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Meat and milk quality and safety: past and future trends in Slovenia

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ABSTRACT

In Slovenia, meat production has stabilised in the last years. The important increase in meat production was noticed in sheep and goats. The quality of slaughtered cattle, estimated on the basis of noted conformation and fatness, has worsened in the last decade, mainly due to changes in the structure of cattle population. On the contrary, large improvement in quality was realized in pigs. Lean meat content increased around 6%. Sheep and goat meat production rapidly increased in the last 15 years (500%). Poultry meat producers have focused mainly to safe, healthy and functional products to satisfy the consumers' needs. Milk production was limited by negotiated quotas and reached 635 million litres in the year 2005. Protein and fat content did not change in the last seven years, but the quality of milk regarding the number of total bacterial and somatic cell count greatly improved.
(Keywords: meat, milk, production, quality, Slovenia)

INTRODUCTION

After the independence the Slovenian agriculture has experienced great alterations. Development Strategy of Slovene Agriculture was passed by the Slovene parliament in 1993 and agriculture development was orientated to market economy that considers environmental and social conditions, and sustainable market economy. Farmers are aware that they will be successful in the EU if they adapt to the new conditions as soon and as best possible. It became obvious, that at least as important as the quantity of produced food will be the quality of produced foods. So, a lot of efforts were invested to assure and improve the quality of animal products.

The aim of present work was to analyse trends in the quality of produced meat and milk in Slovenia in the last decade and to present our future expectations.

MEAT PRODUCTION

Meat production in Slovenia in the last 10 years can be seen in *Table 1*. Total meat production was relatively stable and reached around 170 thousand tons. After a small drop between 1995 and 2000, meat production increased for almost 10 thousand tons. The quantity of meat from animals slaughtered in slaughterhouses was increasing up to 2003 and then it decreased in the year 2004. Veal and beef production reached 45 thousand tons in the year 2004. Pig meat production was estimated to 71 thousand tons. Poultry meat production has stabilised at around 53 thousand tons. The greatest increase

has been achieved in sheep and goats, where the production of sheep meat has more than tripled and goat meat has doubled in the last 10 years, although it is still very low.

Table 1

Meat production in Slovenia (in 1000 t) (*Statistical yearbook*, 2005)

	1995	**2000**	**2001**	**2002**	**2003**	**2004**
Gross indigenous production[1]	160.4	151.5	173	159.6	176.7	169.1
Meat from slaughter in slaughterhouses[1]	119.6	124.7	131.6	129.0	136.5	126.7
Cattle						
Gross indigenous production	43.0	39.3	48.0	44.6	49.6	45.0
Meat from slaughter in slaughterhouses	33.0	34.6	39.2	40.5	43.1	40.1
Pig						
Gross indigenous production	65.1	58.1	66.4	61.9	70.3	71.2
Meat from slaughter in slaughterhouses	36.5	38	35.8	37.1	37.3	34.6
Poultry						
Gross indigenous production	52.3	54.1	58.6	53.1	56.8	52.9
Meat from slaughter in slaughterhouses	50.1	52.1	56.6	51.4	56.1	52.3
Sheep						
Total indigenous meat production (live weight)	0.9	2.7	2.4	2.9	2.5	3.3
Goats						
Total indigenous meat production (live weight)	0.3	0.7	0.4	0.6	0.7	0.6

[1]Mutton, lamb, goats and horse meat is not included.

VEAL AND BEEF PRODUCTION

In the year 1994 the carcass classification of slaughtered cattle was introduced according to the EUROP system. (*Pravilnik o ocenjevanju in razvrscanju govejih trupov in polovic na klavni liniji*, 1994). It has foreseen six categories of slaughtered cattle (calves under six month of age and 160 kg carcass weight, young bulls under 24 months, old bulls over 24 months, heifers, steers and cows). Later on some changes have been introduced, so the age and weight of the slaughtered calves have been increased to 8 months and 185 kg (*Pravilnik o ocenjevanju in razvrscanju govejih trupov in polovic na klavni liniji,* 2001, 2004). The percentage of slaughtered cattle in different category is presented in *Table 2*. After the increase of classified cattle up to 2003, it diminished slightly in the years 2004 and 2005. The percentage of slaughtered calves presented around one quarter of all slaughtered cattle. For beef production the most important categories were bulls, cows, heifers and steers. The age of slaughtered animals was subjectively defined by the ossification of vertebra up to the year 2001. After that the age was defined on the basis of birth date provided by SIR (Cattle Identification Service of Slovenia). Consequently, bulls that were slightly older than 24 months and were before classified as young bulls were then classified into the category of old bulls. So the percentage of bulls older than 24 months increased dramatically in the year 2002. The percentage of slaughtered cows increased due to the strict veterinary legislation and complete control through animal identification service, presenting now around one quarter of slaughtered cattle. Heifers presented slightly more than 10% of slaughter cattle, while the number and percentage of slaughtered steers was negligible.

To evaluate the carcass quality of slaughtered cattle, we collected data from slaughterhouses which have automatic data collection. In year 1997 seven

slaughterhouses were included in data collection, up to the year 2005 the number had been increased to eleven. At the beginning of classification the percentage of included animals from total slaughtered and classified in Slovenia was around 50% for each category. In 2005 it increased to 83.6%.

In *Table 3* the number and carcass weight of slaughtered cattle is shown. The number of classified calves was increasing in the studied period up to 2004 and diminished slightly after that. The percentage of calves included into the valuation in comparison to all slaughtered calves increased from 48% in the year 1999 to 81% in the year 2005. The average carcass weight of calves through the last nine years was 75 kg. Though it increased for 15 kg, it is with 82 kg still very low in comparison with Austria, for example (*Zaufaly et al.,* 2005). The average carcass weight of young bulls was 346 kg and slightly varied in the studied years. It was increasing up to 2002, and started to diminish after that. Up to the same year the carcass of old bulls was more than 50 kg heavier than that of young bulls. Afterwards the number of slaughtered old bulls increased and the carcass weight diminished, so the difference came to only about 20 kg (*Table 4*). Carcass weight of heifers diminished slightly in the period from 1997 to 2005, and was on average for almost 90 kg lighter than young bulls. Carcass weight of cows was with 294 kg for 34 kg heavier compared to heifers.

The best conformation was estimated for the old and young bulls, which on average achieved almost 3.5. Slightly worse conformation was noted for heifers and the lowest for cows and calves. The best conformation was noted in the year 1998 and 1999. Afterwards the conformation notes decreased dramatically in all categories (the least in young bulls for two thirds of conformation class and the most in old bull for almost one conformation class). At this time the cattle population in Slovenia has continuously changed due to increased percentage of dairy cows and crossbreds between Simmental and Montbeliard and Red Holstein. The second reason for those changes could be also the criterion for conformation estimation which had been sharpened in that period.

The highest carcass fatness was noted for heifers (3.16) and the lowest for calves (2.32). Carcass fatness of old bulls, young bulls and cows was on average very similar. In the studied period carcass fatness diminished in all categories, most in calves and least and less in other three categories (*Table 5*).

Table 2

The number of all classified cattle and percentage of different categories in Slovenian slaughterhouses from 1998 to 2005

	Number of all classified animals	Calves	Young bulls*	Old bulls*	Heifers	Steers	Cows
1998**	123.560	19.3	65.6	0.6	-	-	14.5
1999**	128.022	21.3	64.1	0.5	-	-	14.1
2000**	126.898	22.5	61.7	0.9	-	-	14.9
2001	143.473	17.0	49.9	2.6	11.5	0.2	18.8
2002	157.005	18.0	35.8	10.7	12.1	0.3	23.1
2003	165.763	18.3	36.6	7.9	12.7	0.4	24.1
2004	153.799	20.1	38.7	8.1	12.1	0.3	20.7
2005	140.692	19.5	35.5	14.5	11.5	0.4	18.6

* young bulls – bulls younger than 24 months, old bulls – bulls older than 24 months; ** in the year 1998, 1999 and 2000 the percentage of young bulls includes also heifers and steers.

Table 3

Number and carcass weight of slaughtered cattle in slaughterhouses with automatic data collection during the period from 1997 to 2005 in Slovenia

Year	Calves		Young bulls (under 24 m.)		Old bulls (over 24 m.)		Heifers		Cows	
	N	kg	N	kg	N	kg	N	kg	N	kg
1997	6721	67	32854	340	224	409	10660	262	9702	282
1998	9875	67	33090	348	216	389	9921	265	8414	292
1999	13188	68	32516	350	218	409	9808	264	8149	298
2000	14991	69	36220	353	491	420	10718	264	11571	290
2001	10230	82	46173	354	2365	409	11997	269	16755	289
2002	13232	80	35483	343	9988	363	12876	261	32347	313
2003	22828	78	47886	340	10049	357	16234	251	39990	308
2004	23244	79	47933	341	9710	360	15377	251	25442	291
2005	22330	82	42921	342	16370	365	13972	255	21559	283
Σ/Avg.	136639	75	355076	346	49631	387	111563	260	173929	294

Table 4

Carcass conformation of slaughtered cattle in slaughterhouses with automatic data collection during the period from 1997 to 2005 in Slovenia

Year	Calves	Young bulls (under 24 m.)	Old bulls (over 24 m.)	Heifers	Cows
1997	2.85	3.62	3.78	3.37	2.94
1998	2.90	3.65	3.52	3.44	3.00
1999	3.10	3.62	3.71	3.46	3.01
2000	2.98	3.58	3.88	3.41	2.96
2001	2.79	3.51	3.77	3.35	2.97
2002	2.60	3.44	3.37	3.32	2.93
2003	2.68	3.30	3.19	3.12	2.69
2004	2.49	3.17	3.07	2.73	2.50
2005	2.35	2.98	2.92	2.78	2.22
Σ/Avg.	2.75	3.43	3.47	3.22	2.80

(E=5, U=4, R=3, O=2, P=1)

On the basis of conformation and fatness notes, carcasses are classified into 6 payment classes, 1 beeing the best and 6 the worst. As we can see in *Table 6* the best payment class was attained by young and old bulls, heifers, calves and cows. Due to worse conformation payment class also worsen.

Carcass conformation is defined mainly by animal genotype. So it can be improved through selection and introduction of new genotypes. The most effective way is industrial crossbreeding with beef breeds. Fattening technologies will have to adapt to achieve optimal fatness at slaughter in different categories. Basic concepts of animal growth regulation and control will have to be considered (*Hossner*, 2005).

Table 5

Carcass fatness of slaughtered cattle in slaughterhouses with automatic data collection during the period from 1997 to 2005 in Slovenia

Year	Calves	Young bulls (under 24 m.)	Old bulls (over 24 m.)	Heifers	Cows
1997	2.62	2.89	3.14	3.22	2.79
1998	2.57	2.88	3.13	3.25	2.79
1999	2.60	2.89	3.00	3.24	2.85
2000	2.51	2.88	3.09	3.24	2.77
2001	2.29	2.88	3.03	3.30	2.84
2002	2.14	2.86	2.74	3.20	2.78
2003	2.06	2.75	2.64	3.04	2.67
2004	2.03	2.66	2.54	2.94	2.60
2005	2.03	2.65	2.55	2.97	2.57
Σ/Avg.	2.32	2.82	2.87	3.16	2.81

Table 6

Payment class of slaughtered cattle in slaughterhouses with automatic data collection during the period from 1997 to 2005 in Slovenia

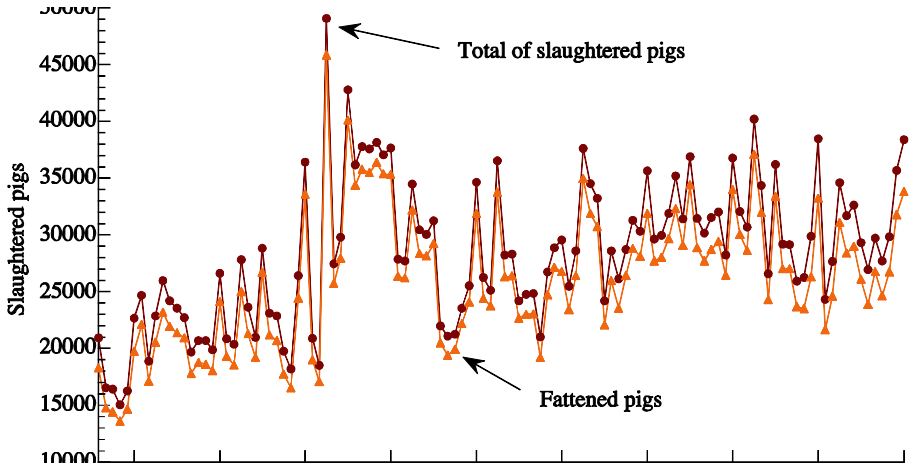
Year	Calves	Young bulls (under 24 m.)	Old bulls (over 24 m.)	Heifers	Cows
1997	3.18	2.40	2.43	2.94	3.34
1998	3.13	2.38	2.69	2.89	3.30
1999	2.92	2.42	2.46	2.86	3.33
2000	3.04	2.47	2.29	2.90	3.36
2001	3.27	2.56	2.38	3.04	3.34
2002	3.39	2.62	2.67	3.00	3.37
2003	3.40	2.75	2.85	3.14	3.66
2004	3.61	2.98	2.97	3.26	3.82
2005	3.76	3.09	3.13	3.45	4.17
Σ/Avg.	3.30	2.63	2.65	3.05	3.52

PIG MEAT PRODUCTION

The improvement in pig carcass quality has been estimated on the base of carcass grading in slaughter houses. The total production comes to around twice the registered number due to relatively high proportion of slaughter for home use and slaughter in small slaughter houses. The number of graded pigs has increased since 1996 (*Figure 1*). The new method of carcass grading was introduced gradually in slaughter houses in 1996, thus showing a larger increase in the number of carcasses graded. There has been a slight seasonal effect with an increase in winter and early spring and a decrease in late spring. However, large changes were usually caused by an increased import of pig carcasses accompanied by substantial subsidies from the importing country. In such cases, a large decrease in the number of pigs slaughtered was followed by a substantial increase in a very short time. The most severe case happened in 1999. Since 1996, the production cycles were very irregular and unpredictable, causing many problems in pig industry.

Figure 1

Number of pigs slaughtered in Slovenia between 1996 and 2005



Changes in pig industry can be extracted from the structure of pig suppliers (*Table 7*). Pigs were sold to the meat industry from 278 suppliers in 2005. Changes have been observed graduately since 1996, however, much larger in the last period. Thus, the number of suppliers was reduced for one third from 2004 to 2005. The reason may be explained by large initiative of some large farms to organize pig production also in the small sector. Some farms have increased reproduction part and organized fattening on family farms, while the others have extended cooperation with smaller stockholders also to reproduction. Pig industry is concentrating around large units lately. Thus, only 7 suppliers (2.52%) sold more than one third of slaughtered pigs (38.50%) last year. The proportion increased for about 5% compared to 2004. Suppliers with less than 1000 pigs slaughtered per year were numerous (80.85%) but sold only 14.46% of pigs which had on the average less lean meat and were also more variable in quality.

Table 7

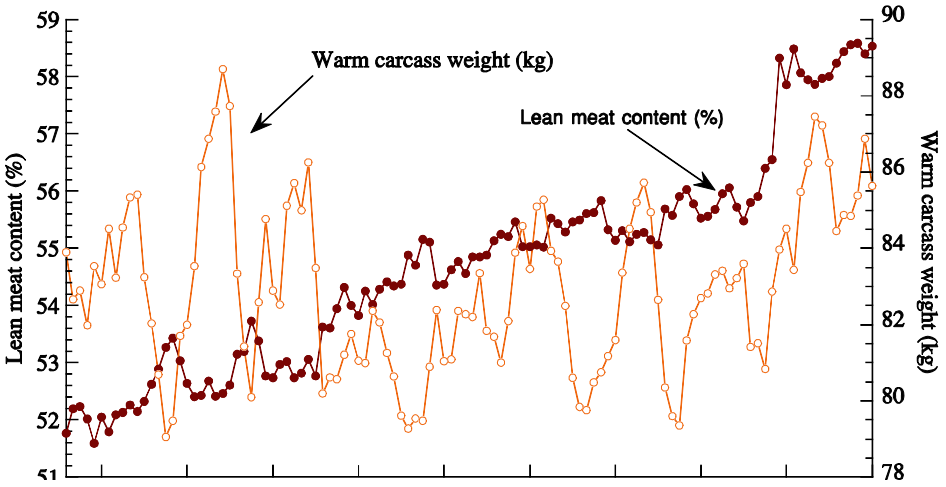
Distribution of suppliers by number of pigs slaughtered in 2004 and 2005

No. of pigs slaughtered per year	**2005**			**2004**		
	Suppliers (%)	Pigs (%)	Lean meat (%)	Suppliers (%)	Pigs (%)	Lean meat (%)
> 10000	2.52	38.50	58.15	1.52	32.97	56.16
7000-10000	2.16	15.21	58.97	1.53	13.91	56.64
4000-6999	2.52	11.31	58.24	1.52	8.41	56.79
2000-3999	5.76	12.36	58.60	4.83	16.04	56.18
1000-1999	6.47	8.17	58.44	6.85	11.05	56.59
500-999	11.15	6.98	57.96	10.15	8.37	55.90
100-499	30.22	6.35	57.35	28.17	7.51	55.76
50-99	11.87	0.70	56.83	11.68	0.99	55.70
< 50	27.34	0.43	56.02	33.76	0.75	55.00
Total	278	368690	58.28	394	379125	56.27

Changes in carcass quality can be described by two aspects (*Figure 2*). The first one is carcass weight which showed slow long term increase in the last years. The average carcass weight in 2005 was 85.8 kg and was increased about for 5 kg. The increase of overall variation can be justified by the tendency of some slaughter houses to get heavier pigs for ham. However, the producers slightly decrease a variation with groups. Large seasonal changes of carcass weight over years were observed. Seasonal changes in weight are closely related to the market situation. The second aspect of carcass quality was connected to lean meat content. As seen from *Figure 2*, lean meat content was constantly improving from around 52% in 1996 to over 58% in 2005. The larger step in 2004 was caused by renewed equation for DM5 and will be explained later. The changes were due to improvement of fattening conditions like reduced density, better housing conditions, splitting fatteners by sex and/or genotypes, and improving feeding regimes as well as diets. Some changes were also caused by changes of genotypes in the population. Lately, we have recorded much smaller pure breed populations, increased use of Pietrain as terminal sire breed and increased terminal hybrids containing Pietrain breed as well. The production data collected regularly did not give a possibility to determine the importance of each factor.

Figure 2

Changes of warm carcass weight an lean meat content since 1996



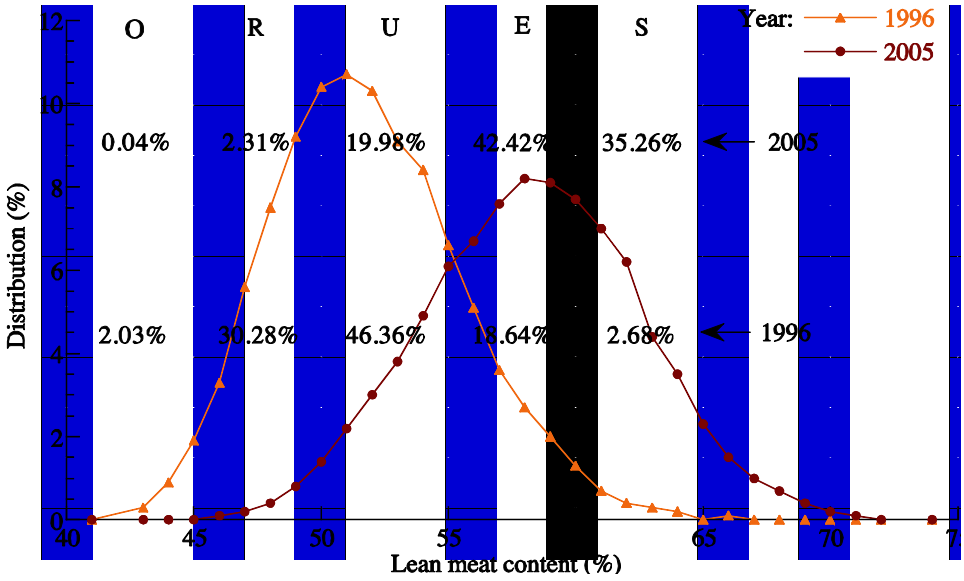
Lean meat content changed about 6% in 10 years causing large changes in distribution of carcasses over grading classes (*Figure 3*). In 1996, only 21.32% of carcasses were assigned into class E and S while ten years later the two upper classes contained altogether 77.68% carcasses. Almost the same proportion of carcasses (76.64%) was allocated into classes U and R in 1996. The standard deviation of lean meat content was increased form 3.83% to 4.26% and was mainly due to large variation in carcass weight.

Some major changes in carcass quality can be explained from trends in lean meat content (*Figure 4*), measurement M (*Figure 5*) and S (*Figure 6*) observed at different weights. Carcasses were observed on 5 kg interval for warm carcass weight between 70 and 95 kg. Independently of carcass weight, all three traits were improving over years.

Changes for predictor traits M and S were changing more or less constantly. Trait M was enlarging by rates between +0.41 mm/year at 70 kg and +0.60 mm/year at 95 kg and advanced more at heavier carcasses. The change may be caused by the improvement of genotypes or faster growth reducing some critical points in fattening. Trend for fat thickness (measurement S) was decreasing gradually up to 2002. Since than, trends were almost none for two years. The average trend was -0.57 mm/year at 70 kg and -0.74 mm/year at 95 kg. The changes were again more evident at heavier carcasses. The carcasses of 95 kg had more subcutaneous fat (7.5 mm) than carcasses of 70 kg in 1996. The difference was reduced to 5.5 mm in 2005. Changes in fat were caused to a large degree by environmental components influencing growth rate and body composition.

Figure 3

Comparison of lean meat content in 1996 and 2005



There was a sudden increase in lean meat content in 2004. It was mainly due to the adjustment of prediction equation used by DM5 grading method. The adjustment of formulae was needed because most carcasses were underestimated with the old equation. On average, the bias was 1.7%, however, almost half of the carcasses were assigned into lower grading classes. Thus the reduced trend since 2000 can be explained by increasing bias due to the deficiency of prediction equation.

In the future, we do not expect many changes in average lean meat content. It is intended to focus on the reduction of variability in carcass weight as well as leanness. Nevertheless, it is neccessary to define carcass characteristics required for special products like various hams and other traditional products. Pigs used for fresh meat, which are slaughtered at 100 kg live weight, are usually not appropriate for most of dried and smoked products. There are still large improvements possible in some production traits, like fertility, growth, and pig survival.

Figure 4

Trends in lean meat content over time at different carcass weights

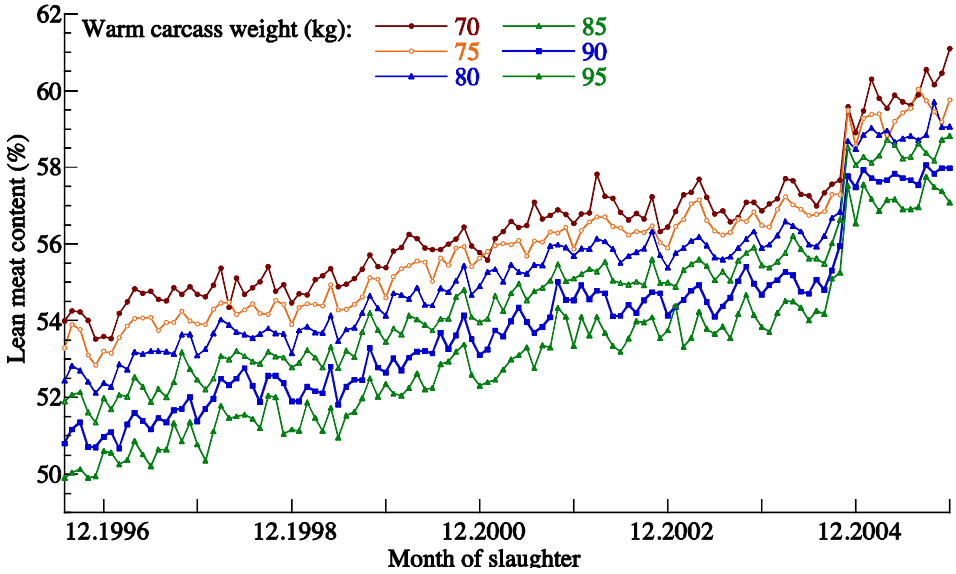


Figure 5

Trends in measurement M over time at different carcass weights

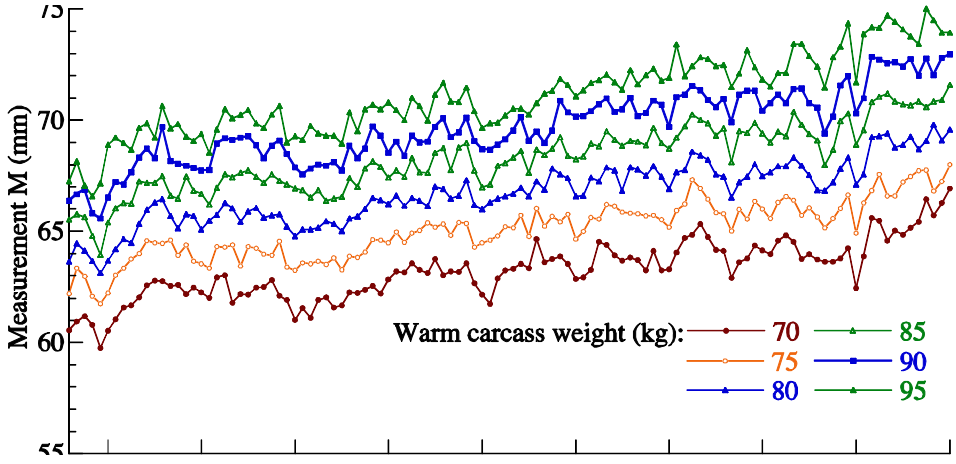
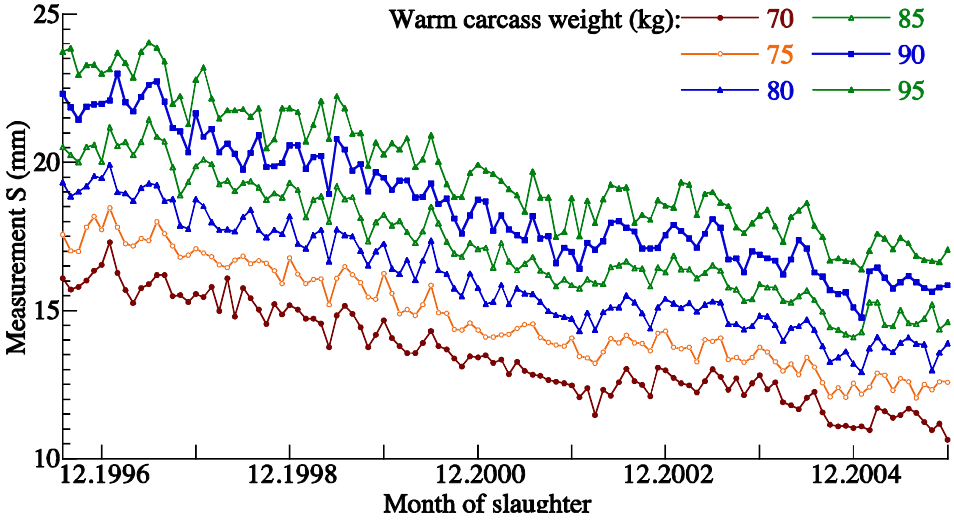


Figure 6

Trends in measurement S over time at different carcass weights



SHEEP AND GOAT MEAT PRODUCTION

Sheep and goat meat production is based on two types of production:

- Suckling lamb and kid production by milk breeds (Bovška breed and Istrian Pramenka sheep breed, and Slovene Saanen and Slovene Alpine goat breed). The average live weight by slaughter is less than 22 kg.
- Lamb and kid production by meat breeds (Jezersko-Solčava breed, Improved Jezersko-Solčava breed and Bela Krajina sheep breed ,and Goat Boer breed). The average live weight by slaughter is between 25–40 kg.
- In last years the most effective way is industrial crossbreeding with Texel and Charollais breeds.

POULTRY MEAT PRODUCTION

In Slovenia like in most of the world, the great part of poultry meat is chicken. In the last decade several changes in quality of poultry meat have been noticed in accordance with veterinary and health trends. Owing to its specific composition poultry meat is regarded as healthy and light food. Healthy and functional foods are now the main trends in poultry product trades. Better quality of poultry meat has been achieved by the following changes in *poultry nutrition*:

- no fish meal and other animal proteins are used,
- no antibiotics,
- some enzymes are added to achieve better absorption of minerals and nutritive matters from other cereals (wheat).

Several tests of probiotic and prebiotic additives that affect intestine microflora and digestion in animals and can, therefore, prevent some diseases in people have already been done; the mentioned additives are not used in nutrition at present; addition of

minerals (organic selenium – better feed conversion) and vitamins (HyD – better bone firmness); additives are not used in production.

A constant quality of feed enables a constant quality of meat and fatness of chickens. The insertion of home produced feed in larger poultry companies prevents changes in quality of poultry meat production. A considerable advancement was noticed in *safety and constant quality of products:*

- certificates that ensure higher level of safety and quality of meat and products were achieved (HACCP, EFSIS, BRC…);
- strict veterinary and sanitary conditions in the whole chain of production that have already been introduced diminish health risks;
- permanent in-service training of employees in hygienic treatments of foods diminishes possibilities of later contaminations;
- uninterrupted cooling during poultry processing preserves constant quality and prevents microbiological risks;
- some technological changes like elimination of water-cooling system, higher quality of treatment and lower rate of damages contribute to better quality of meat;
- animal welfare,
- strict microbiological monitoring diminishes microbiological risks.

A *special product* is "maize chicken", i.e. a typically yellow coloured chicken reached by feeding meals with at least 50 % of maize. Some markets require "aged fillet" that has very tender and soft structure attained by a specific way of production.

Most chickens are reared in intensive indoor production. The biggest poultry company in Slovenia started to produce *free range chickens* at their cooperative farmers in 2001. The chickens are certified as "better quality". The free range system requires at least one m^2 of grass-covered area per bird in the second part of breeding but due to danger of aviary influenza in domestic poultry this system of breeding is not used at present. The results of our researches with free range chickens have shown that:

- free range chickens were significantly less fat than extensively indoor reared chickens (*Holcman et al*., 2003). Samples of breast with skin of the free range chickens contained significantly less fat and more minerals than samples from indoor-raised chickens. The instrument-measured cutting values were significantly higher in the free range chickens (*Rajar et al*., 1999).
- Free range broilers showed a higher degree of pigmentation in skin colour than the broilers in confinement. The differences were significant for the L* (lightness) and b* (yellowness) values (*Terčič et al*., 2000).
- From the point of view of human nutrition, free range broilers gave meat with better fatty acid composition (increased content of n-3 and n-6 fatty acids) compared to indoor raised chickens. Fatty acid composition was more favourable for breast than leg (*Polak et al*., 2002).

Some breeders have recently started to fatten chickens according to ecological standards, and others produce capons. In the past the breeding of capons of Slovene autochthonous breed of Styrian hen was very popular. The meat was famous for its tastiness and juiciness. Hence our aim is to renew the production of capon meat.

Due to the awareness of consumers and their health care the consumption of safe, healthy and functional products that satisfy their needs and do not cause further diseases will prevail. The present trends are functional poultry production and poultry meat products, which are followed by poultry companies in Slovenia as well.

MILK PRODUCTION AND QUALITY

According to the report by Slovene Dairy Association (GIZ Mlekarstva Slovenije) which combine 7 dairies, 383 million litres of milk were bought-in from 24.165 producers by Slovenian dairies in 1996, and 448.6 million litres of milk from 8.908 producers in 2005. Compared with previous five years, the bought-in quantity of milk was increasing progressively and reached the highest rate of buying-in in 2004 (486 million litres), and then decreased approximately to the level of 445.5 million litres in 2000 once more. The main reason for decrease of buying-in milk in 2005 was export of raw milk by the producers association. Slovenian dairies bought only 88.25% of delivered milk in the year 2005. *Table 8* shows the quantity of produced and delivered milk in Slovenia.

Table 8

Quantity of produced and delivered milk (1000 Litres) in Slovenia from 2000 to 2005 (*Statistical Office of the Republic of Slovenia*, 2006)

Year	Produced milk	Delivered milk
2000	629.736	453.896
2001	633.820	472.765
2002	706.446	487.683
2003	642.380	498.705
2004	631.456	503.348
2005	635.000	508.341

More strict regulations and new systems of payment by quality have improved the milk quality. In 1996, 78.8% of bought-in milk was classified into the category of European milk quality, i.e. the total number of micro-organisms in 1 ml of milk was lower than 100.000 and with 62.9%, the number of micro-organisms in 1 ml of milk was lower than 50.000. Only in 5% of bought-in milk, the number of somatic cells in 1 ml exceeded 600.000, and in 75% of milk the number of somatic cells in 1 ml was lower than 400.000 (*Slovene Dairy Association*, 2006). The goal was to achieve the European milk quality; that was the only way to be able to trade with other countries. The Council Directive (92/46/EEC) published on 16 June 1992 included all the aspects of quality assurance for milk and milk products, from milk production and placing of products on the market.

Rules on lying down the bacteriological quality of foodstuff on the market (Official Gazette of the RS, No. 39/92) was the first step in improving the quality of milk. They described that since 1994 the total bacterial count of raw milk should be 100.000 of m.o./ml not 3.000.000 m.o./ml allowed before.

In 1994, the country started paying the bacteriological milk quality dependent upon the level achieved by individual producers at the time of supplying milk into the dairy. The raw milk was classified into quality grade on the base of total bacterial count. The stimulation was different. The quality up to 50.000 m.o./ml was stimulated for 10%. The quality of milk from 50.000 m.o./ml to 100.000 m.o./ml was declared as normal quality and was not stimulated. In the same year, the determination of bacteriological milk quality by automatic epifluorescent microscopy by means of the instrument BactoScan 8000 was introduced in Slovenia. In 1995, we joined the network for comparability of the results of bacteria cell measurements, liaising 12 European countries (104 instruments) at that time and 18 laboratories (84 instruments) in 2006. The comparison was organized by Milk Standard Service (Hüfner), Germany, now Milchwirtschaftliches Institut Dr. Hüfner (MIH). The comparability of bacteriological milk quality measurements at the international level is confirmed in this way.

The raw milk quality has been improving due to the increased payment of milk by quality and by raising the criteria (Rules on laying down the cow milk purchase price, Official Gazette of the RS, No. 34/93, No. 72/93, No. 68/94, No. 16/96, No. 41/96). *Table 9* shows the share of milk in relation to bacteriological quality.

Table 9

Share of milk (%) in relation to bacteriological quality in Slovenia from 1994 to 2005 (*Slovene Dairy Association*, 2006)

Year	Share of milk, % to 50.000 m.o./ml	Share of milk, % to 100.000 m.o./ml
1995	60.99	78.10
1996	63.31	79.03
1997	68.61	83.05
1998	69.89	84.60
1999	70.02	85.97
2000	85.78	95.16
2001	90.55	96.74
2002	91.21	97.35
2003	91.81	98.12
2004	92.94	98.57
2005	93.72	98.52

Milk producers decided to adopt the so-called directed dairy farming. Smaller producers who could not meet the quality criteria, started to abandon the production. The year 2000 was a turning point.

In 1996, the average milk in Slovenia contained 3.98% of milk fat, 3.24% of proteins, 8.55% of non-fat solids and the average freezing point was -0.521 ºC (*Golc Teger*, 1998). In 1993, payment of protein content as part of the system for payment of milk by quality started (*Golc Teger*, 1998). The protein content in bought-in milk after 1995 increased to the average level of 3.36% in 2005 (*Slovene Dairy Association*, 2006). The fat content in bought-in milk reached the average level of 4.10% in the period following the year 1999, and reached the level of 4.15% in 2005 (*Slovene Dairy Association*, 2006). The quantity of proteins and fat content in bought-in milk in Slovenia are shown in *Table 10*.

Table 10

Buying-in milk (millions litres) and quantity of proteins and fat content in milk in Slovenia from 1999 to 2005 (*Slovene Dairy Association*, 2006)

Year	Buying-in milk	Proteins %	Fat %
1999	434.9	3.35	4.10
2000	445.5	3.36	4.10
2001	459.0	3.34	4.12
2002	473.5	3.33	4.13
2003	484.2	3.34	4.14
2004	486.0	3.36	4.16
2005	448.6	3.36	4.15

The rules on the milk quality in force state the freezing point of -0.520 ºC as the basic criterion to assess the raw milk quality (Official Gazette of the RS, No. 21/93). The criterion in 1994 was the value of freezing point lower than -0.515 ºC (*Golc Teger*, 1998).

The number of somatic cells as a criterion for milk quality and a parameter for payment of bought-in milk was introduced in 1994. The share of milk at the time of buying-in with the number of somatic cells in ml of milk lower than 400,000 was constantly increasing after 1996 and amounted to 91.2% in 2000; in 1.1% of milk, the number of somatic cells in ml was lower than 600.000. In 2005, 91.8% of milk reached the level of less than 400.000 somatic cells in ml and only 1% of milk reached over 600.000/ml. *Table 11* shows the share of milk in relation to somatic cells count.

Table 11

Share of milk in relation to somatic cells count in Slovenia in the period from 1997 to 2005 (*Slovene Dairy Association*, 2006)

Year	Share of milk, % to 400.000 sc/ml	Share of milk, % over 600.000 sc/ml
1997	83.37	3.48
1998	82.06	3.06
1999	85.15	2.16
2000	91.15	1.07
2001	93.39	0.81
2002	92.76	0.88
2003	92.19	0.82
2004	92.72	0.80
2005	91.81	0.93

Slovenian laboratories are checking the quality of analyses and of micro-biological tests performed by integration into the international inter-laboratory comparative tests, which have been organised by recognised institutions and associations (MUVA, Kempten, CECALAIT, Poligny, AIA, Rome, AFEMA, Vienna) since 1992.

In the future we expect to maintain the quality control of milk for payment at the time of buying-in and for the selection service performed in central laboratories. Development of analytical methods will be directed towards supporting dairy farm management by selecting additional parameters, important to achieve the required quality (for example: determination of urea, free fatty acids, etc).

CONCLUSIONS

- Meat and milk production has stabilised in the last years.
- The quality of slaughtered cattle, estimated on the basis of noted conformation and fatness, has worsened
- On the contrary, very big improvement in quality of slaughtered pigs was noted. Meat percentage increased for almost 5%.
- Sheep and goat meat production increasing about five times in the last 15 years
- Poultry meat producers have focused their efforts to satisfy the consumers needs for safe, healthy and functional products.
- Te quality of milk regarding the number of total bacterial and somatic cell count greatly improved.

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