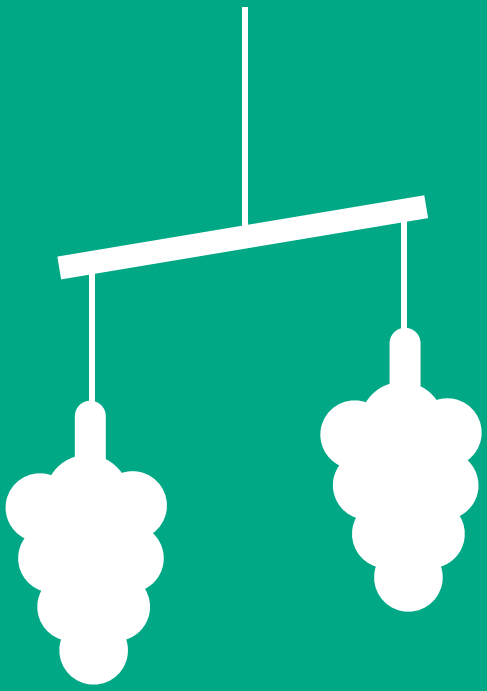
Adulteration of food
—
current problem?



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2015

Adulteration of food – current problem?

A concise summary to begin. The facts given below are the result of years of activity by the Czech Agriculture and Food Inspection Authority (CAFIA) focusing on exposing low quality or adulterated food. What is important for the consumer is that generally speaking the quality of food coming from Czech producers is very high.

The results of the work carried out by CAFIA unequivocally indicate that the Czech food industry produces quality food and the discovered cases of low quality or adulterated food are actually confirmation of the successfulness of the inspection activities of the supervisory authorities rather than evidence of any systematic deception of consumers in the Czech Republic.

What is quality?

Food is a theme of interest to everybody on this planet. Depending on the economic conditions in the society in question, people unfortunately sometimes have to work to secure its basic availability. In economically mature societies the issue of availability is gradually replaced with that of quality.

Quality is talked about today and every day – the media is full of quality and it is discussed at great length by consumers. Yet how should we understand the concept of quality food? Can it be understood as the sum of all the characteristics through which the food in question meets the expectations of each individual consumer? In other words, quality is the reason why we purchase or want to purchase a particular product. The concept of quality is always closely tied to a specific consumer, and so a food enjoyed by one consumer might be unacceptable to another.

Table water. They look identical, they taste the same. Both glasses contain branded table water, yet the one on the left is eight times more expensive.

However, certain preferences might also be a general phenomenon. In the Czech Republic, popular commodities include Czech garlic, onions from Všetaty, carp from Třeboň, Moravian wine or grape must, and potatoes from Vysočina.

Unfortunately it was and always will be true that it is simply not possible to increase the production of highly quality foods at low prices indefinitely. Quality always costs something and the production of quality food is demanding in both expertise and ingredients. We have a quite significant advantage in this country in that our food producers are among the global leaders in a wide range of fields, and many universities and high schools offer specialised education in food production technologies. The various guilds with an interest in maintaining and improving the good quality of Czech food are also of considerable importance. The Czech Republic does not possess ideal natural conditions for agricultural production, and therefore we cannot compete on price with the main global producers in a wide range of commodities. Yet this is precisely why betting on better quality and documented origin may be a path to success for the domestic food industry.

What is adulteration?

The fact that consumers' purchasing power is gradually growing alongside efforts by producers and merchants to satisfy customers' needs to the greatest possible extent is a good sign. On the other hand, the sources of quality ingredients with the required origin are not inexhaustible. Hence there has been a gradual opening up of space for unlawful behaviour by some producers and merchants by producing food from lower quality ingredients or switching ingredients, or who are willing to present foreign foods as Czech ones. In these cases the issue is no longer that a given

For one person steak tartare must be made from beef tenderloin (left), while another is satisfied with just sirloin (right). The price difference is about CZK 450 per kilogram.

food is of low quality. These are cases of a significant worsening of the elementary characteristics of the food in question and this is where we can use the term "adulterated food".

We can explain this problem using a model as follows. Legislation says that it is not possible to consider as chocolate a product that contains less than 35% cocoa solids (if we are talking about dark chocolate). If a product declares 50% cocoa solids yet an official inspection finds that in fact this value is only 45%, then we can speak of failure to comply with the declared quality. However, if this analysis finds that the product only contains 32% cocoa solids, then we can no longer talk of chocolate and the food in question will be assessed as being misleadingly labelled, or adulterated. From the legal perspective there is also the principle of strict liability, meaning that the entrepreneur who currently has it in his possession is liable for the characteristics of a given food. During an official inspection it is not – in the majority of cases – practically possible to decide whether the adulteration occurred intentionally with the objective of gaining an unjustified competitive advantage, or as a result of gross technological lack of discipline. In effect, gross indiscipline is a deliberate act and every producer or merchant should have an effective internal control system implemented in order to prevent such excesses.

The social danger of adulteration

So when did the adulteration of food actually start? There were surely cases of fraud even before mankind had learned how to write them down. The first preserved writing from which we can conclude that adulteration had to be addressed at the highest possible level can be found in the Code of Hammurabi dating from around 1760 BC. It includes the note "he who fails to comply with the correct quantity of malt when

Technological advances have also enabled the production of this type of product: on the left, classic Edam, on the right a so-called alternative with added vegetable oil.

brewing beer will be thrown into the water". References to the adulteration of food are also found in texts dating from the days of the Roman Empire, and record cases of adulteration of the origin of wine or mushrooms.

During the Middle Ages the number of records of adulteration increases. In Prague dishonest bakers were dipped into the River Vltava in baskets, while elsewhere cases were discovered when sugar of lead was added to wine or soap was added to milk. In the 19th century, the significant advances made in science and, consequently, progressive changes in food technologies, resulted in completely new possibilities to produce hitherto unknown types of products, but also new and very sophisticated ways to adulterate food. Fortunately, there was also a similar rapid development in methods for the analysis of food and in the number of cases when this socially dangerous practice was revealed.

What exactly is the danger from adulteration? One idea that immediately occurs is that the main impact is felt by the consumer because they are being cheated. Yet this is by no means the end of it. If, in the given food segment, there is a company that has based its business around such fraud, we can also speak about unfair competition. And if the situation is not resolved, honest enterprises will not be able to compete with their quality products and will go bankrupt. Yet this is still not the end of the consequences. If, for example, the fruit component in fruit products was not maintained, then the primary producers would not have to plant hundreds of hectares of orchards and would not need to employ the relatively large number of workers needed in this highly specialised sector. Similarly, fraud cases involving mechanically separated meat would mean, for example, that thousands of pigs would not have to be kept. In other words, the production of adulterated food could have a direct impact on rural employment. And finally, the prosecution of food fraud and the fight against its adulteration are closely watched by companies, consumers and entrepreneurs, and this is reflected in people's trust in the legal system.

Adulteration and food safety

In a fairly significant number of cases food adulteration borders on failure to comply with food safety requirements. History provides us with cases of mass poison-

ings and deaths after the consumption of adulterated food. These have included the addition of melamine to dairy products, the use of aniline dyes in edible oils, the use of peanuts instead of various other types of nuts, consumer deaths after the consumption of wine adulterated with ethylene glycol, or the misuse of methanol in the illegal production of spirits.

The situation in the Czech Republic

So how do Czech producers fare in terms of compliance with quality requirements, respectively adulteration? The presentation of the results of official inspections performed by the supervisory authorities would not provide an appropriate answer to this question. These data are strongly distorted because the inspection capacity is focused primarily on risky sectors, on risky producers or risky merchants. We can say that in the Czech Republic there are practically no enterprises with a business plan based on food adulteration. If, however, one does appear, it is quickly dealt with.

As part of its activities, the Czech Agriculture and Food Inspection Authority inspects not only whether food is safe, but for many years has also focused more and more of its energy on the inspection of quality requirements. The very good situation in the area of food safety has allowed CAFIA to shift a significant part of its financial and human resources into quality control. Quality inspection is professionally and financially much more demanding than inspecting food safety. In many cases we can speak of differences of an order of magnitude in the financial demands when comparing these two types of inspections. The demands placed on the qualifications of the employees that carry out these inspections are also far higher. However, as the text above indicates, it is money well spent.

CAFIA laboratories

The performance of highly specialised laboratory analyses is thus a specific issue. In very many cases such analyses are not provided by any commercial laboratory and are very demanding in terms of both time and human resources. For this reason two laboratories form an essential part of CAFIA. The laboratory operating at the Inspectorate in Brno specialises in the complex analysis of wine, in the verification of the

On the left 100% juice, on the right nectar with 50% fruit content. In the past there were relatively frequent cases of juice being diluted with water with added sugar.

geographical origin of wine or in discovering a range of unauthorized oenological practices.

The second laboratory, operating at the Prague Inspectorate, focuses on uncovering fraud in a wide range of commodities. Its specialisation is analysis of fruit juices, processed fruit, cocoa, coffee, chocolate, and meat and fish products. Every year samples are taken of around 4,000 lots of all types of food for laboratory quality inspections, and the total number of analyses carried out reaches several hundred thousand a year.

Retail arrangement and presentation of food

Laboratory analyses are not always needed to establish that the consumer has been deceived, as a food must not mislead consumers through its labelling, promotion and retail arrangement, shape, appearance or packaging, the packaging material used, the method for its arrangement and the place of offer, or information provided through any medium. It is a fact that in the past official controls have uncovered

No difference at first glance. Yet on the left is bouillon made from beef, while on the right is a "solution" prepared from stock cubes.

The proper ingredients for beef bouillon.

The use of stock cubes should be declared. If this fact is concealed, unlawful profit of up to CZK 20 per portion can be made.

cases when, for example, the way wine was displayed in some markets evoked in consumers the feeling that all the wines offered were from Moravia. One relatively curious case was the offer of foreign products labelled using a shelf price tag featuring the Czech flag and the slogan "Czech Quality".

Unfortunately, with adulterated food the rules of the free market – where it is assumed that quality at a reasonable price establishes itself through the action of fair competition – do not apply. In the majority of cases the consumer, without the option of laboratory analysis, does not have the least chance of discovering for themselves whether the food they are buying is adulterated. Even during official inspections, as a rule the evaluation of the sensory properties of adulterated food cannot be considered the sole and decisive characteristic sufficient for a final verdict.

Which foods are most often adulterated and how?

Wine

This was and remains one of the most frequently adulterated commodities. Thanks to the good work of Moravian and Bohemian winemakers, demand for domestic wines is high and the area of our vineyards can no longer be significantly expanded for well-known reasons. Hence imported wine is frequently passed off as Moravian wine. The case is similar for burčák (partially fermented grape must). Burčák is the protected geographical indication of partially fermented grape must produced from grapes grown in Moravia or in Bohemia. If foreign grapes are used the product must be labelled as partially fermented grape must.

The laboratory verification of the origin of wine or burčák is extremely demanding in terms of time, equipment and the experience of the laboratory personnel. Other methods of wine adulteration include a wide range of so-called unauthorised oenological practices. These include adding water to wine, the unauthorised use of colouring, illegal chaptalisation (the sweetening of the must) or the alteration of the taste of the wine using synthetic glycerol. Most often these abuses occur in wines on tap from small enterprises where it is practically impossible to discover who it was in the production to store chain that illegally altered the wine.

It is difficult for the inexperienced consumer to identify adulterated wine. The wine on the right contains around 30% water.

Spirits

Fraud with spirits resulted in the infamous "methanol" affair in 2012. Its main cause was the desire to make unlawful profit by avoiding excise duty on alcohol.

A role was also played by the relatively easy availability of methanol, which is used in large quantities as a raw material for industry, for example in the production of rapeseed methyl ester. It is important to emphasise that this fraud was in no way connected with the legal operations of spirits producers. CAFIA has focused on uncovering fraud with spirits for many years and has accredited methods in its laboratories enabling the identification of the botanical origin of alcohol and the presence of residues of denaturing agents. All findings of residues of denaturing agents were and are immediately forwarded to the Directorate General of Customs as they are clear cases of the use of untaxed denatured alcohol.

The origin of alcohol cannot be determined using the senses. On the left is distillate of apricot, on the right "other" spirit – apricot flavoured.

Honey

CAFIA considers honey to be a very problematic food on the Czech market from the perspective of the opportunities for adulteration. One interesting fact is that the methods for adulteration have evolved over time and have closely mirrored the possibilities for the laboratory detection of adulterated products.

Initially there was the discovery of the use of sugars from plants that are not visited by bees – these were the so-called C4 sugars, meaning that these sugars can only get into honey through human intervention. A classic case is the use of cane sugar

The colour and consistency of honey is not important for verifying its authenticity. Analysis is always required. On the left is honey, on the right a sweet substance passed off as honey.

or glucose syrup produced from cereals, especially corn. After the introduction of the appropriate analyses into the inspection work this method of adulteration was eliminated and a different method began to be used.

This consisted of the breaking down of the higher sugars derived from flowering plants. A classic example of this is the breaking down of sucrose from sugar beet enzymes that are not typical for bees. For approximately two years, honeys containing the enzyme fructofuranoside, used in the processing of higher sugars, were available on the market in the Czech Republic. In this case, too, the introduction of laboratory methods into normal inspection work made it possible to put an end to this method of adulteration, while it was sometimes significantly modified. Enzymes are proteins and heating them to higher temperatures causes them to become denatured. Hence there arose the need to add enzymes to substances being passed off as honey that masked the presence of the bees' own enzyme diastase, the so-called α-amylase. Yet the problem was that this type of amylase was not normally available on the market, and so the counterfeiters started using a different type of amylase, the so-called β-amylase, which is inherent in plants. Over time a method was added to the laboratory analyses focusing on determining the type of amylase, which compared the origin of the proteins and sugars contained in the honey. This method is based on checking the compliance between carbon isotope ratios – this ratio must be the same in the proteins and sugars of a given sample.

A new adulteration method is switching of foreign honey for Czech honey. In order to verify the truthfulness of a declaration of the domestic provenance of honey, a pollen analysis is carried out, during which the spectrum of the discovered types of pollen and their quantities is assessed. The actual origin is determined based on

an assessment of a whole series of parameters and their comparison with standard honeys from different parts of the world. This method is very sophisticated and demanding in terms of the qualifications of the laboratory personnel. Recently there have been cases of various unqualified misinterpretations, for example that Czech honeys have been contaminated with pollen from Actinidia grown in Czech gardens. Here is not the place for an extensive clarification of the principles of this method, but to illustrate the complexity we can state that the Actinidia is not a nectar-producing plant and thus this type of plant is excluded in advance from the assessed pollen spectrum.

Products from fruit

Adulteration of jams and fruit spreads is relatively easy. It is possible to replace the fruit component with sugar and a gelling agent or replace a more expensive fruit component, for example, strawberries or blueberries, with a cheaper one, usually apples. In the past problems were discovered quite often for this food group, especially for jams.

Both of these products are ostensibly blackcurrant jam. Yet the one on the right contains more apples than blackcurrants.

The method used in the CAFIA laboratories was developed in cooperation with the University of Chemistry and Technology, Prague. No other laboratory in the Czech Republic has this method accredited. Since its introduction into inspections, problems with fruit products have been discovered much less often, and these are practically all related to products from abroad. Domestic producers maintain a high standard in this field.

Cocoa and chocolate

For this food group, there have been and are still attempts to replace the most expensive component – cocoa mass – with a different one. In the past there have been

cases when sucrose, carob (the ground fruit of the carob tree) or the ground shelled pods of the cacao tree were mixed into cocoa.

Another way to falsify these products is to use different fats than cocoa butter. This is because cocoa is approximately 4 times more expensive than carob and 15 times more expensive than sucrose. Cocoa butter is then up to 8 times more expensive than fats of vegetable origin. Laboratory methods have also been developed for this food group through close cooperation between CAFIA and the University of Chemistry and Technology.

At the top of the triangle is proper, unadulterated cocoa. The sample on the lower left included added sugar, while the one on the right added carob.

Fruits and vegetables

The adulteration of these commodities depends on changes in the preferences of Czech consumers, who mainly tend to seek out domestic products. The origin of garlic is most commonly falsified, as domestic garlic has long been favoured by consumers. Laboratory methods make it possible to verify the origin of garlic to some extent. They are based on verifying the truthfulness of the declaration of Czech varieties of garlic because Czech varieties are virtually not grown at all abroad.

Regarding fruit, there have been exceptional cases of switching apple varieties with other popular varieties, for example the Rubín variety being replaced by others. For fresh fruit and vegetables, information about the country of origin is a mandatory

and very important part of the labelling. Cases are relatively common in the retail network when the indicated country of origin is not correct.

Potatoes

The standard of Czech potato production has significantly improved over the past 20 years. Not only have yields increased, but Czech potato producers have also made large investments into storage technologies and post-harvest treatment. At around the turn of the century a method was introduced into inspections enabling the verification of whether the labelling of a particular potato variety was correct.

On the left is a classic variety used as a side dish, while on the right is a variety suitable for making mashed potato. If the two are mixed together, they cannot be properly cooked, and this becomes the subject of consumer complaints.

The potato variety is an indicator of quality and many consumers seek out a specific type for cooking or even a specific variety of potato. The first results of inspections 20 years ago were very alarming. More than one-third of inspected lots on the market had misleading labelling or were mixes of different varieties. There was even a case in which one inspected lot was made up of five different varieties. The situation on the market today is far better, and if problematic lots are discovered, they are usually potatoes from abroad.

Fish and fish products

With this food group the most frequent method of adulteration is failure to provide information about added water and additives intended to retain the added water in the flesh of the fish.

Adulteration has been recorded for both whole fish and also fillets and fish products, for example fish fingers. Another adulteration method is replacing more expensive

types of fish with cheaper ones or fish caught at sea for farmed fish. CAFIA carried out an inspection of this in 2013 and did not discover a single case of deception of consumers.

On the left there is a fish fillet without any added water, while the fillet on the right contains approximately 30% added water.

Fish without added water remains firm and retains its original structure even after cooking.

Fish with added water falls apart during the cooking process and loses its structure. Hence it is usually sold as fish fingers, where this change is not so evident.

Meat and meat products

Regarding meat products, they are relatively commonly discovered to contain less meat or muscle protein than legislation prescribes for the given product group. Sometimes there are cases when long-life meat products contain more water activity than permitted. Inspections of mechanically separated meat may be a significant problem in the future – it may be used in some lower quality products, yet its content may not be included in the total meat content.

One problem is the quantification of the separate used. In this case there is no known adequate analytical method.

Sausages without mechanically separated meat.

Sausages with mechanically separated meat – its use must be indicated on the labelling and may not be included in the total meat content.

Vegetable oils

For some years now, methods have been used in the CAFIA laboratories to verify the correctness of the information on the botanical origin of the oil. Cases of substitution of different types of oils were never very frequent in the past, and now oil substitutions are not encountered virtually at all. In 2014 only 4 cases were recorded in which the sensory properties of olive oil did not meet the standards for extra virgin olive oil.

Dietary supplements

The original purpose for this food group being put to market was to provide people with some vitamins and minerals in addition to their normal intake from food. Subsequently, foods with substances providing differing physiological effects were also included in this food group – in many cases they had the same substances as contained in registered medicaments.

The frauds encountered by CAFIA in this group most commonly relate primarily to failure to comply with the declared content of an active substance. However, cases

when synthetic medicaments are added to food supplements that are declared to be purely natural in origin are far more dangerous. This sometimes occurs in quantities significantly exceeding the content of these medicaments in medicines issued only on prescription.

Information system for fraud in the food chain

The European Commission considers food adulteration to be a serious social problem and hence is preparing a warning system for food fraud called "Administrative Assistance and Cooperation System (AACS)". This system will also be used to transmit information about cases of "Food Fraud" – fraud, adulteration, smuggling and deception relating to food and feed – if these cases will have an impact on more than one EU Member State.

On the left basmati rice. On the right, regular long-grain rice. The price of basmati rice is around five times higer that of regular rice.

The objective of the system is to strengthen administrative cooperation and to facilitate Member States' implementation of the requirements stipulated in Regulation (EC) No 882/2004 of the European Parliament and of the Council of 29 April 2004 on official controls, in Title IV "Administrative Assistance and Cooperation".

The system is being built on the basis of experience with the Rapid Alert System for Food and Feed (RASFF), while to a certain extent the RASFF was the model for the AACS.

It is already possible to transmit information about food fraud within the EU in two ways:

1. By using the RASFF, into which cases of food fraud are notified as so-called noti-

fications, while Member States are not obligated to react to them in any way and in fact do not react to them.

2. By using the Food Fraud Contact Points in the future AACS network through e-mail communication.

In 2014 the RASFF National Contact Point addressed a total of 37 cases (8 sent, 29 received), which fell within the scope of Administrative Assistance and Cooperation pursuant to Regulation (EC) No 882/2004. From the perspective of CAFIA the bilateral exchange of information about adulterated food cases operates very well and the anticipated launch of the AACS information system will surely raise it to a qualitatively higher level.

The AACS NCP has been established at CAFIA since 1 January 2015 – this will manage the AACS information system in the Czech Republic after its launch. CAFIA has already offered supervisory authorities operating in the Czech Republic the possibility to connect to this system and has been adding its findings to it since the start of 2015.

Conclusion

The Czech Agriculture and Food Inspection Authority has intensively focused on the issue of food adulteration for several decades. For this purpose it has systematically built up its own unique laboratory workplaces, which often carry out analyses not possible at other laboratories in Central Europe.

It also pays great attention to the expert training of inspectors. Every year training focusing on product evaluation and also on food labelling is carried out. The result of the work performed by CAFIA and other supervisory authorities is the fact that there is no systematic deception of consumers in the Czech Republic. However, this situation is primarily thanks to the Czech producers themselves. The inspections carried out at their premises find low quality foods extremely rarely. The situation is, however, different for many foreign foods, and it is precisely on this area that the Czech Agriculture and Food Inspection Authority will focus even more intensively in the future.

Annex – model menu or what you stand to lose if they cheat...

These examples could be a regular weekend lunch. The amounts are the prices of the ingredients and correspond to prices displayed in March 2015 in various internet stores.

MENU 1

Unadulterated version

Soup:
0.3 l Beef bouillon with noodles

Main course:
100 g Fried cheese (Edam 30%)
250 g Boiled potatoes with butter (real butter)
30 ml Tatare sauce

Dessert:
Chocolate dessert with buttercream

Drink:
0.25 l Sparkling mineral water (mineral water)
Instant coffee (approx. 0.15 l, 100% instant coffee)

Adulterated version

Soup:
0.3 l Beef bouillon (from stock cubes) with meat and noodles

Main course:
100 g Fried cheese (alternative)
250 g Boiled potatoes with butter (actually margarine)
30 ml Tatare sauce

Dessert::
Chocolate dessert (adulterated cocoa) with buttercream (actually margarine)

Drink
0.25 l Sparkling mineral water (soda water)
Instant coffee (approx. 0.15 l, adulterated instant coffee – 70% coffee, 30% coffee substitute)

CALCULATION FOR MENU 1	unadulterated version	adulterated version	price difference adulterated x unadulterated version
Soup	24.20	5.03	19.17
Main course	25.86	18.68	7.18
Dessert	19.31	17.28	2.03
Drink - mineral water	4.25	1.98	2.27
Drink - coffee	6.50	4.92	1.57
Total (rounded)	**80.10**	**47.90**	**32.20**

MENU 2

Unadulterated version

Soup:
0.3 l Beef bouillon with meat and noodles

Main course:
200 g Venison medallions marinated in red wine
200 g Boiled basmati rice (basmati rice)

Dessert:
Chocolate dessert with buttercream

Drink:
0.2 l White wine

Adulterated version

Soup:
0.3 Beef bouillon (from stock cubes) with meat and noodles

Main course:
200 g Venison medallions (roast beef) marinated in red wine
200 g Basmati rice (long-grain rice) boiled

Dessert:
Chocolate dessert (adulterated cocoa) with buttercream (actually margarine)

Drink:
0.2 l White wine (diluted 1:1 with water)

CALCULATION FOR MENU 2	unadulterated version	adulterated version	price difference adulterated x unadulterated version
Soup	24.20	5.03	19.17
Main course	93.07	83.78	9.29
Dessert	19.31	17.28	2.03
Drink – wine	29.31	14.65	14.65
Total (rounded)	**165.90**	**120.70**	**45.20**

MENU 3

Unadulterated version

Soup:
0.3 l Beef bouillon with meat and noodles

Main course:
200 g Fish fillet (seafrozen) – natural
250 g Boiled potatoes with butter (real butter)

Dessert:
Chocolate dessert with buttercream

Drink:
0.2 l Orange juice (100% orange juice)

Adulterated version

Soup:
0.3 l Beef bouillon (from stock cubes) with meat and noodles

Main course:
200 g Fish fillet (30% water) – natural
250 g Boiled potatoes with butter (actually margarine)

Dessert:
Chocolate dessert (adulterated cocoa) with buttercream (actually margarine)

Drink:
0.2 l Orange juice (orange nectar)

CALCULATION FOR MENU 3	unadulterated version	adulterated version	price difference adulterated x unadulterated version
Soup	24.20	5.03	19.17
Main course	40.74	29.59	11.15
Dessert	19.31	17.28	2.03
Drink – juice	8.38	4.99	3.39
Total (rounded)	**92.60**	**56.90**	**35.70**

MENU 4

Unadulterated version

Soup:
Beef bouillon with meat and noodles

Main course:
200 g Pease pudding
2 Frankfurters
Bread
Pickled gherkin

Dessert:
Chocolate dessert with buttercream

Drink:
0.2 l Orange juice (100% orange juice)

Adulterated version

Soup:
Beef bouillon (from stock cubes) with meat and noodles

Main course:
200 g Pease pudding
2 Frankfurters (with mechanically separated meat)
Bread
Pickled gherkin

Dessert:
Chocolate dessert (adulterated cocoa) with buttercream (actually margarine)

Drink:
0.2 l Orange juice (orange nectar)

CALCULATION FOR MENU 4	unadulterated version	adulterated version	price difference adulterated x unadulterated version
Soup	24.20	5.03	19.17
Main course	35.81	16.08	19.73
Dessert	19.31	17.28	2.03
Drink – juice	8.38	4.99	3.39
Total (rounded)	**87.70**	**43.40**	**44.30**

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