RUOKAVIRASTO
Livsmedelsverket • Finnish Food Authority

Publications
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Fineli analyses 2023—2024: Meat

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Abstract

The purpose of this work/study was to update composition data in Fineli (Finnish Food Composition Database). The analysed food items are selected by the Fineli monitoring group, which is led by the Finnish Institute for Health and Welfare (THL). The Finnish Food Authority is responsible for the sampling, analyses and reporting of the results, while THL takes care of updating the data into the Fineli database.

The study analysed 20 food items, all of which were analysed for basic composition (protein, fat, water, ash), amino acids, fatty acids, minerals (Ca, Cr, Cu, Fe, K, Mg, Mn, Na, P, Se, Zn) and heavy metals (As, Cd, Ni, Pb). In addition, vitamin B1 (thiamine) was analysed from 16 items. The analyses were carried out at the Finnish Food Authority's chemical laboratory, except for vitamin B1, which was analysed by a commercial laboratory.

This report presents all the obtained results. The new analytical results have been compared to previous Fineli values when applicable. It was noted that most of the new results differ from the previous values in Fineli. The differences were observed both as percentages and as absolute values, as even small changes in very small concentrations appeared to be large in percentage terms only.

There were many differences in the fat content, and in particular in the fatty acid results, compared to the previous data from Fineli. Calcium levels were significantly lower in most samples than before, and iron levels were also generally slightly lower than Fineli values. Potassium levels in most meats were found to be clearly higher than in Fineli, and magnesium, sodium, phosphorus and selenium levels were also found to be higher on average than before, according to the new analyses. Vitamin B1 results differed in both directions depending on the meat.

Since there were significant differences between the new analytical results and the previous Fineli values, updating the compositional database is very necessary also in the future. Fineli has a wide range of users, the needs of the uses are diverse, and updated values are crucial in many cases.

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Tiivistelmä

Vuosina 2023–2024 toteutetun Finelin (kansallinen elintarvikkeiden koostumustietokanta) päivitystyön tarkoituksena oli saattaa lihan koostumustiedot ajan tasalle. Analysoitavat nimikkeet valittiin Finelin seurantaryhmässä, jonka koollekutsujana toimii THL. Näytteenotosta, analyyseistä ja tulosten raportoinnista vastasi Ruokavirasto. THL huolehtii tietojen päivittämisestä Fineli-tietokantaan.

Työssä analysoitiin 20 nimikettä, joista kaikista analysoitiin peruskoostumus (proteiini, rasva, vesi, tuhka), aminohapot, rasvahapot sekä mineraalit (Ca, Cr, Cu, Fe, K, Mg, Mn, Na, P, Se, Zn) ja raskasmetallit (As, Cd, Ni, Pb). Lisäksi B1-vitamiini (tiamiini) analysoitiin 16 nimikkeestä. Analyysit tehtiin Ruokaviraston kemian laboratoriossa, lukuun ottamatta B1-vitamiinianalyysejä, jotka analysoitiin kaupallisesta laboratoriosta.

Tässä raportissa on esitetty kaikki päivitystyössä saadut tulokset. Analyysituloksia on verrattu Finelin aikaisempiin arvoihin soveltuvin osin. Vertailussa huomattiin, että suurin osa uusista tuloksista poikkeaa aikaisemmista arvoista. Eroja tarkasteltiin sekä prosentuaalisesti että absoluuttisina lukuina, sillä pienetkin muutokset hyvin pienissä pitoisuuksissa näyttivät prosentuaalisesti suurilta.

Rasvapitoisuuksissa ja erityisesti rasvahappotuloksissa oli paljon eroja aikaisempiin Finelin tietoihin verrattuna. Kalsiumia löytyi useimmista näytteistä huomattavasti aikaisempaa vähemmän ja myös rautapitoisuudet olivat yleisesti Finelin arvoja hieman pienemmät. Useimpien lihojen kaliuminpitoisuudet olivat analyysien mukaan Fineliin verrattuna selvästi suuremmat, ja myös magnesiumin, natriumin, fosforin ja seleenin pitoisuudet olivat uusien analyysien mukaan keskimäärin aikaisempaa suuremmat. B1-vitamiinitulokset erosivat aikaisemmasta molempiin suuntiin lihasta riippuen.

Analyysitulokset ja aikaisempien Finelin arvojen välillä oli merkittävässä määrin eroja. Voidaan todeta koostumustietokannan päivittämisen olevan erittäin tarpeellista myös jatkossa, koska sen käyttäjäkunta on laaja ja käyttötarkoitukset moninaiset.

Beskrivning

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Referat

Syftet med uppdateringen av Fineli (den nationella livsmedelsdatabasen) som genomfördes 2023–2024 var att uppdatera grundsammansättningen för kött. De produkter som analyserades valdes ut av den av THL sammankallade uppföljningsgruppen för Fineli. Livsmedelsverket ansvarade för provtagning, analyser och rapportering av resultat. THL ansvarar för uppdateringen av uppgifterna i Fineli-databasen.

I arbetet analyserades 20 titlar, var och en med avseende på grundsammansättning (protein, fett, vatten, aska), aminosyror, fettsyror samt mineraler (Ca, Cr, Cu, Fe, K, Mg, Mn, Na, P, Se, Zn) och tungmetaller (As, Cd, Ni, Pb). Dessutom analyserades 16 titlar med avseende på vitamin B1 (tiamin). Analyserna utfördes av Livsmedelsverkets kemilaboratorium, med undantag för analyserna för vitamin B1, vilka utfördes av ett kommersiellt laboratorium.

I denna rapport presenteras alla resultat från uppdateringen. Analysresultaten har i tillämpliga delar jämförts med tidigare värden i Fineli. Jämförelsen visade att de flesta av de nya resultaten skiljer sig från de tidigare värdena. Skillnaderna beaktades både som procentuella och absoluta tal, eftersom även små förändringar i mycket små koncentrationer verkade stora procentuellt sett.

Fetthalterna och i synnerhet resultaten för fettsyror avvek avsevärt från de tidigare uppgifterna i Fineli. De flesta prover innehöll betydligt mindre kalcium än tidigare, och även halterna av järn var i många fall något lägre än värdena i Fineli. Enligt analyserna innehöll de flesta köttslag mycket mer kalium jämfört med uppgifterna i Fineli, och även halterna av magnesium, natrium, fosfor och selen var enligt de senaste analyserna i genomsnitt högre än tidigare. Beroende på köttslag avvek resultaten för vitamin B1 i bägge riktningarna jämfört med tidigare.

Skillnaderna mellan analysresultaten och de tidigare värdena i Fineli var signifikanta. Man kan dra slutsatsen att det finns ett stort behov av att fortsätta uppdatera databasen över livsmedlens sammansättning, med tanke på att databasen har många olika användare och användningsområden.

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1 Background

Updating the data of Fineli (the Finnish Food Composition Database maintained by THL) is very important, as the nutritional content of foods eaten in Finland changes over time. It is affected by changes in soil, e.g. due to fertilization, which in turn is reflected as changes in the composition of vegetables. Changes in animal nutrition, raw material handling, food preparation methods, and recipes also affect the chemical composition of foods. In addition, new products are constantly entering the market while others disappear.

The Fineli database must be up-to-date as it has many uses and users: the industry uses Fineli compositional data to prepare nutrition information for products, and nutrition advice and mass catering planning are based on Fineli data. Research, teaching and various health applications also utilize the database, which has open access information available to everyone at www.fineli.fi.

Updating Fineli is based on a three-year plan. The food items to be examined and the analyses to be performed are selected on an annual basis. The needs for updating are assessed in the Fineli monitoring group, which has members from the following organisations: the National Institute for Health and Welfare (THL), Finnish Food Authority, Ministry of Agriculture and Forestry (MMM), Ministry of Social Affairs and Health (STM), University of Helsinki (HY), Customs Laboratory, Finnish Food and Drink Industries' Federation (ETL), Finnish Grocery Trade Association (PTY), Natural Resources Institute Finland (LUKE), and the National Nutrition Council (VRNK).

The annual update work of Fineli proceeds as follows: based on the food items selected by the monitoring group, THL and the Finnish Food Authority prepare a more detailed sampling and analysis plan. Then, the Finnish Food Authority performs and/or coordinates the sampling, the pre-treatment of the samples, and analyses the samples when possible. If some analyses cannot be performed in-house, the analysis services of other laboratories will be used. The Finnish Food Authority gathers the results, reports them to THL, and writes an annual report to be published in the Finnish Food Authority's publication series. Finally, THL uploads the results to its database and publishes them on Fineli.

In 2023-24, the meat samples were purchased using funds from ETL and PTY. The Reindeer Herders' Association also contributed to the purchase costs of the reindeer meat samples. The moose meat was obtained as donations. The Finnish Food Authority carried out the analyses for 2023-2024 mainly at its own cost. Only vitamin B1 analyses were carried out in a commercial laboratory, and the costs were covered by the ETL and PTY.

The aim of the work, which started in 2023, was to update the meat composition data to Fineli, because the current data is incomplete and outdated. Meat is a good source of protein, iron, zinc, selenium, magnesium and vitamins A and B (B1, B2, B3, B6 and B12). In particular, information on minerals and trace elements is incomplete in Fineli. There are no up-to-date vitamin B1 analyses of animal products. For game meat, only very few analysed results can be found in Fineli. Altogether, 20 meat items were selected for analysis. All were analysed for basic composition (protein, fat, water, ash), amino acids, fatty acids, minerals (Ca, Cr, Cu, Fe, K, Mg, Mn, Na, P, Se, Zn), and heavy metals (As, Cd, Ni, Pb). In addition, vitamin B1 (thiamine) was analysed from 16 meat items.

2 Sampling

Meat items analysed in this study:

1. Elk, rump
2. Reindeer, loin
3. Reindeer, rump/leg
4. Reindeer, frying meat
5. Turkey, cold cuts
6. Chicken, thigh, without skin
7. Chicken, leg, without skin
8. Chicken, drumstick, with skin
9. Chicken, wing, with skin
10. Chicken, skin, (taken from leg)
11. Pork fillet, sirloin
12. Pork/kassler steak (pork`s neck)
13. Pork assortment 0 (meat for sauce)
14. Beef chuck/beef shoulder (meat for stewing)
15. Pork-beef, minced meat (fat content 20% or more)
16. Pork fillet, tenderloin
17. Pork, ribs
18. Beef, minced meat (10% fat)
19. Beef, minced meat (17% fat)
20. Beef, sirloin

Elk meat samples were obtained through hunting clubs, because elk meat is usually not available in retail stores. The age and sex of the animals were taken into account when sampling elk meat, and they were divided as follows: male bull, 4 samples; female cow, 3 samples; male calf, 2 samples; female calf, 1 sample; calf of unknown sex, 1 sample. Samples were obtained from a large area (North Karelia, Central Finland, South Ostrobothnia and Pirkanmaa) and the sampling was excellent in that respect.

Reindeer meat sampling was assisted by the Reindeer Herders` Association. Since reindeer meat is nowadays treated (slaughtered, cut, packaged, and sold) like any other meat, the sampling was carried out at retail stores. Sampling was implemented in two parts: summer 2023 and early 2024. In Helsinki, the availability of reindeer meat was limited, so a representative of the Reindeer Herders' Association completed the sampling on both occasions in Northern Finland (Rovaniemi, Levi, Ivalo, Sodankylä).

For **turkey, chicken, pig** and **beef meat**, sampling was planned based on the market shares of three largest trade groups (2022; NielsenIQ, PTY). The aim was to collect 12 subsamples for each food item (20 food items * 12 subsamples = 240 subsamples). Meats were mainly purchased from the three largest trade groups, and in addition, 1 subsample/food item was bought from the meat stores at the Hakaniemi Market Hall.

Each piece of meat/package of meat should represent (at least) one animal to ensure that sampling is as comprehensive as possible. It was decided to collect the samples from 12 different shops in order to avoid a situation where several subsamples of the same food item would originate from the same animal. At the stores, the products were selected based on supply. Within each food item category, the products with different batch numbers/best before dates were chosen.

Sampling was almost as successful as planned. Only food items No 1 (elk meat → poor availability) and No 17 (pork, ribs → one sample was unusable/spoiled) had 11/12 subsamples, whereas 12/12 subsamples were obtained for all other food items (Table 1). If the subsamples were not obtained in accordance with the market shares of the trading groups, the subsamples were replaced by purchasing them from other shops.

Table 1. *Number of subsamples taken in the sampling. The number of subsamples purchased is presented by Finnish trade groups and in total.*

No	Food item	FoodEx2	S-Group	K-Group	Lidl	Other private	Total
1	Elk, rump	A01SE	From hunting clubs directly				11
2	Reindeer, Loin	A01SF	6	2		4	12
3	Reindeer, rump/leg	A01SF	4	4		4	12
4	Reindeer, frying meat	A01SF	5	5		2	12
5	Turkey, cold cuts	A01SQ#F28.A07KV	7	4	1		12
6	Chicken, thigh, without skin	A01SP#F02.A07XQ$ F20.A07QR	7	4	1		12
7	Chicken, leg, without skin	A01SP#F02.A07XQ$ F20.A07QR	6	5		1	12
8	Chicken, drumstick, with skin	A01SP#F02.A07XQ$ F20.A07QQ	6	4	1	1	12
9	Chicken, wing, with skin	A01SP#F02.A06AG$ F20.A07QQ	6	5		1	12
10	Chicken, skin*	A022A	6*	5*		1*	12
11	Pork fillet, sirloin	A01RG	6	4	1	1	12
12	Pork/kassler steak	A01RG#F03.A06JA	7	4		1	12
13	Pork assortment 0 (for sauce)	A01RG#F03.A06JA	6	5	1		12
14	Beef chuck/beef shoulder (for stewing)	A01QX	5	5		2	12
15	Pork-beef, minced meat (fat ≥ 20%)	A04GP#F07.A073H	6	5	1		12
16	Pork fillet, tenderloin	A01RG	5	5	1	1	12
17	Pork, ribs	A01RG	3	5		3	11
18	Beef, minced meat (10% fat)	A049S#F07.A072X	5	5	1	1	12
19	Beef, minced meat (17% fat)	A049S#F07.A073E	6	5	1		12
20	Beef, sirloin	A01QX	5	5	1	1	12

*Taken from food item No 7 (chicken, leg).

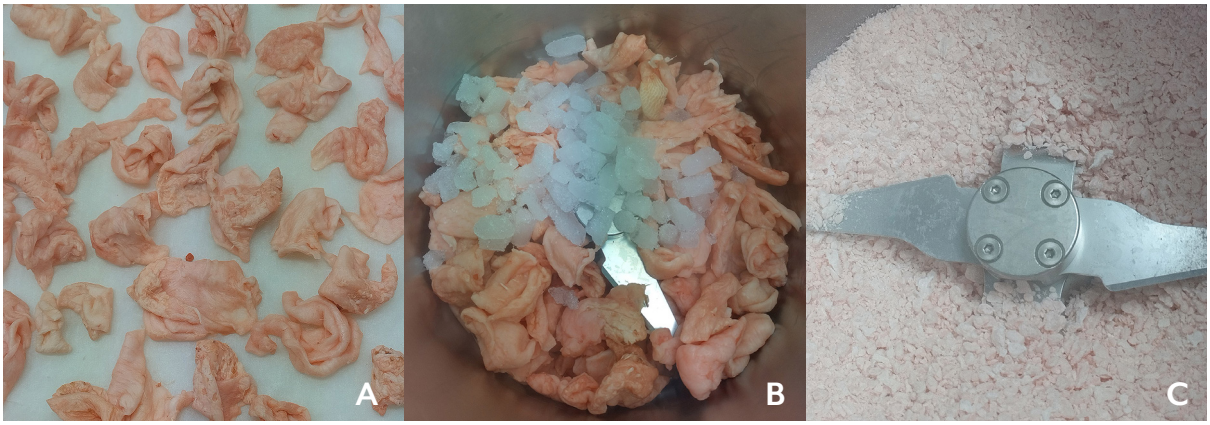
2.1 Pretreatment of samples

From subsamples 1-9 and 11-20, 70 g were weighed (with ±3 g precision) and the meat pieces were combined into one composite sample. If necessary, bones and skin were removed from the samples. The weight of the composite samples formed ranged from 770 g to 840 g (11 or 12 subsamples). The samples were taken to include the surface and internal parts of the meats. The taken pieces were chopped smaller with ceramic knives and milled (Retsch GM300) metal-free. By paying attention to the pre-treatment tools used, the aim was to ensure the success of elemental analyses. Half of the homogeneous sample mass was freeze-dried. The rest waited for analysis.

The skin of the broiler (food item No 10) was obtained from the legs of the broiler (food item No 7). All the detached skin was combined. The weight of the composite sample formed was less than that of the other food items, but sufficient for all analyses. Half of the skins were cut into smaller pieces, frozen and ground with the help of dry ice. Half were freeze-dried and then ground (Figure 1).

Figure 1. *A) Chicken skin frozen; B) Chicken skin and dry ice in the mill; C) Chicken skin after grinding. Photos: Helena Pastell, Finnish Food Authority*

Homogenised meat composite samples were stored in the freezer awaiting analysis. Efforts were made to avoid unnecessary freezing and defrosting phases. Each composite sample was therefore divided into several boxes and several analyses of the thawed sample were often carried out at the same time. Humidity analyses were carried out immediately after homogenisation before freezing.



3 Analytical methods used

Laboratory analyses were mainly carried out at the Finnish Food Authority. Vitamin B1 (thiamine) was subcontracted from a commercial laboratory (MetropoliLab). Table 2 summarises the short descriptions, measurement uncertainties and limits of quantification of the methods used by the Finnish Food Authority. Item-specific analyses can be found in Table 3.

The Finnish Food Authority's laboratory is a testing laboratory T014 accredited by the FINAS accreditation service, accreditation requirement SFS-EN ISO/IEC 17025. All methods marked with an asterisk (*) are accredited.

Validated and accredited methods typically use 2–3 replicates in the analyses. In this report, the results are presented as averages of parallel analyses without ranges, similar to Fineli.

In addition to the analyses carried out by the Finnish Food Authority (Table 2), the samples were analysed for vitamin B1 at MetropoliLab`s subcontracting laboratory (GBA mbH, D-PL-14170-01-00/DAkkS ISO/IEC 17025). The used liquid chromatographic method (§ 64 LFGB L) is based on DIN EN 14122 (2014 mod.). Its measurement uncertainty is 20%.

Species identification analyses were carried out on elk and reindeer samples at the Finnish Food Authority using a DNA-based qPCR method utilising SYBR-Green chemistry (LM 8889). The method is based on the Swedish Food Authority's method of analysis. Its validation at the Finnish Food Authority is still ongoing. All elk subsamples (11) were analysed separately and for reindeer only the composite samples (3) were analysed.

Table 2. *Analytical methods used by the Food Authority, including their measurement uncertainties and limits of quantification.*

Analysis (Method No)	**Method type**	**Measurement uncertainty (MU)**	**Limit of detection (LOD)**	**Other information**
Moisture (Evira 8280*)	Drying + gravimetric	8%	-	-
Ash (Evira 8287*)	Ashing + gravimetric	0.24% units	Suitable for contents >0.45 g/100 g (¤>0.05 g/100 g)	-
Protein (Evira 8282*)	Kjeldahl	8%, for contents ≤40%; 4%, for contents >40%	-	Nitrogen-to-protein factor 6.25
Fat (Evira 8206*)	Solvent extraction + gravimetric	14%, for contents <5%; 8%, for contents 5–10%; 4%, for contents >10%	0.1 g/100 g	
Fatty acids (Evira 8237*)	Fat extraction + esterification (FAME1), GC-MS	36%, for contents <2%; 16%, for contents 2–15%; 6%, for contents >15%; 42% for short-chain fatty-acids (C4-C10)	0.8 g/kg of oil (0.08% of total fatty acids)	Fatty acid group totals calculated on the basis of individual analyses. The chromatographic response of fatty acid methyl esters (FAME1) is corrected by a factor calculated from the response of the reference compounds and, if necessary, the sum of the fatty acids is normalised to 98–100%.
Amino acids (Evira 8263*)	Oxidation/no oxidation, acid hydrolysis, UPLC-UV	Cys 27%; His 26%; Met 24%; Ser, Ala, Lys 21%, Arg 12%; Gly, Asp 15%; Glu, Thr, Ile 18%; Pro 19%; Tyr 23%; Val, Phe 20%; Leu 16%	0.32–1.00 g/kg for individual amino acids	Accredited for feed only, food results not accredited
Tryptofan (Evira 8265*)	Basic hydrolysis, UPLC-FL	Trp 20%	1 g/kg	Accredited for feed only, food results not accredited

Analysis (Method No)	**Method type**	**Measurement uncertainty (MU)**	**Limit of detection (LOD)**	**Other information**
Chemical elements (Evira 8128*)	ICP-MS (As, Cd, Cr, Cu, Mn, Ni, Pb, Se, Zn)	As, Mn, Pb: 0.010–0.015: 0.0030 mg/kg, >0.015: 20% Cd: 0.0010–0.0015: 0.00030 mg/kg, >0.0015: 20% Cr: 0.10–0.13: 0.070 mg/kg; >0.13: 55% Cu: 0.20–0.40: 0.080 mg/kg; >0.40: 20% Ni: 0.10–0.15: 0.030 mg/kg; >0.15: 20% Se: 0.020–0.033: 0.010 mg/kg; >0.033: 30% Zn: 0.20–0.40: 0.060 mg/kg; >0.40: 15%	As: 0.010 mg/kg Cd: 0.0010 mg/kg Cr: 0.10 mg/kg Cu: 0.20 mg/kg Mn: 0.010 mg/kg Ni: 0.10 mg/kg Pb: 0.010 mg/kg Se: 0.020 mg/kg Zn: 0.20 mg/kg	-
Chemical elements (Evira 8145*)	ICP-OES (Ca, Fe, K, Mg, Na, P)	Ca, P: 25% Fe, Mg, Na: 30% K: 20%	Ca, Na: 2.5 mg/kg Fe: 0.25 mg/kg K: 25 mg/kg Mg: 1.3 mg/kg P: 5 mg/kg	-

*Accredited method; ¤LOD for dried samples; [1]FAME = fatty acid methyl esters

SFA = saturated fatty acids, MUFA = monounsaturated fatty acids, PUFA = polyunsaturated fatty acids, TFA = trans-fatty acids

Table 3. *Analysis by food item.*

No	Food item	Moisture	Fat	Fatty acids	Nitrogen	Amino acids	Chemical elements	Ash	Vitamin B1	Species identification (DNA)
1	Elk, rump	x	x	x	x	x	x	x	x	x
2	Reindeer, loin	x	x	x	x	x	x	x	x	x
3	Reindeer, rump/leg	x	x	x	x	x	x	x	x	x
4	Reindeer, frying meat	x	x	x	x	x	x	x	x	x
5	Turkey, cold cuts	x	x	x	x	x	x	x	x	
6	Chicken, thigh, without skin	x	x	x	x	x	x	x		
7	Chicken, leg, without skin	x	x	x	x	x	x	x	x	
8	Chicken, drumstick, with skin	x	x	x	x	x	x	x		
9	Chicken, wing, with skin	x	x	x	x	x	x	x		
10	Chicken, skin*	x	x	x	x	x	x	x		
11	Pork fillet, sirloin	x	x	x	x	x	x	x	x	
12	Pork/kassler steak	x	x	x	x	x	x	x	x	
13	Pork assortment 0 (for sauce)	x	x	x	x	x	x	x	x	
14	Beef chuck/beef shoulder (for stewing)	x	x	x	x	x	x	x	x	
15	Pork-beef, minced meat (fat ≥ 20%)	x	x	x	x	x	x	x	x	
16	Pork fillet, tenderloin	x	x	x	x	x	x	x	x	
17	Pork, ribs	x	x	x	x	x	x	x	x	
18	Beef, minced meat (10% fat)	x	x	x	x	x	x	x	x	
19	Beef, minced meat (17% fat)	x	x	x	x	x	x	x	x	
20	Beef, sirloin	x	x	x	x	x	x	x	x	
	TOTAL	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**16**	**4**

*Taken from food item No 7 (chicken, leg).

4 Results and discussion

The samples were analysed as planned. The results of the analysis are presented in the tables as follows:

Table 4: Moisture, ash, protein, and fat
Table 5: Comparing fat and protein results with Fineli values
Table 6: Fatty acids (+ Figure 3)
Table 7: Ration of total amino acids to protein content
Table 8: Amino acids
Table 9: Chemical elements
Table 10: Comparison of chemical elemental results with Fineli values
Table 11: Vitamin B1
Table 12: Comparison of vitamin B1 results with Fineli values
Table 13: Individual fatty acids (Annex 1)

In addition to the text, the comparison between the analysis results and Fineli values is presented in the figures as follows: Fat and protein (Figure 2; Annex 2, Figure 8), fatty acids (Figure 4; Annex 2, Figure 9), elements (Figures 5 and 6; Figures 10 and 11 in Annex 2) and vitamin B1 (Figure 7; Annex 2, Figure 12).

Fineli did not previously contain the food items “chicken, thigh, without skin” (No 6), “chicken, skin” (No 10), “pork, ribs” (No 17), therefore those food items were omitted from the comparisons. The data used in the comparisons are based on version 20 of the Fineli composition database (27.6.2019).

4.1 Moisture, ash, protein and fat

Moisture, ash, protein, and fat results are presented in Table 4. When the above concentrations are added together (checksum), the result should be 100 g. Due to the measurement uncertainties of the methods, a deviation of about ±5 g can be considered acceptable.

Carbohydrates (starch, sugar, dietary fibre) were not analysed in the meat samples because their concentration in meat is very low. The carbohydrate content is therefore not taken into account in the checksums, which ranged from 98.9 g to 102.4 g/100 g and are very close to the target value.

***Table 4**. Moisture, protein, ash, and fat results (g/100 g, as fresh weights).*

No	Food item	Moisture	Protein¤	Ash	Fat	Total
1	Elk, rump	74.6	23.4	1.2	1.5	**100.7**
2	Reindeer, loin	72.8	24.3	1.1	2.2	**100.4**
3	Reindeer, rump/leg	73.2	24.2	1.4	2.0	**100.8**
4	Reindeer, frying meat	74.3	21.7	1.1	3.0	**100.1**
5	Turkey, cold cuts	74.7	19.7	3.0	1.4	**98.9**
6	Chicken, thigh, without skin	73.8	19.0	1.1	6.8	**100.6**
7	Chicken, leg, without skin	77.7	20.2	1.0	1.9	**100.8**
8	Chicken, drumstick, with skin	75.7	18.9	1.0	5.1	**100.7**
9	Chicken, wing, with skin	71.8	17.7	0.9	7.1	**97.6**
10	Chicken, skin*	49.2	12.9	0.7	39.3	**102.1**
11	Pork fillet, sirloin	70.0	22.9	1.1	6.9	**100.9**
12	Pork/kassler steak	69.2	19.9	1.0	10.6	**100.7**
13	Pork assortment 0 (for sauce)	69.2	19.7	1.0	12.5	**102.4**
14	Beef chuck/beef shoulder (for stewing)	74.0	20.9	1.0	4.4	**100.3**
15	Pork-beef, minced meat (fat ≥ 20%)	60.4	17.9	0.8	22.3	**101.5**
16	Pork fillet, tenderloin	73.5	21.7	1.1	4.4	**100.7**
17	Pork, ribs	58.3	17.5	0.8	25.4	**102.0**
18	Beef, minced meat (10% fat)	69.1	20.3	0.9	9.7	**100.0**
19	Beef, minced meat (17% fat)	62.6	18.5	0.8	18.2	**100.2**
20	Beef, sirloin	72.2	23.0	1.0	3.3	**99.6**

¤Protein = Nitrogen x 6.25; *Taken from food item No 7 (chicken, leg).

Table 5. *Comparison of the analytical results with Fineli data. The numbers indicate the percentage (%) by which the Fineli results are higher (positive numbers; yellow colour when the difference is greater than 5%) or lower (negative numbers; blue colour when the difference is greater than -5%) than the new analytical results. The analytical result is compared to the corresponding value in Fineli, without taking into account the measurement uncertainties of the analyses.*

No	Food item	Fat	Protein
1	Elk, rump	50	-11
2	Reindeer, loin	51	-13
3	Reindeer, rump/leg	56	-12
4	Reindeer, frying meat	33	0
5	Turkey, cold cuts	22	-13
7	Chicken, leg, without skin	44	-3
8	Chicken, drumstick, with skin	-12	1
9	Chicken, wing, with skin	44	-1
11	Pork fillet, sirloin	0	-7
12	Pork/kassler steak	29	-11
13	Pork assortment 0 (for sauce)	-91	5
14	Beef chuck/beef shoulder (for stewing)	-28	1
15	Pork-beef, minced meat (fat ≥ 20%)	-2	-2
16	Pork fillet, tenderloin	2	-3
18	Beef, minced meat (10% fat)*	-10	2
19	Beef, minced meat (17% fat)	-7	3
20	Beef, sirloin	17	-1

> 20%	15–20%	10–15%	5–10%	0– ±5%	-5–-10%	-10–-15%	-15–-20%	< -20%

*Compared with Fineli food item “beef, minced meat, 9% fat”.

The new protein analysis results are closer to previous Fineli values than the fat contents (Table 5 and Figure 2). All results of reindeer meat (Nos 2–4) have been compared to the food item “reindeer meat” in Fineli. The analysed protein content of the reindeer frying meat (No 4) is almost the same as in the reference product, while reindeer loin and rump/leg (Nos 2 and 3) contain 2.6 and 2.7 g/100 g (respectively) more protein. Furthermore, the protein content of elk (No 1), turkey (No 5) and pork steak (No 12) is also over 2 g/100 g (11-13%) higher than previously in Fineli.

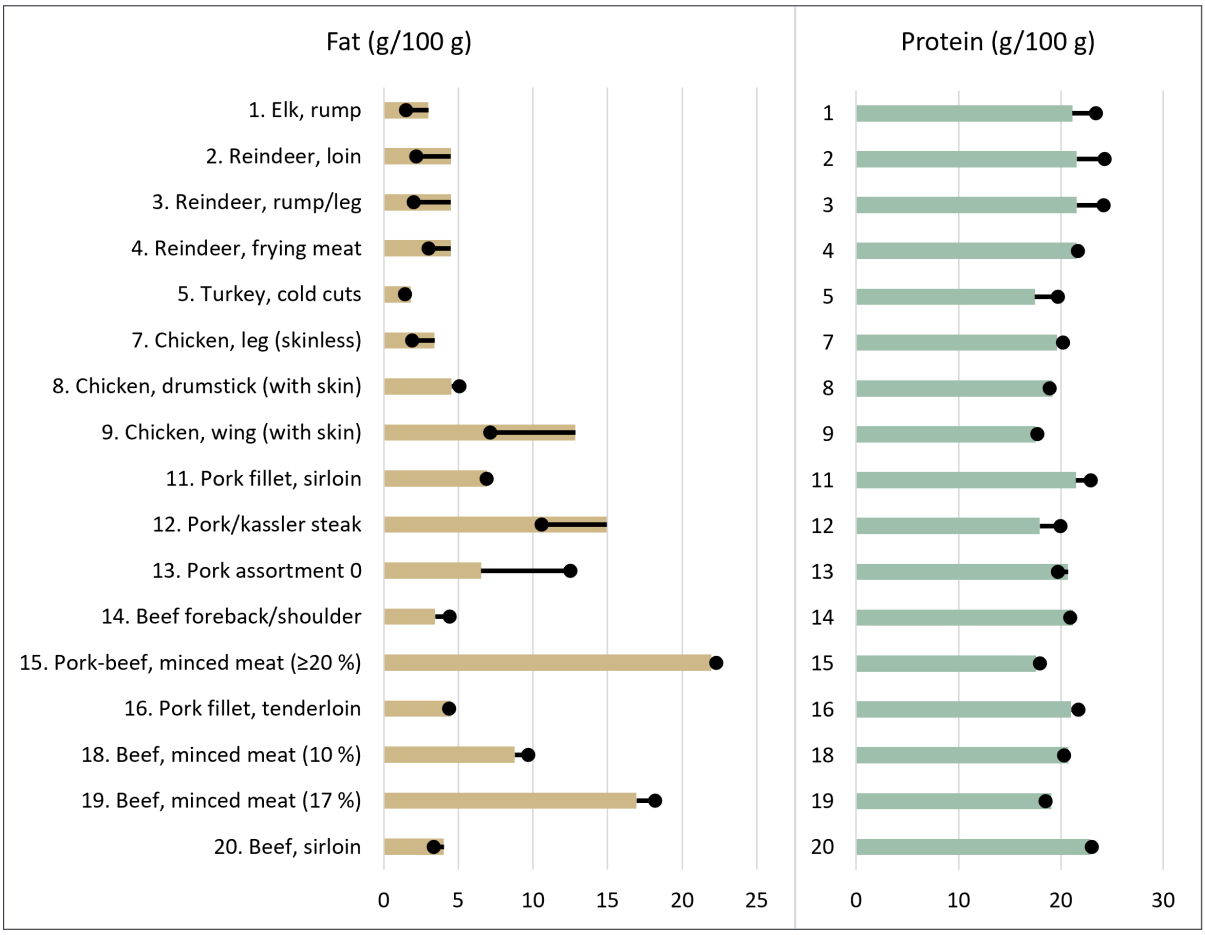


Figure 2. *Comparison of previous fat (brown, left) and protein (green, right) Fineli values (g/100 g) with new analytical results. The coloured bars represent Fineli values (g/100 g). The black ball shows the new analytical result and shows whether it is higher or lower than the Fineli value. The differences are also described in Annex 2, Figure 8.*

4.2 Fatty acids

Fatty acid concentrations are given in Table 6 in units of "g/100 g, fresh weight", as in Fineli. The group results (PUFA, MUFA, SFA and TFA) presented in the table are calculated from the analytical results of the individual fatty acids. In Figure 3, the fatty acid profiles are presented in relation to the total fat content, which makes it easier to visualise the relative concentrations of the different fatty acid groups.

Table 6. *Fatty acid concentrations (g/100 g) as group results per fresh weight. The concentrations are calculated from total fat.*

No	Food item	PUFA g/100 g	MUFA g/100 g	SFA g/100 g	TFA g/100 g	Fat g/100 g
1	Elk, rump	0.4	0.5	0.6	0	1.5
2	Reindeer, loin	0.6	0.6	0.9	0	2.2
3	Reindeer, rump/leg	0.6	0.6	0.8	0	2.0
4	Reindeer, frying meat	0.4	1.1	1.5	0	3.0
5	Turkey, cold cuts	0.4	0.6	0.4	0	1.4
6	Chicken, thigh, without skin	1.3	3.3	1.7	0	6.8
7	Chicken, leg, without skin	0.5	0.8	0.5	0	1.9
8	Chicken, drumstick, with skin	1.0	2.4	1.3	0	5.1
9	Chicken, wing, with skin	1.2	3.7	1.8	0	7.1
10	Chicken, skin*	8.1	19.1	10.0	0.2	39.3
11	Pork fillet, sirloin	0.7	3.1	2.9	0	6.9
12	Pork/kassler steak	1.0	5.0	4.4	0	10.6
13	Pork assortment 0 (for sauce)	1.2	5.7	5.3	0	12.5
14	Beef chuck/beef shoulder (for stewing)	0.2	1.9	2.1	0.1	4.4
15	Pork-beef, minced meat (fat ≥ 20%)	1.5	10.5	9.6	0.1	22.3
16	Pork fillet, tenderloin	0.5	1.9	1.9	0	4.4
17	Pork, ribs	2.2	12.4	10.1	0.1	25.4
18	Beef, minced meat (10% fat)	0.3	4.5	4.4	0.1	9.7
19	Beef, minced meat (17% fat)	0.4	8.4	8.6	0.2	18.2
20	Beef, sirloin	0.1	1.6	1.5	0	3.3

PUFA = polyunsaturated fatty acids, MUFA = monounsaturated fatty acids, SFA = saturated fatty acids, TFA = trans-fatty acids; 0 = Low concentration, rounded to 0 g/100 g; *Taken from food item no 7 (chicken, leg).

The meat naturally contains small amounts of trans-fatty acids, which are therefore of a different origin than the trans-fatty acids produced in industrial fat hardening.

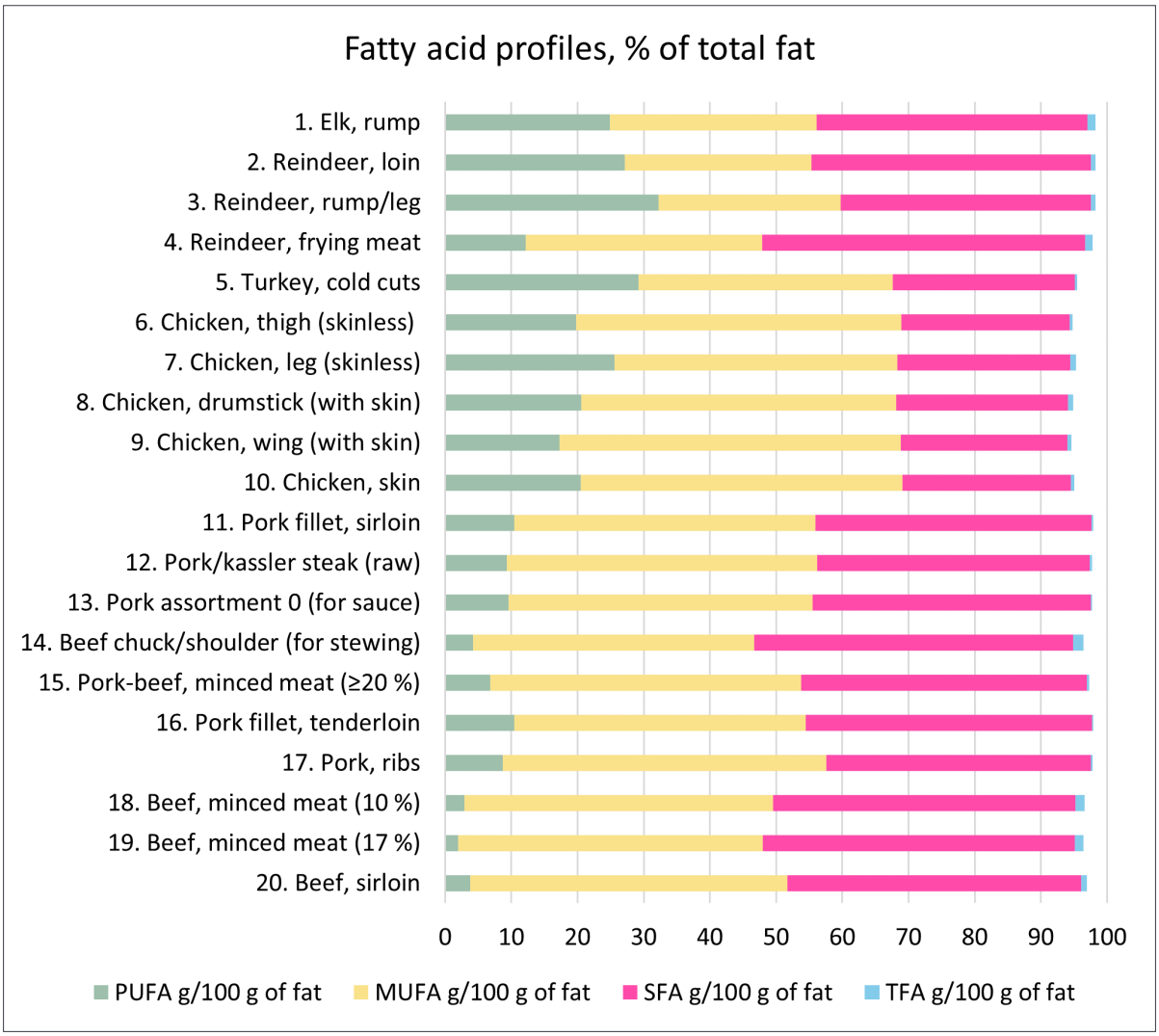


Figure 3. *Fatty acid profiles of meats according to the analytical results calculated per g/100 g fat.*

Figure 4 shows Fineli values and the new analysis results on the same horizontal bar chart. The differences between the Fineli values and the analytical results are shown in Annex 2, Figure 9. The results for individual fatty acids are shown in Annex 1, Table 13.

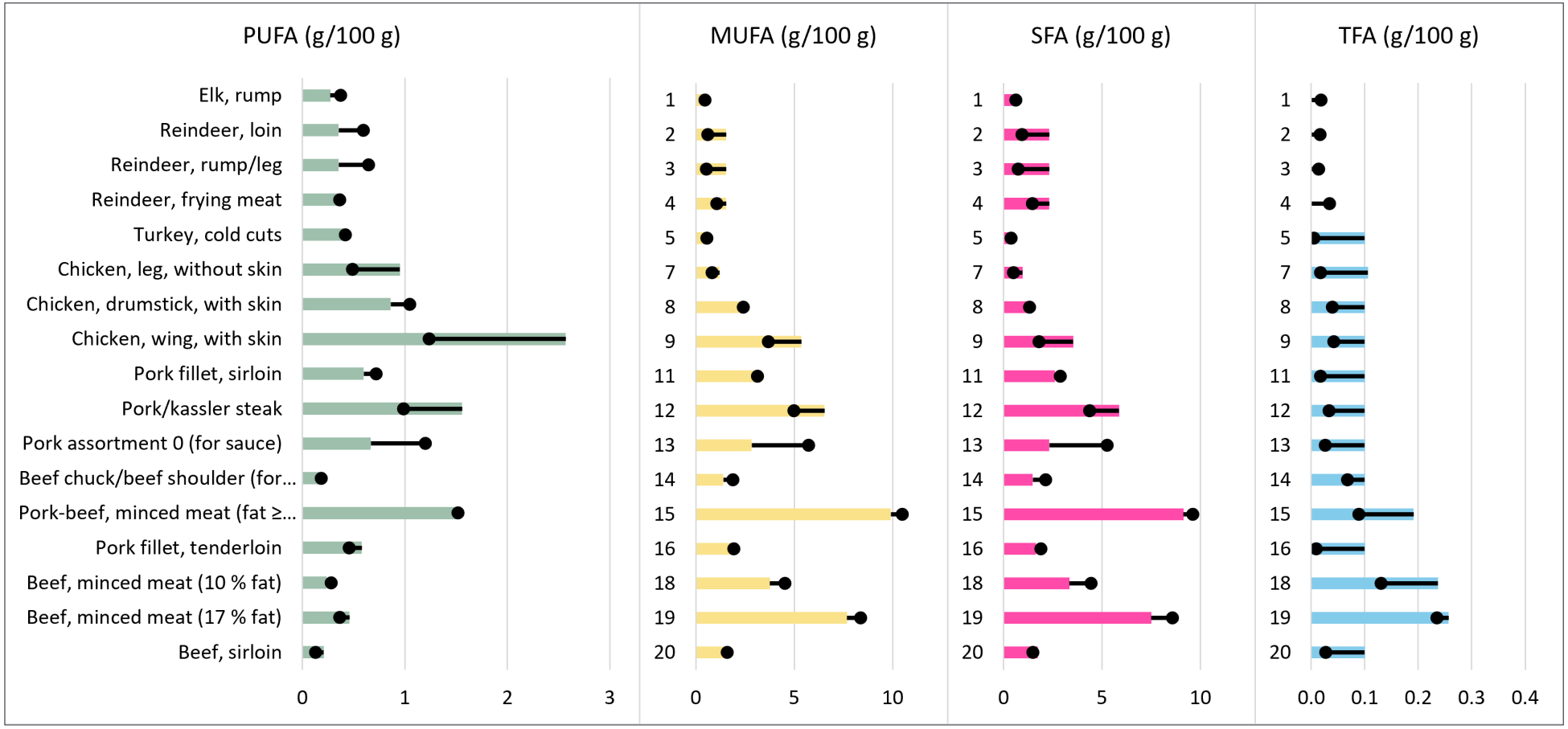


Figure 4. *Coloured bars represent the content of polyunsaturated (PUFA = green), monounsaturated (MUFA = yellow), saturated (SFA = pink) and trans-fatty acids (TFA = blue) in Fineli (g/100 g fat). The black ball indicates the new analytical result and shows whether the result is higher or lower compared to the Fineli value.*

4.3 Amino acids

The amino acid results for each sample were calculated as amino acid residues (considered water released at the formation of peptide bonds), which were added together, and the results compared with total protein (Table 7). These should agree. For all food items, the protein content was higher than the sum of amino acid residues. The ratio varied between 70-84%. The differences are mainly explained by method differences: the Kjeldahl method is used to determine the total protein. The method includes not only the nitrogen from the amino acids, but also non-protein nitrogen, which makes it possible to slightly overestimate the number of proteins. The amino acid method determines the 19 most common essential and non-essential amino acids, but in addition to these, there are other amino acids found in meat in small amounts. Some of the most sensitive amino acids can also degrade during the analysis. Due to these factors, the amount of amino acids may be lower than expected. The differences can also partly be explained by the measurement uncertainties of the methods.

The ratio of amino acid residues and protein in chicken skin (No 10) was only 70%. Nitrogen levels in skin and meat are not the same, which is why a different protein factors should be used for skin and meat. Jones's specific factor for gelatine (5.55; Factors for converting percents of nitrogen in foods and feeds into percents of proteins, 1941.) is suitable for skin because it is mainly collagen from which gelatine is made. Using a factor of 5.55, the protein content of chicken skin is 11.5 g/100 g. Since the sum of amino acid residues is 9.0 g/100 g, the ratio between them is 78%, which is more in line with the other results.

All amino acid concentrations analysed are presented in Table 8.

Table 7. *Ratio of total amino acids to protein content (%). For comparison, amino acids have been calculated as amino acid residues. A protein factor of 6.25 has been used for all food items.*

No	Food item	Amino acids in total (g/100 g)	Protein (g/100 g)	Ratio%
1	Elk, rump	19.1	23.4	82
2	Reindeer, loin	19.9	24.3	82
3	Reindeer, rump/leg	19.5	24.2	81
4	Reindeer, frying meat	17.8	21.7	82
5	Turkey, cold cuts	15.3	19.7	77
6	Chicken, thigh, without skin	14.5	19.0	76
7	Chicken, leg, without skin	15.9	20.2	79
8	Chicken, drumstick, with skin	14.6	18.9	77
9	Chicken, wing, with skin	14.9	17.7	84
10	Chicken, skin*	9.0	12.9	70
11	Pork fillet, sirloin	18.2	22.9	79
12	Pork/kassler steak	16.0	19.9	80
13	Pork assortment 0 (for sauce)	15.6	19.7	79
14	Beef chuck/beef shoulder (for stewing)	17.1	20.9	82
15	Pork-beef, minced meat (fat ≥ 20%)	13.7	17.9	76

No	Food item	Amino acids in total (g/100 g)	Protein (g/100 g)	Ratio%
16	Pork fillet, tenderloin	17.0	21.7	78
17	Pork, ribs	13.5	17.5	77
18	Beef, minced meat (10% fat)	16.4	20.3	81
19	Beef, minced meat (17% fat)	15.3	18.5	83
20	Beef, sirloin	18.8	23.0	81

*Taken from food item no 7 (chicken, leg).

Table 8. *Amino acid concentrations. Results expressed as mg/100 g fresh weight.*

No	Food item	Ala	Arg	Asp	Fen	Glu	Gly	His	Iso	Cys	Leu	Lys	Met	Pro	Ser	Tau	Tre	Trp	Tyr	Val
1	Elk, rump	1 300	1 200	2 200	970	3 600	1 000	860	1 100	240	1 900	2 100	650	880	900	73	1 000	320	750	1 200
2	Reindeer, loin	1 300	1 300	2 300	1 000	3 600	1 000	830	1 200	230	2 000	2 100	700	890	930	170	1 100	350	820	1 300
3	Reindeer, rump/leg	1 300	1 300	2 200	1 000	3 400	1 000	800	1 100	240	2 000	2 100	670	890	940	170	1 100	340	790	1 200
4	Reindeer, frying meat	1 300	1 200	2 000	910	3 300	1 200	640	980	210	1 800	1 900	570	960	850	200	960	280	660	1 100
5	Turkey, cold cuts	1 000	1 000	1 800	730	2 700	810	890	880	200	1 500	1 600	410	680	780	28	860	270	580	910
6	Chicken, thigh, without skin	990	1 000	1 700	730	2 800	860	530	830	190	1400	1 600	240	700	770	85	810	230	610	850
7	Chicken, leg, without skin	1 100	1 100	1 800	760	3 000	900	600	920	210	1 600	1 700	520	740	810	78	880	260	680	930
8	Chicken, drumstick, with skin	1 000	1 000	1 600	710	2 700	990	600	800	180	1 400	1 500	450	770	740	110	790	230	580	830
9	Chicken, wing, with skin	1 100	1 000	1 700	710	2 700	1 300	470	840	170	1 400	1 500	470	900	730	34	770	210	590	890
10	Chicken, skin*	800	710	880	380	1 400	1 700	230	360	93	650	660	210	960	450	58	370	65	250	460
11	Pork fillet, sirloin	1 200	1 200	2 100	880	3 400	1 100	820	1 100	220	1 800	2 000	620	890	860	34	990	280	770	1 100
12	Pork/kassler steak	1 100	1 000	1 800	770	3 000	970	660	910	210	1 500	1 700	540	810	760	85	860	250	660	970
13	Pork assortment 0 (for sauce)	1 100	1 000	1 800	750	2 900	1 000	620	870	190	1 500	1 600	510	840	740	82	830	240	630	930
14	Beef chuck/beef shoulder (for stewing)	1 200	1 100	1 900	800	3 300	1 100	690	960	190	1 700	1 800	530	890	830	28	920	280	690	1 000
15	Pork-beef, minced meat (fat ≥ 20%)	1 000	920	1 500	680	2 400	1 200	560	740	130	1 300	1 400	390	860	650	44	710	210	550	810
16	Pork fillet, tenderloin	1 100	1 100	1 900	840	3 100	920	780	1 000	190	1 700	1 800	570	790	810	80	940	290	720	1 000
17	Pork, ribs	950	910	1 500	670	2 400	1 000	560	750	140	1 300	1 400	410	770	650	38	720	210	560	810
18	Beef, minced meat (10% fat)	1 200	1 100	1 800	790	3 100	1 300	660	880	170	1 500	1 700	480	970	780	33	850	240	630	950
19	Beef, minced meat (17% fat)	1 200	1 000	1 700	740	2 800	1 400	600	810	150	1 400	1 500	430	990	720	23	780	210	580	900
20	Beef, sirloin	1 300	1 200	2 100	940	3 500	990	930	1 100	210	1 900	2 100	610	870	890	14	1 000	220	760	1 100

*Taken from food item no 7 (chicken, leg).

4.4 Minerals and heavy metals

Of the chemical elements, the minerals, and such heavy metals that could be analysed in the same analysis as the minerals, were studied. The analytical results are shown in Table 9. Only some of the elements had previous data in Fineli: Calcium (Ca), iron (Fe), potassium (K), magnesium (Mg), sodium (Na), salt (NaCl), phosphorus (P), selenium (Se), zinc (Zn). The new analytical results were compared with the above when appropriate (Table 10, Figures 5 and 6).

In percentage terms, most of the analytical results differed from the values in Fineli. One fifth (33/153) of the analysis results, differed from the previous Fineli values by less than 10%. Just over a quarter of the analysis results (42/153) differed by 10-20% from the data published in Fineli. The remaining 78 results differed by more than 20% from previous results.

A comparison of the percentage differences between the analytical results and the Fineli values (Table 10) gives a slightly misleading impression as some of the results are very small in number, making a marginal shift appear large in percentage terms. In these cases, the difference may result not only from actual changes in the composition of the food, but also from the analytical method used or be explained by measurement uncertainty. The absolute differences between the analytical results and Fineli values are shown in Figures 5 and 6.

Table 9. *Analytical results for the chemical elements. The amount of salt is obtained by multiplying the amount of sodium (Na) by 2.548.*

No	Food item	As µg/ 100 g	Ca mg/ 100 g	Cd µg/ 100 g	Cr µg/ 100 g	Cu µg/ 100 g	Fe mg/ 100 g	K mg/ 100 g	Mg mg/ 100 g	Mn µg/ 100 g	Na mg/ 100 g	Salt mg/ 100 g	Ni µg/ 100 g	Pb µg/ 100 g	P mg/ 100 g	Se µg/ 100 g	Zn mg/ 100 g
1	Elk, rump	<1	3.4	0.16	<10	140	2.6	390	26	16	48	0.12	<10	<1	220	5	3.8
2	Reindeer, loin	<1	4.1	<0.1	<10	370	4.0	350	27	36	46	0.12	<10	<1	240	31	2.7
3	Reindeer, rump/leg	<1	3.1	0.11	<10	370	3.9	400	29	39	40	0.10	<10	<1	260	37	2.4
4	Reindeer, frying meat	<1	4.5	0.17	<10	210	3.0	350	23	24	98	0.25	<10	<1	210	27	4.3
5	Turkey, cold cuts	<1	16	0.14	15	32	0.4	440	22	15	780	1.99	<10	<1	300	15	0.86
6	Chicken, thigh, without skin	<1	4.8	<0.1	<10	65	0.6	350	25	15	85	0.22	<10	<1	210	30	1.3
7	Chicken, leg, without skin	<1	9.0	<0.1	<10	60	0.5	320	25	15	95	0.24	<10	<1	190	29	1.2
8	Chicken, drumstick, with skin	<1	9.0	<0.1	10	65	0.6	300	22	15	100	0.25	<10	<1	170	29	1.6
9	Chicken, wing, with skin	<1	18	<0.1	<10	48	0.5	270	20	11	100	0.25	<10	<1	160	29	1.4
10	Chicken, skin*	<1	8.8	<0.1	<10	25	0.7	200	13	14	69	0.18	<10	<1	120	26	0.94
11	Pork fillet, sirloin	<1	3.8	<0.1	<10	49	0.5	410	26	6.3	46	0.12	<10	<1	220	26	1.8
12	Pork/kassler steak	<1	4.2	<0.1	<10	84	0.9	360	21	10	51	0.13	<10	<1	190	27	3.0
13	Pork assortment 0 (for sauce)	<1	4.0	<0.1	<10	93	0.9	370	22	9.3	57	0.15	<10	<1	200	28	3.1
14	Beef chuck/beef shoulder (for stewing)	<1	5.2	<0.1	<10	86	2.1	340	21	8.1	65	0.17	<10	<1	180	20	6.6
15	Pork-beef, minced meat (fat ≥ 20%)	<1	5.0	<0.1	11	60	1.1	290	17	7.6	59	0.15	<10	<1	150	22	3.2
16	Pork fillet, tenderloin	<1	3.6	<0.1	<10	89	0.9	430	27	11	45	0.11	<10	<1	240	28	1.9
17	Pork, ribs	<1	12	<0.1	<10	54	0.6	270	17	6.4	68	0.17	<10	<1	150	22	2.2
18	Beef, minced meat (10% fat)	<1	5.3	<0.1	<10	60	1.8	320	20	6.9	65	0.17	<10	<1	170	16	4.9
19	Beef, minced meat (17% fat)	<1	7.5	<0.1	23	57	1.8	290	18	6.7	65	0.17	<10	<1	150	21	5.0
20	Beef, sirloin	<1	3.9	<0.1	<10	59	1.9	380	24	6.5	50	0.13	<10	<1	200	25	4.6

*Taken from food item no 7 (chicken, leg).

Table 10. *Comparing the analytical results of chemical elements with Fineli data. The figures show the percentage (%) by which the Fineli results are higher (positive figures; yellow colour when the difference is greater than 5%) or lower (negative figures; blue colour when the difference is greater than -5%) than the new analytical results. The analytical result is compared to the corresponding value in Fineli, without taking into account the measurement uncertainties of the analyses.*

No	Food item	Ca (Calcium)	Fe (Iron)	K (Potassium)	Mg (Magnesium)	Na (Sodium)	Salt	P (Phosphorus)	Se (Selenium)	Zn (Zinc)
1	Elk, rump	43	26	0	4	14	14	0	-25	17
2	Reindeer, loin	68	40	20	18	52	52	23	-3	44
3	Reindeer, rump/leg	76	42	9	12	58	58	16	-23	50
4	Reindeer, frying meat	65	55	20	30	-3	-3	32	10	10
5	Turkey, cold cuts	-39	18	-195	-67	-3	-3	-190	-53	-10
7	Chicken, leg, without skin	10	51	-39	-4	-10	-10	-13	-123	37
8	Chicken, drumstick, with skin	-13	5	-42	-22	-43	-43	-4	-26	11
9	Chicken, wing, with skin	-50	43	-73	-11	-37	-37	-21	-87	-5
11	Pork fillet, sirloin	49	22	-46	-30	-10	-10	-38	-44	0
12	Pork/kassler steak	43	18	-29	-5	-31	-31	-19	-38	9
13	Pork assortment 0 (for sauce)	46	12	-32	-10	-19	-19	-25	-56	-24
14	Beef chuck/beef shoulder (for stewing)	13	3	-17	-11	-14	-14	-13	-18	-12
15	Pork-beef, minced meat (fat ≥ 20%)	50		-26	-13	-18	-18	-15	-10	11
16	Pork fillet, tenderloin	51	-43	-54	-35	29	29	-50	-40	-19
18	Beef, minced meat (10% fat)	24	42	20	20	-59	-59	19	-2	-29
19	Beef, minced meat (17% fat)	17	2	-16	-6	-12	-12	-7	-24	9
20	Beef, sirloin	29	8	3	11	-28	-28	9	-39	9

> 20%	15–20%	10–15%	5–10%	0 – ±5%	-5 – -10%	-10 – -15%	-15 – -20%	-20%

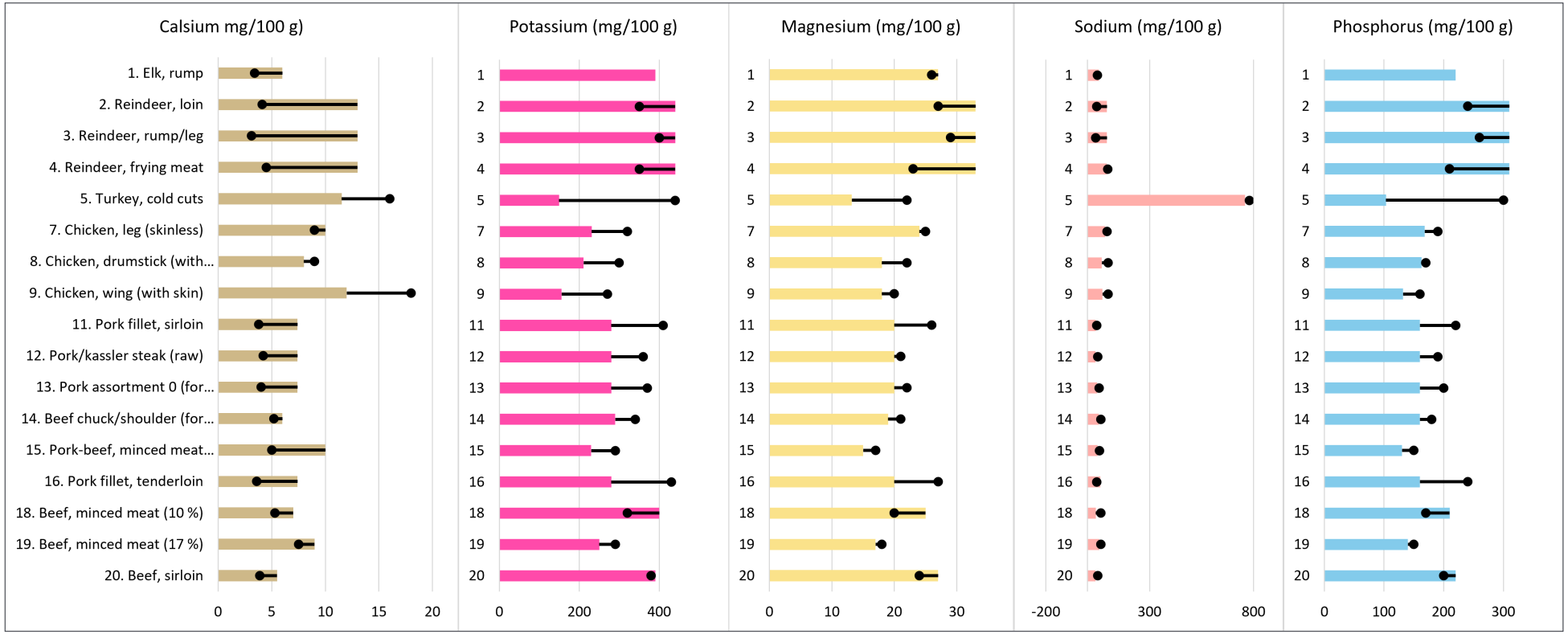


Figure 5. *Comparison of the Fineli values and new analytical results. The coloured bars represent the Fineli values (calcium (Ca) = brown; potassium (K) = pink; magnesium (Mg) = yellow; sodium (Na) = pink; phosphorus (P) = light blue). New analytical results are indicated by black balls showing whether the new analytical result is higher or lower than the Fineli value. Measurement uncertainties are not taken into account in the comparison. The results are presented as mg/100 g.*

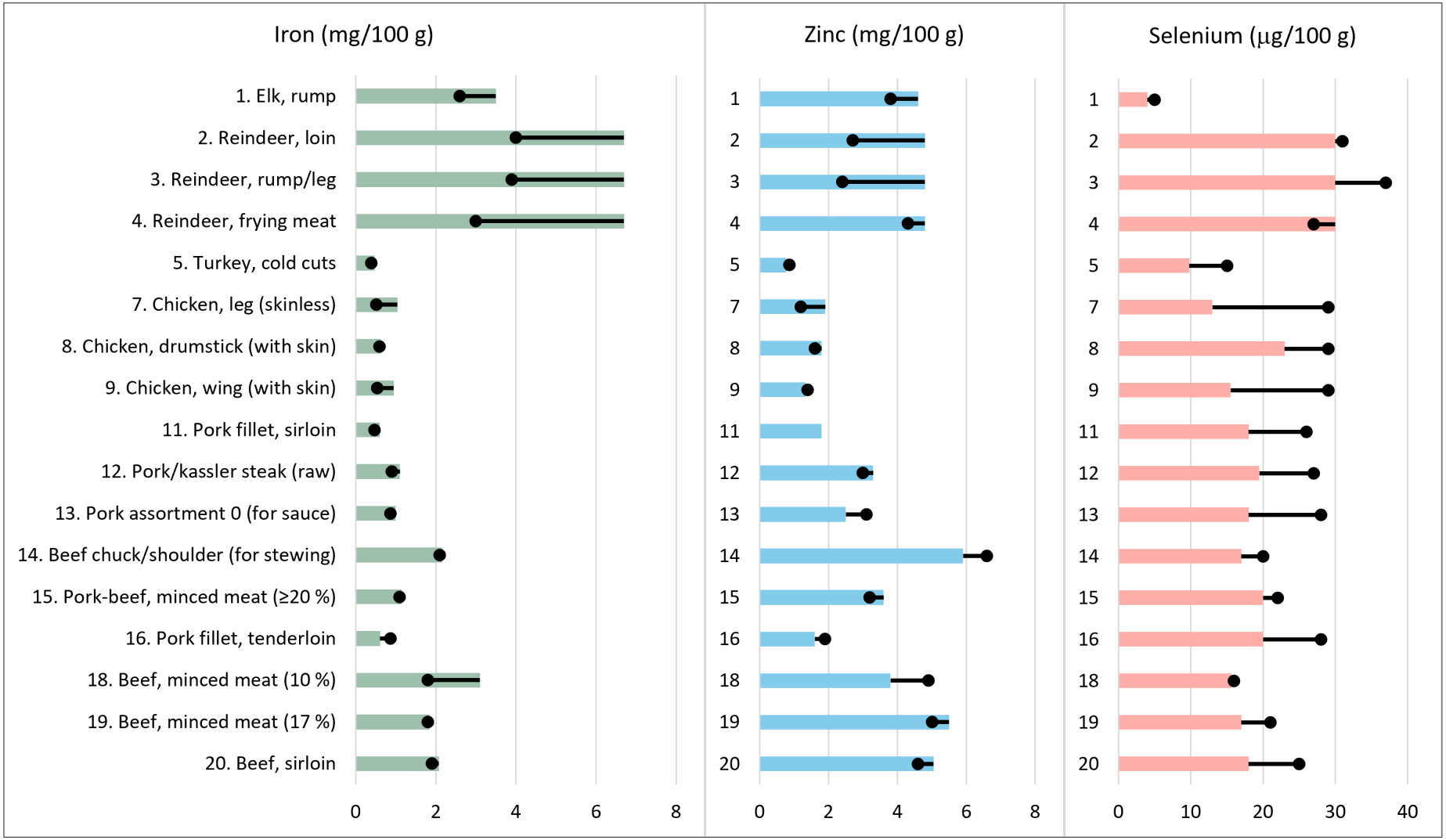


Figure 6. *Comparison of the Fineli values and new analytical results. The coloured bars represent the Fineli values (iron (Fe) = green; zinc (Zn) = light blue; iodine (I) = bright pink; selenium (Se) = light pink). New analytical results are indicated by black balls showing whether the new analytical result is higher or lower than the Fineli value. Measurement uncertainties have not been taken into account in the comparison. The results are presented as mg/100 g or µg/100 g.*

4.5 Vitamin B1

Thiamine (vitamin B1) was analysed in a commercial laboratory, as the Finnish Food Authority`s laboratory does not have a suitable method for meat. The results are presented in Table 11.

Table 11. *Results of the analysis of thiamine (B1; expressed as thiamine). Accredited method with MU of 20%.*

No	Food item	Vitamin B1 (thiamine) mg/100 g
1	Elk, rump	0.12
2	Reindeer, loin	0.30
3	Reindeer, rump/leg	0.34
4	Reindeer, frying meat	0.18
5	Turkey, cold cuts	0.058
6	Chicken, thigh, without skin	Not analysed
7	Chicken, leg, without skin	0.13
8	Chicken, drumstick, with skin	Not analysed
9	Chicken, wing, with skin	Not analysed
10	Chicken, skin*	Not analysed
11	Pork fillet, sirloin	0.85
12	Pork/kassler steak	0.80
13	Pork assortment 0 (for sauce)	0.64
14	Beef chuck/beef shoulder (for stewing)	0.062
15	Pork-beef, minced meat (fat ≥ 20%)	0.34
16	Pork fillet, tenderloin	1.1
17	Pork, ribs	0.56
18	Beef, minced meat (10% fat)	0.070
19	Beef, minced meat (17% fat)	0.047
20	Beef, sirloin	0.061

*Taken from food item no 7 (chicken, leg).

Table 12. *Comparison of vitamin B1 analytical results with Fineli data. The numbers indicate the percentage (%) by which the Fineli results are higher (positive numbers; yellow colour when the difference is greater than 5%) or lower (negative numbers; blue colour when the difference is greater than -5%) than the new analytical results. The analytical result is compared to the corresponding value in Fineli, without taking into account the measurement uncertainties of the analyses.*

No	Food item	Vitamin B1 (mg/100 g)
1	Elk, rump	60
2	Reindeer, loin	-200
3	Reindeer, rump/leg	-240
4	Reindeer, frying meat	-80
5	Turkey, cold cuts	-58
7	Chicken, leg, without skin	-71
11	Pork fillet, sirloin	23
12	Pork/kassler steak	27
13	Pork assortment 0 (for sauce)	42
14	Beef chuck/beef shoulder (for stewing)	31
15	Pork-beef, minced meat (fat ≥ 20%)	-36
16	Pork fillet, tenderloin	-18
18	Beef, minced meat (10% fat)	36
19	Beef, minced meat (17% fat)	41
20	Beef, sirloin	45

> 20%	15–20%	10–15%	5–10%	0 – ±5%	-5 – -10%	-10 – -15%	-15 – -20%	-20%

All results differ significantly in percentage (>20%) from the Fineli values, but in absolute terms the differences are rather small (0.02 to 0.46 mg/100 g; Table 12 and Figure 7). The analytical results of reindeer meat (Nos 2–4) above Fineli's values are emphasised in percentage terms, but in absolute terms Fineli's results differ more from those of pork meat (Nos 11–13) with lower concentrations than before.

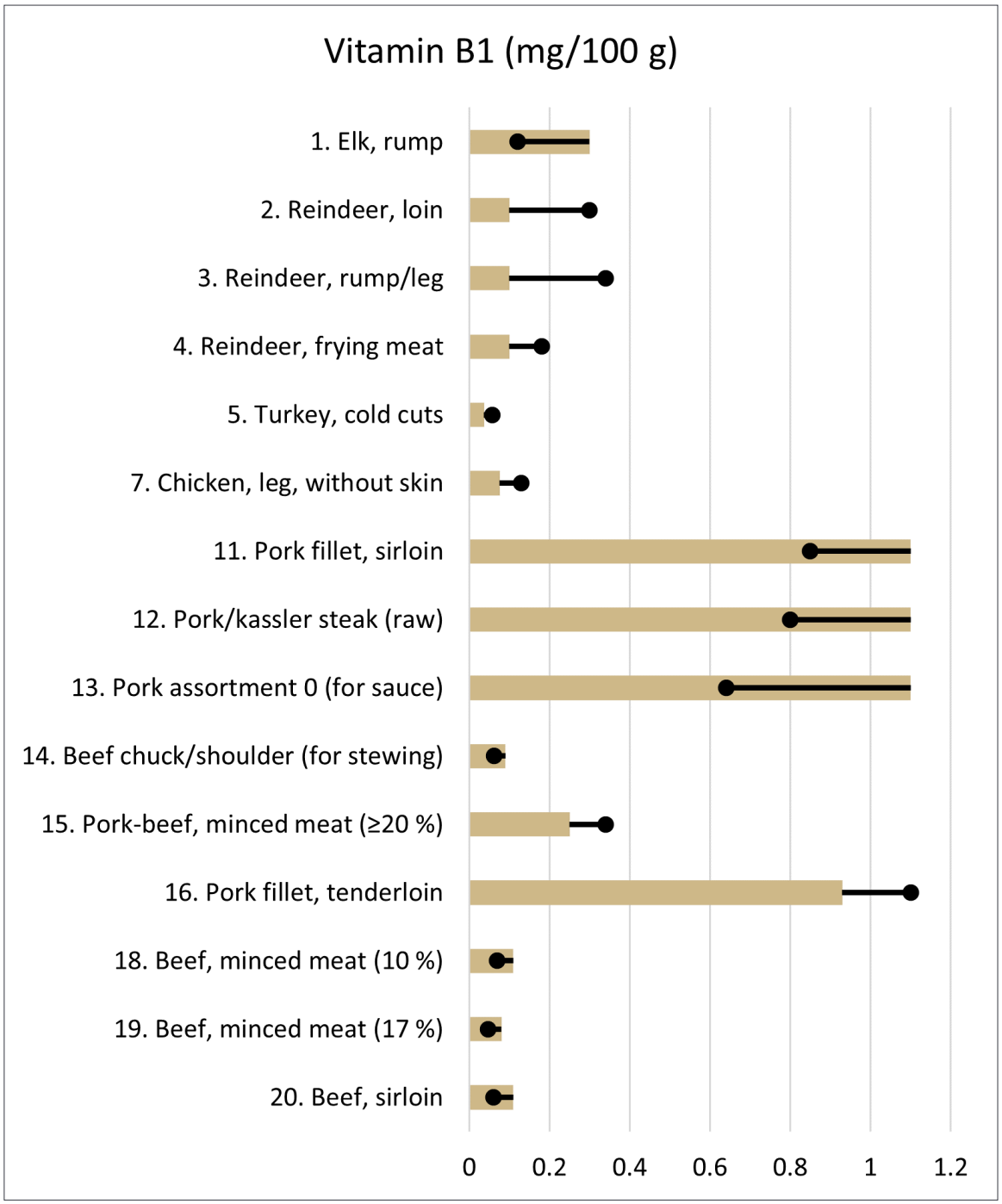


Figure 7. *Comparison of vitamin B1 analytical results (mg/100 g) with previous Fineli values. The coloured bars represent the Fineli values for vitamin B1 (= brown). The new analytical results are indicated by black balls showing whether the new analytical result is higher or lower compared to the Fineli value. Measurement uncertainties have not been taken into account in the comparison. The results are presented as mg/100 g.*

4.6 Species identification analyses

According to the analyses, all the individual elk samples (11) were derived from elk. Reindeer meat was examined as composite samples (3 samples). All the composite samples were derived from reindeer, so it can be stated that the individual samples in them were also reindeer.

Annex 1. Results of fatty acids analysis

Table 13. *Analytical results for individual fatty acids; n.d. = not detected.*

No	Food item	C10:0	C12:0	C14:0	C14:1 n-5	C15:0 iso	C15:0 anteiso	C15:0	C16:0 iso	C16:0	C16:1 n-7 trans	C16:1 n-7	C16:2
1	Elk, rump	n.d.	n.d.	0.52	n.d.	<0.08	0.09	0.27	0.47	14	0.36	0.58	n.d.
2	Reindeer, loin	<0.08	n.d.	0.96	<0.08	0.09	<0.08	0.20	0.76	20	0.33	0.76	n.d.
3	Reindeer, rump/leg	<0.08	n.d.	0.65	<0.08	<0.08	0.09	0.18	0.80	17	0.35	0.77	n.d.
4	Reindeer, frying meat	<0.08	<0.08	1.8	0.16	0.11	0.1	0.29	0.64	24	0.38	1.2	n.d.
5	Turkey, cold cuts	n.d.	<0.08	0.37	0.1	n.d.	n.d.	<0.08	n.d.	20	0.22	4.0	<0.08
6	Chicken, thigh, without skin	n.d.	n.d.	0.28	<0.08	n.d.	n.d.	<0.08	n.d.	19	0.43	4.1	0.08
7	Chicken, leg, without skin	n.d.	n.d.	0.28	<0.08	n.d.	n.d.	<0.08	n.d.	18	0.42	3.3	<0.08
8	Chicken, drumstick, with skin	n.d.	n.d.	0.33	0.09	n.d.	n.d.	<0.08	n.d.	20	0.44	4.0	0.08
9	Chicken, wing, with skin	n.d.	n.d.	0.34	0.12	n.d.	n.d.	<0.08	n.d.	20	0.40	5.2	<0.08
10	Chicken, skin*	n.d.	n.d.	0.31	0.08	n.d.	n.d.	<0.08	n.d.	19	0.40	4.0	0.1
11	Pork fillet, sirloin	<0.08	<0.08	1.1	n.d.	n.d.	n.d.	<0.08	n.d.	26	0.20	1.8	n.d.
12	Pork/kassler steak	<0.08	<0.08	1.0	n.d.	n.d.	n.d.	n.d.	n.d.	25	0.23	1.9	n.d.
13	Pork assortment 0 (for sauce)	<0.08	<0.08	0.99	n.d.	n.d.	n.d.	n.d.	n.d.	25	0.21	1.7	n.d.
14	Beef chuck/beef shoulder (for stewing)	<0.08	<0.08	2.0	0.29	0.17	0.18	0.4	n.d.	25	0.13	2.4	n.d.
15	Pork-beef, minced meat (fat ≥ 20%)	<0.08	<0.08	1.6	0.23	n.d.	n.d.	0.16	n.d.	26	0.21	2.4	n.d.
16	Pork fillet, tenderloin	<0.08	<0.08	1.1	n.d.	n.d.	n.d.	<0.08	0.11	26	0.21	1.9	n.d.
17	Pork, ribs	<0.08	<0.08	0.97	n.d.	n.d.	n.d.	<0.08	n.d.	24	0.23	1.8	n.d.
18	Beef, minced meat (10% fat)	<0.08	<0.08	2.3	0.67	0.19	0.17	0.37	0.22	26	0.14	3.5	n.d.
19	Beef, minced meat (17% fat)	<0.08	<0.08	2.6	0.72	0.18	0.19	0.39	0.23	27	0.14	3.5	n.d.
20	Beef, sirloin	<0.08	<0.08	2.1	0.48	0.10	0.10	0.22	0.21	28	0.11	3.5	n.d.

*Taken from food item no 7 (chicken, leg).

No	Food item	C17:0 iso	C17:0	C17:1 n-9	C17:1 n-8	C18:0 iso	C18:0	C18:1 n-9 trans	C18:1 n-7 trans	C18:1 n-9	C18:1 n-7	C18:1 n-6
1	Elk, rump	0.66	0.91	n.d.	0.33	0.15	23	n.d.	0.66	29	1.2	0.17
2	Reindeer, loin	0.68	0.67	n.d.	0.17	<0.08	19	<0.08	0.3	26	1	0.08
3	Reindeer, rump/leg	0.64	0.66	n.d.	0.24	<0.08	17	<0.08	0.24	25	1.2	0.08
4	Reindeer, frying meat	0.78	0.96	n.d.	0.23	0.11	19	n.d.	0.62	33	0.84	0.08
5	Turkey, cold cuts	n.d.	0.09	n.d.	n.d.	n.d.	7.3	<0.08	<0.08	32	2.2	n.d.
6	Chicken, thigh, without skin	n.d.	<0.08	n.d.	n.d.	n.d.	5.9	<0.08	<0.08	42	2.4	n.d.
7	Chicken, leg, without skin	n.d.	<0.08	n.d.	n.d.	n.d.	7.5	<0.08	<0.08	36	2.7	n.d.
8	Chicken, drumstick, with skin	n.d.	0.09	n.d.	n.d.	n.d.	6	<0.08	<0.08	41	2.3	n.d.
9	Chicken, wing, with skin	n.d.	<0.08	n.d.	n.d.	n.d.	5	<0.08	<0.08	44	2.2	n.d.
10	Chicken, skin*	n.d.	0.09	n.d.	n.d.	n.d.	5.4	<0.08	<0.08	42	2.2	n.d.
11	Pork fillet, sirloin	n.d.	0.22	n.d.	0.15	n.d.	15	<0.08	n.d.	40	2.7	n.d.
12	Pork/kassler steak	n.d.	0.17	n.d.	0.16	n.d.	15	0.08	n.d.	41	2.9	n.d.
13	Pork assortment 0 (for sauce)	n.d.	0.18	n.d.	0.15	n.d.	16	n.d.	n.d.	41	2.8	n.d.
14	Beef chuck/beef shoulder (for stewing)	0.92	1	<0.08	0.52	0.15	18	0.16	1.02	38	1.2	0.11
15	Pork-beef, minced meat (fat ≥ 20%)	0.34	0.43	n.d.	0.3	n.d.	14	n.d.	0.19	41	2.2	n.d.
16	Pork fillet, tenderloin	n.d.	0.2	n.d.	0.17	n.d.	15	n.d.	n.d.	39	2.8	n.d.
17	Pork, ribs	n.d.	0.19	n.d.	0.19	n.d.	15	<0.08	n.d.	44	2.8	n.d.
18	Beef, minced meat (10% fat)	0.86	0.78	n.d.	0.53	0.12	14	0.27	0.71	40	1.5	0.16
19	Beef, minced meat (17% fat)	0.95	0.84	n.d.	0.55	0.17	15	0.18	0.75	39	1.4	0.12
20	Beef, sirloin	0.65	0.63	n.d.	0.46	0.14	12	0.12	0.42	42	1.3	0.14

*Taken from food item no 7 (chicken, leg).

No	Food item	C18:1 n-5	C18:1 (cis/trans?)	C18:2 n-6	C19:0	C18:3 n-6 gamma	C18:3 n-3	C18:2 CLA (cis-9, trans-11)	C20:0	C18:2 CLA (trans-10, cis-12)	C20:1 n-11	C20:1 n-9
1	Elk, rump	n.d.	0.28	14	n.d.	n.d.	4.4	0.17	0.24	n.d.	n.d.	n.d.
2	Reindeer, loin	n.d.	0.09	17	<0.08	<0.08	1.1	0.09	0.13	n.d.	n.d.	n.d.
3	Reindeer, rump/leg	<0.08	0.11	20	<0.08	0.11	1.1	0.09	0.17	n.d.	n.d.	0.1
4	Reindeer, frying meat	<0.08	0.19	7.6	0.12	n.d.	0.57	0.14	0.2	n.d.	n.d.	0.11
5	Turkey, cold cuts	n.d.	n.d.	23	n.d.	n.d.	1.6	n.d.	0.09	n.d.	n.d.	0.23
6	Chicken, thigh, without skin	<0.08	n.d.	17	n.d.	0.14	1.2	n.d.	n.d.	n.d.	n.d.	0.31
7	Chicken, leg, without skin	<0.08	n.d.	20	n.d.	0.13	1.3	0.3	<0.08	<0.08	n.d.	0.3
8	Chicken, drumstick, with skin	<0.08	n.d.	17	n.d.	0.13	1.3	0.24	n.d.	n.d.	n.d.	0.29
9	Chicken, wing, with skin	<0.08	n.d.	15	n.d.	0.16	0.94	0.08	n.d.	n.d.	n.d.	0.31
10	Chicken, skin*	<0.08	n.d.	18	n.d.	0.12	1.7	n.d.	<0.08	n.d.	n.d.	0.33
11	Pork fillet, sirloin	0.09	n.d.	8.9	n.d.	n.d.	0.57	n.d.	0.11	n.d.	n.d.	0.58
12	Pork/kassler steak	0.12	n.d.	8	n.d.	n.d.	0.54	n.d.	0.14	n.d.	n.d.	0.62
13	Pork assortment 0 (for sauce)	<0.08	n.d.	8.2	n.d.	n.d.	0.64	n.d.	n.d.	n.d.	n.d.	0.63
14	Beef chuck/beef shoulder (for stewing)	0.13	0.31	3.1	n.d.	n.d.	0.64	0.21	0.16	n.d.	n.d.	0.1
15	Pork-beef, minced meat (fat ≥ 20%)	0.16	n.d.	6.3	n.d.	n.d.	0.55	n.d.	n.d.	n.d.	n.d.	0.43
16	Pork fillet, tenderloin	<0.08	n.d.	8.7	n.d.	n.d.	0.47	n.d.	0.14	n.d.	n.d.	0.48
17	Pork, ribs	<0.08	n.d.	7.6	n.d.	n.d.	0.59	n.d.	<0.08	n.d.	n.d.	0.54
18	Beef, minced meat (10% fat)	0.25	0.31	2.2	n.d.	n.d.	0.39	0.23	0.13	n.d.	n.d.	0.16
19	Beef, minced meat (17% fat)	0.25	0.32	1.6	n.d.	n.d.	0.41	0.22	n.d.	n.d.	0.11	0.13
20	Beef, sirloin	0.2	0.26	2.7	n.d.	n.d.	0.51	0.16	n.d.	n.d.	n.d.	n.d.

*Taken from food item no 7 (chicken, leg).

No	Food item	C20:2 n-6	C20:2 n-?	C20:3 n-6 gamma	C20:4 n-6	C20:5 n-3 EPA	C22:0	C23:0	C22:4 n-6	C22:5 n-3 DPA	C22:6 n-3 DHA	C24:1 n-9	Unknown
1	Elk, rump	0.32	n.d.	0.13	3.7	1.1	n.d.	n.d.	n.d.	1.6	n.d.	n.d.	0.11
2	Reindeer, loin	0.36	0.12	0.37	5.1	0.97	n.d.	n.d.	n.d.	2.3	n.d.	n.d.	<0.08
3	Reindeer, rump/leg	0.44	0.12	0.4	5.9	1	0.15	0.13	0.22	2.5	0.15	n.d.	0.1
4	Reindeer, frying meat	0.13	n.d.	0.15	2.4	0.27	0.09	n.d.	n.d.	1.1	n.d.	n.d.	0.33
5	Turkey, cold cuts	0.28	0.17	0.19	2.6	n.d.	n.d.	n.d.	0.52	0.28	0.16	n.d.	n.d.
6	Chicken, thigh, without skin	0.17	n.d.	0.15	0.74	n.d.	n.d.	n.d.	0.15	0.15	n.d.	n.d.	<0.08
7	Chicken, leg, without skin	0.4	0.09	0.41	2.4	0.14	n.d.	n.d.	0.42	0.46	0.21	0.14	<0.08
8	Chicken, drumstick, with skin	0.22	n.d.	0.18	1.1	n.d.	n.d.	n.d.	0.17	0.13	n.d.	n.d.	<0.08
9	Chicken, wing, with skin	0.16	n.d.	0.13	0.45	n.d.	n.d.	n.d.	<0.08	n.d.	n.d.	n.d.	<0.08
10	Chicken, skin*	0.11	n.d.	<0.08	0.19	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	<0.08
11	Pork fillet, sirloin	0.3	n.d.	n.d.	0.64	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
12	Pork/kassler steak	0.36	n.d.	n.d.	0.49	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
13	Pork assortment 0 (for sauce)	0.34	n.d.	n.d.	0.47	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
14	Beef chuck/beef shoulder (for stewing)	n.d.	n.d.	n.d.	0.48	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
15	Pork-beef, minced meat (fat ≥ 20%)	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
16	Pork fillet, tenderloin	0.3	n.d.	0.11	0.88	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
17	Pork, ribs	0.29	n.d.	n.d.	0.21	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	<0.08
18	Beef, minced meat (10% fat)	n.d.	n.d.	n.d.	0.3	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.14
19	Beef, minced meat (17% fat)	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.15
20	Beef, sirloin	n.d.	n.d.	n.d.	0.58	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.1

*Taken from food item no 7 (chicken, leg).

Annex 2. Absolute differences between Fineli values and new analysis results as graphs

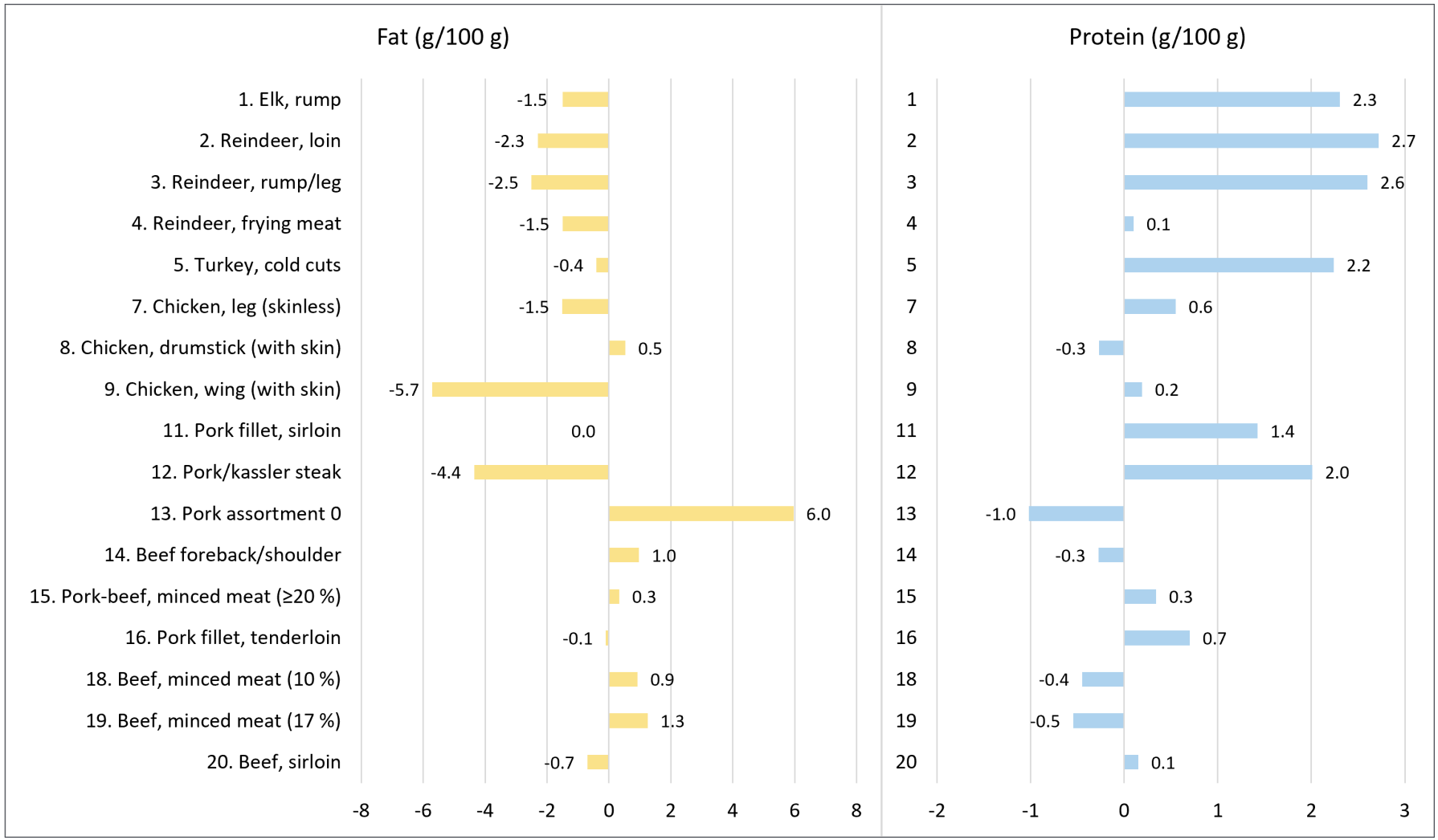


Figure 8. *Comparison of fat (yellow) and protein (blue) analysis results with Fineli values. The differences are obtained by subtracting the Fineli value from the new analytical result (analytical result – Fineli value = difference (g/100 g)). The negative bars indicate that the new analytical results are lower than the previous values in Fineli, while the positive bars indicate higher analytical results than the current values in Fineli.*

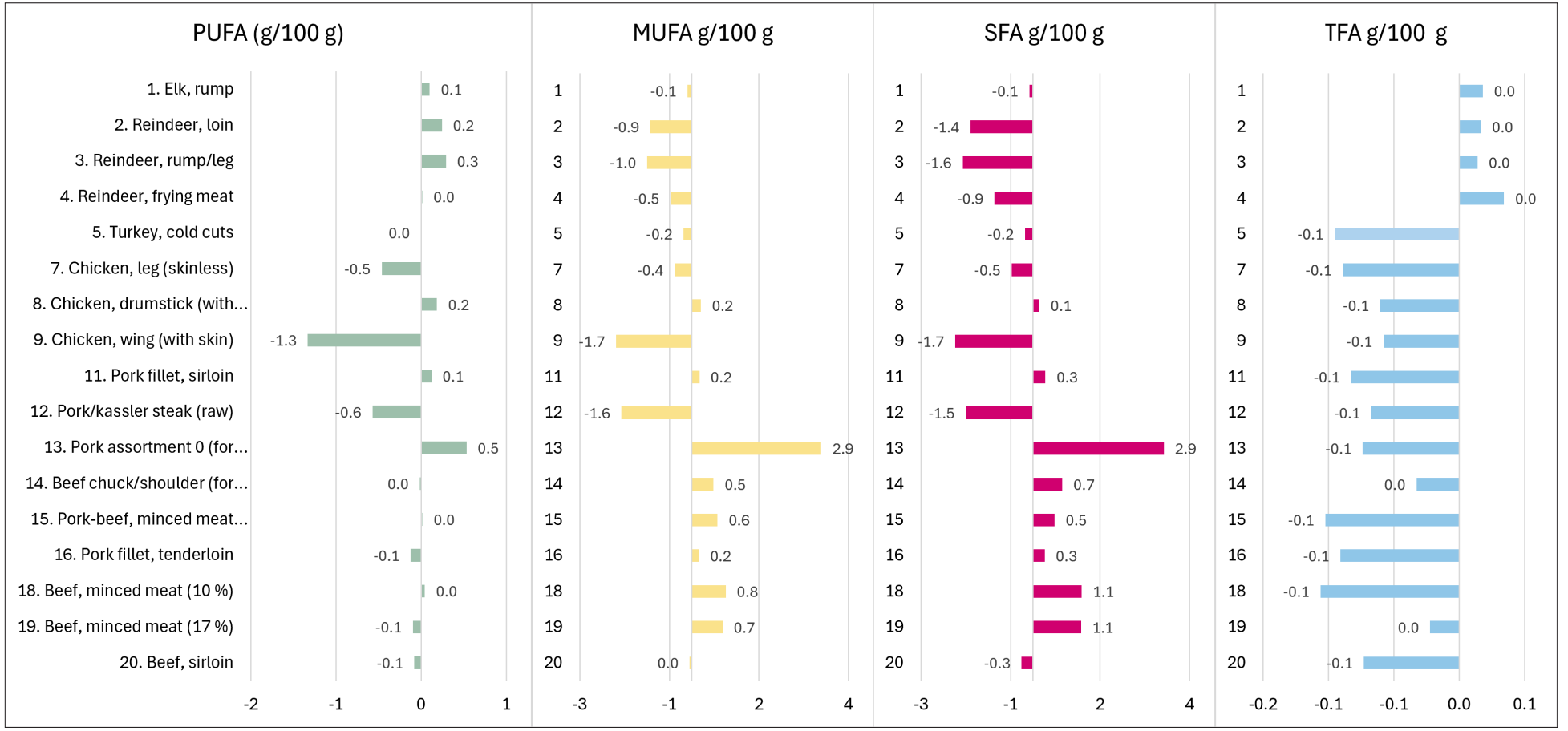


Figure 9. *Comparing fatty acid analysis results (g/100 g fat) with previous values from Fineli. The bars represent the difference between the new analytical results and Fineli values (g/100 g; (analytical result – Fineli value = difference (g/100 g) of fat); polyunsaturated (PUFA = green), monounsaturated (MUFA = yellow), saturated (SFA = pink), trans-fatty acids (TFA = blue)). A negative number indicates that the new analytical result is lower than Fineli value and a positive number indicates a higher analytical content.*

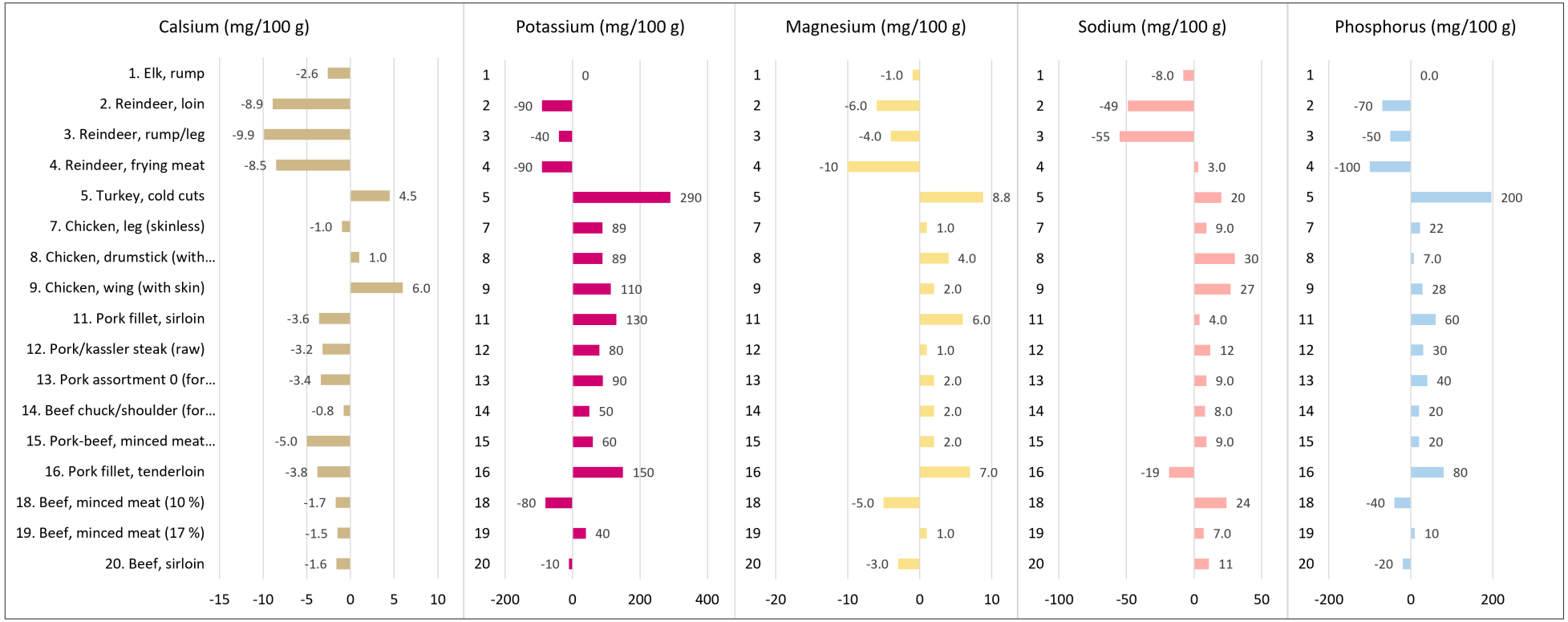


Figure 10. *Comparison of calcium (light brown), potassium (pink), magnesium (yellow), sodium (light pink) and phosphorus (light blue) analysis results with Fineli values. The differences are obtained by subtracting the Fineli value from the new analytical result (analytical result – Fineli value = difference (mg/100 g)). The negative bars mean that the new analytical results are lower than the previous Fineli values, while the positive bars mean that the analytical results are higher than the current values of Fineli.*

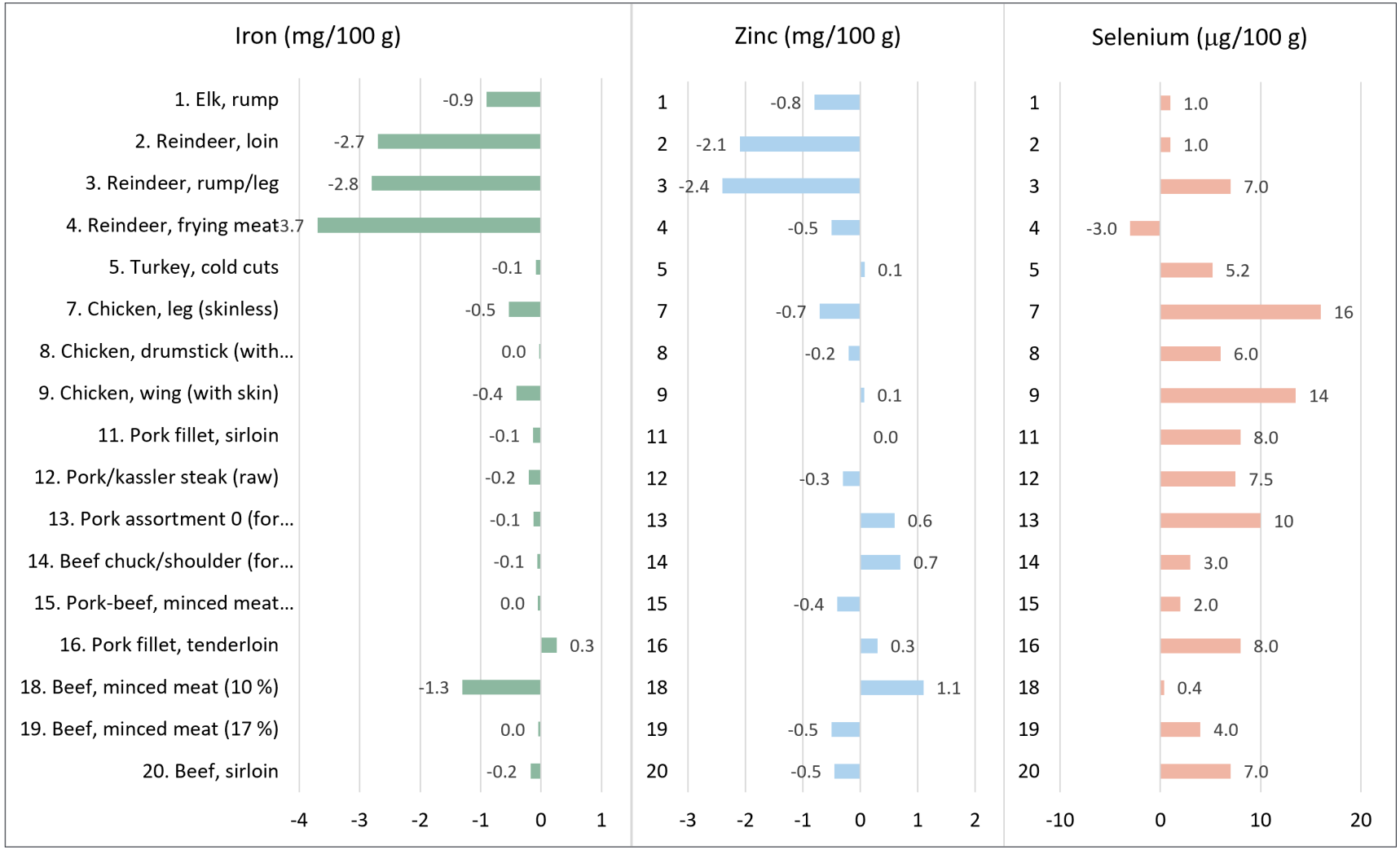


Figure 11. *Comparison of iron (green), zinc (light blue), and selenium (light pink) analysis results with Fineli values. The differences are obtained by subtracting the Fineli value from the new analytical result (analytical result – Fineli value = difference (mg/100 g, iron and zinc; µg/100 g selenium)). The negative bars indicate that the new analytical results are lower than the previous Fineli values, while the positive bars indicate higher analytical results than the current values of Fineli.*

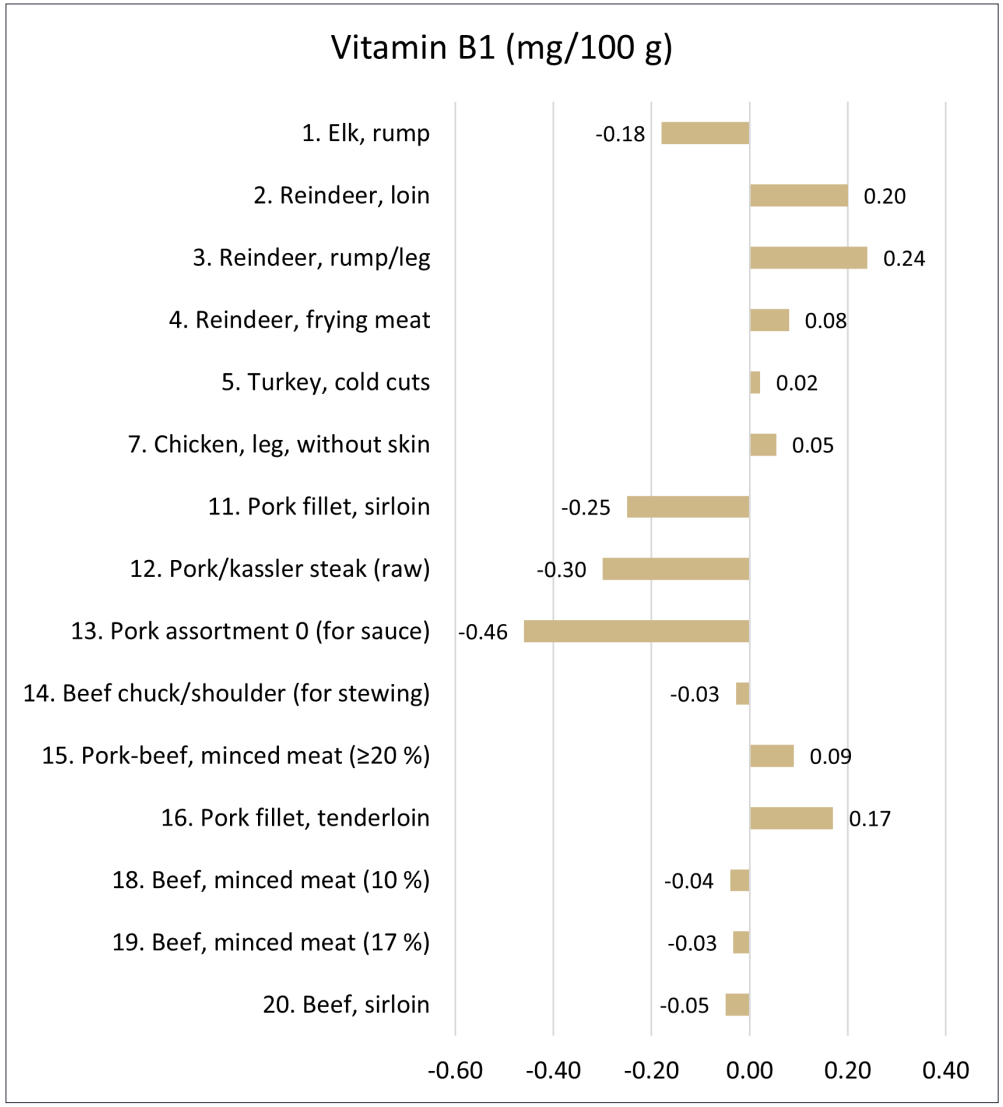


Figure 12. *Comparison of vitamin B1 (brown) analysis results with Fineli values. The differences are obtained by subtracting the Fineli value from the new analytical result (analytical result – Fineli value = difference (mg/100 g)). The negative bars mean that the new analytical results are lower than the previous Fineli values, while the positive bars mean that the analytical results are higher than the current values of Fineli.*

Annex 3. Chicken thigh, leg, drumstick and wing

Figure 13. *Chicken meat samples before handling: Chicken skinless thigh (= roast cut, no 6), some pieces had a lot of visible fat (narrow picture on the right); Chicken leg with skin (no 7) → this sample was skinned to form sample 10 (chicken, skin); Chicken drumstick with skin (no. 8); Chicken wing with skin (no. 9). The amount of visible fat varied between samples. An attempt was made to include fat in the samples, but the amount was not standardised. Photos: Helena Pastell, Finnish Food Authority*

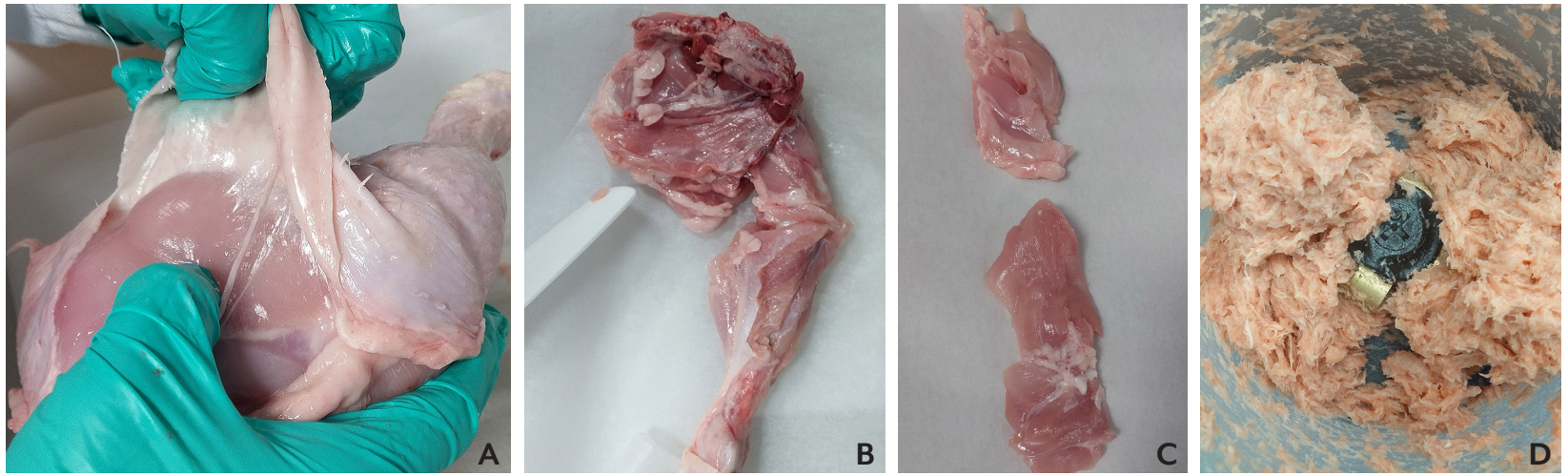


Figure 14. *Chicken leg (No 7): A) skin removal B) separation of meat from bones C) meat removed D) minced/homogenized meat. Removing the meat from the bones was challenging and it is possible that proportionally more lean meat was removed from the leg than from chicken thigh, for example. Photos: Helena Pastell, Finnish Food Authority*

RUOKAVIRASTO

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