM}	G21 _C	G28 _{SFM}	G28 _{SBM}	G28 _C
Initial body weight, g	2947 ± 96	2996 ± 146	3170 ± 128	3496 ± 251	3534 ± 190	3772 ± 179
Final body weight, g	3821 ± 133	3677 ± 93	3616 ± 217	5158 ± 204 ^a	4850 ± 213 ^a	4164 ± 147 ^b
Daily body weight gain, g/day ²	31.21 ± 4 ^a	24.32 ± 6 ^a	15.93 ± 10 ^b	59.36 ± 2 ^a	47.00 ± 3 ^a	14.00 ± 8 ^b
Feed intake, g/day	82.36 ± 2.9	90.01 ± 3.8	94.11 ± 4.2	102.40 ± 4.4	107.68 ± 3.6	112.10 ± 2.1
Feed conversion ratio	0.38	0.27	0.17	0.58	0.44	0.13

¹a, b; For comparison in the group the difference between values with different superscripts is significant (P < 0.05).

²a, b; Means with different superscripts in the same row differ for among groups (P < 0.05).

Discussion

When the experimental groups (G21_{SFM}-G28_{SFM} and G21_{SBM}-G28_{SBM}) were compared, incomes from per cost feed of groups weaned on day 28 were higher than those of groups weaned on day 21, whereas those of the

control group weaned on day 21 (G21_C) were higher than those of the control group weaned on day 28 (G28_C). Except for the control groups, because the experimental groups had higher body weight gain, incomes from these groups were higher.

Table 3. Economic comparison of the alternative feeding methods.

Cost and Income Groups	Groups weaned on day 21			Groups weaned on day 28		
	G21 _{SFM}	G21 _{SBM}	G21 _C	G28 _{SFM}	G28 _{SBM}	G28 _C
Feed intake (g)	2306	2520	2635	2867	3015	3139
Feed cost (YTL)	0.92	1.15	0.13	1.15	1.37	0.16
Body weight gain (g)	874	681	446	1662	1316	392
Income from body weight gain (YTL)	4.37	3.41	2.23	8.31	6.58	1.96
Income - Cost (YTL)	3.45	2.26	2.10	7.16	5.21	1.80
Benefit/Cost (YTL)	4.74	2.97	16.93	7.25	4.80	12.49

1 US Dollar: 1.40 YTL

In this study, in spite of the higher values of growth performance, body weight gain and feed conversion traits of the piglets weaned on day 21 for the experimental groups than the controls, the differences were statistically insignificant (18). In addition, final body weights and daily body weight gain values of the piglets weaned on day 28 for the experimental groups were higher than the controls and they were statistically significant. However, the differences between the experimental groups were statistically insignificant. Furthermore, the final body weights of all of the groups were lower than the live weight values reported by some authors for similar aged piglets (6,7). Final body weights of the G21_{SFM}-G21_{SBM} and G21_C groups weaned on day 21 and fed different diets for 4 weeks were lower than the 4.2 kg live weight value reported by Akdağ for 45-day-old piglets, while the final body weight values of the G28_{SFM}-G28_{SBM} groups were higher (1).

Feed intake, feed conversion ratio and live weight gain comparisons of the 2 major groups with different weaning dates revealed a similar condition to the within group comparisons: there was no statistical difference, and live weight gains and feed conversion ratios of the experimental groups weaned on day 28 (G28_{SFM}-G28_{SBM}) were higher than those of the other experimental groups (G21_{SFM}-G21_{SBM}). Despite this, all of the experimental groups had higher values than the control groups.

However, average daily weight gain and feed conversion ratio values determined for all groups were lower than the values reported by some authors for piglets of similar ages (9,10,14,19,20). In addition, the average live weight gain and feed conversion values that Bruinx et al. (3) reported for piglets weaned on day 28 and given a ration containing soybean and sunflower for 34 days were somewhat higher than the same values determined in this study for all groups.

Although G21_{SFM} was more profitable, income from G21_C versus per unit feed cost was higher (16.93 YTL) in groups weaned on day 21. However, the income:cost ratios of G21_{SFM} and G21_{SBM} were 4.74 and 2.97 YTL, respectively. Results for groups weaned on day 28 were similar and the income:cost ratios of G28_C, G28_{SFM} and G28_{SBM} were 12.49, 7.25 and 4.80 YTL, respectively.

When it is considered that the principal aim of economical activities is to obtain maximum profit versus certain cost (21), it is obvious that the use of food waste in weaned piglet feeding will be economical compared to other feeding methods.

Acknowledgement

This study was supported by the Pig Production Farm of Çerkezo Meat and Food Productions Commercial Company.

References

1. Akdağ, F.: Özel işletme koşullarında yetiştirilen domuzların dölerimi özellikleri ve yavruların büyüme performansları üzerinde araştırmalar. Doktora tezi, İstanbul Üniv. Sağlık Bilimleri Enstitüsü, İstanbul. 2003.
2. Yalçın, B.C.: Genel Zootečni. İstanbul Üniv. Veteriner Fakültesi Zootečni Anabilim Dalı Yayınları, Ankara. 1981.
3. Bruininx, E.M.A.M., van der Peet-Schwering, C.M.C., Schrama, J.W., Vereijken, P.F.G., Vesseur, P.C., Everts H., den Hartog, L.A., Beynen, A.C.: Individually measured feed intake characteristics and growth performance of group-housed weanling pigs: effects of sex, initial body weight, and body weight distribution within groups. *J. Anim. Sci.*, 2001; 79: 301-308.
4. Worobec, E.K., Duncan, I.J.H., Widowski, T.M.: The effects of weaning at 7, 14 and 28 days on piglet behaviour. *Appl. Anim. Behav. Sci.*, 1999; 62: 173-182.
5. Hohenshell, L.M., Cunnick, J.E., Ford, S.P., Kattesh, H.G., Zimmerman, D.R., Wilson, M.E., Matters, R.L., Carroll, J.A., Lay, D.C.: Few differences found between early- and late-weaned pigs raised in the same environment. *J. Anim. Sci.*, 2000; 78: 38-49.
6. Vesseur, P.C., Kemp, B., Den Hartog, L.A., Noordhuizen, J.P.T.M.: Effect of split-weaning in first and second parity sows on sow and piglet performance. *Livest. Prod. Sci.*, 1997; 49: 277-285.
7. Azain, M.J., Tomkins, T., Sowinski, J.S., Arentson, R.A., Jewell, D.E.: Effect of supplemental pig milk replacer on litter performance: seasonal variation in response. *J. Anim. Sci.*, 1996; 74: 2195-2202.
8. Wolter, B.F., Ellis, M., Corrigan, B.P., DeDecker, J.M.: The effect of birth weight and feeding of supplemental milk replacer to piglets during lactation on preweaning and postweaning growth performance and carcass characteristics. *J. Anim. Sci.*, 2002; 80: 301-308.
9. Mahan, D.C., Cromwell, G.L., Ewan, R.C., Hamilton, C.R., Yen J.T.: Evaluation of the feeding duration of a phase 1 nursery diet to three-week-old pigs of two weaning weights. *J. Anim. Sci.*, 1998; 76: 578-583.
10. Bruininx, E.M.A.M., Binnendijk, G.P., van der Peet-Schwering, C.M.C., Schrama, J.W., den Hartog, L.A., Everts, H., Beynen, A.C.: Effect of creep feed consumption on individual feed intake characteristics and performance of group-housed weaning pigs. *J. Anim. Sci.*, 2002; 80: 1413-1418.
11. Aral, S., Yalçın, C., Cevger, Y.: Hayvansal üretimde maliyet hesaplamalarında karşılaşılan sorunlar. *Ekin Derg.*, 1999; 3: 24-31.
12. Hermesch, S., Kanis, E., Eissen, J.J.: Economic weights for feed intake in the growing pig derived from a growth model and an economic model. *J. Anim. Sci.*, 2003; 81: 895-903.
13. Houška, L., Wolfová, M., Fiedler J.: Economic weights for production and reproduction traits of pigs in the Czech Republic. *Livest. Prod. Sci.*, 2004; 85: 209-221.
14. Chae, B.J., Han, I.K., Kim, J.H., Yang, C.J., Hancock, J.D., Kim, I.H., Anderson, D.A.: Effects of dietary protein sources on ileal digestibility and growth performance for early-weaned pigs. *Livest. Prod. Sci.*, 1999; 58: 45-54.
15. Aras, A.: Tarım Muhasebesi. Ege Üniversitesi Basımevi, İzmir. 1988; 237-241.
16. Erol, H.T. (Çeviri): Tarım İşletmelerinin Planlanmasında Kullanılan Bazı Bütçe Metotları. MPM, Ankara. 1968.
17. Bokranz, R., Bühner, V.: Maliyet Muhasebesi. MPM-REFA, Ankara. 1991.
18. Friesen, K.G., Goodband, R.D., Nelssen, J.L., Blecha, F., Reddy, D.N., Reddy, P.G., Kats, L.J.: The effect of pre- and post-weaning exposure to soybean meal on growth performance and on the immune response in the early-weaned pig. *J. Anim. Sci.*, 1993; 71: 2089-2098.
19. Sohn, K.S., Maxwell, C.V., Buchanan, D.S., Southern, L.L.: Improved soybean protein sources for early-weaned pigs: I. Effects on performance and total tract amino acid digestibility. *J. Anim. Sci.*, 1994; 72: 622-630.
20. Nessmith W.B.Jr., Nelssen, J.L., Tokach, M.D., Goodband, R.D., Bergström, J.R., Dritz, S.S., Richert, B.T.: Evaluation of the interrelationships among lactose and protein sources in diets for segregated early-weaned pigs. *J. Anim. Sci.*, 1997; 75: 3214-3221.
21. Erkuş, A., Bülbül, M., Kiral, T., Açıl, F., Demirci, R.: Tarım Ekonomisi. Ankara Üniv. Ziraat Fak. Eğitim, Araştırma ve Geliştirme Vakfı, Ankara. 1995; 29-30.