



Interim Summary Report

EURL-*Salmonella* Proficiency Test Serotyping 2019

W.F. Jacobs-Reitsma, RIVM, Bilthoven, The Netherlands

A.J. Verbruggen, RIVM, Bilthoven, The Netherlands

K.A. Mooijman, RIVM, Bilthoven, The Netherlands

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1. Introduction

This interim summary report describes the overall results on the serotyping part of the Proficiency Test (PT) on typing of *Salmonella* spp. organised by the European Union Reference Laboratory for *Salmonella* (EURL-*Salmonella*, Bilthoven, the Netherlands). Results of the part on Cluster Analysis (CA) will be reported separately.

A total of 35 laboratories participated in this study. These included 29 National Reference Laboratories for *Salmonella* (NRLs-*Salmonella*) in the 28 EU Member States, 3 NRLs of EU-candidate countries, and 3 NRLs of EFTA countries. The main objective of this study was to check the performance of the NRLs for serotyping of *Salmonella* spp. and to compare the results of serotyping of *Salmonella* spp. among the NRLs-*Salmonella*. All NRLs performed serotyping of the strains. Any NRLs of EU Member States that do not achieve the defined level of good performance for serotyping have to participate in a follow-up study, in which 10 additional strains have to be serotyped.

2. Materials and Methods

2.1. *Salmonella* strains for serotyping

A total of 20 *Salmonella* strains (coded S1 - S20) had to be serotyped by the participants. As decided at the 24st EURL-*Salmonella* Workshop in Amersfoort, The Netherlands, a less common strain (S21) was additionally included in the study. Testing this strain was optional and results were not included in the evaluation.

The *Salmonella* strains used for the study on serotyping originated from the collection of the National *Salmonella* Centre in the Netherlands. The strains were verified by the Centre before distribution. The complete antigenic formulas of the 21 serovars, according to the most recent White-Kauffmann-Le Minor scheme (Grimont and Weill, 2007), are shown in Table 1. However, participants were asked to report only those results, on which the identification of serovar names was based. Two strains (S10 and S18) represented serovars included in the EURL-*Salmonella* serotyping studies for the first time.

2.2 Laboratory codes

Each participant was randomly assigned a laboratory code between 1 and 35.



Table 1. Antigenic formulas of the 21 Salmonella strains according to the White-Kauffmann-LeMinor scheme used in the EURL-Salmonella PT Serotyping 2019

Strain code	O-antigens	H-antigens (phase 1)	H-antigens (phase 2)	Serovar
S1	6,8	Z ₁₀	e,n,x	Hadar
S2	<u>1</u> ,4,[5],12	y	1,2	Coeln
S3	<u>1</u> ,13,22	z	1,6	Poona
S4	9,46	Z ₃₈	-	Fresno
S5	<u>1</u> ,9,12	g,m	-	Enteritidis
S6	3,{10}{15}{15,34}	e,h	l,w	Meleagridis
S7	<u>1</u> ,4,[5],12,[27]	d	1,2	Stanley
S8	<u>1</u> ,4,[5],12	f,g,s	[1,2]	Agona
S9 ^{a)}	<u>1</u> ,4,[5],12	i	1,2	Typhimurium
S10 ^{b)}	6,7	r	1,6	Nigeria
S11	3,{10},{15}	l,Z ₁₃	1,5	Uganda
S12	11	r	e,n,x	Rubislaw
S13	{6,7, <u>14</u> }{54}	g,m,[p],s	[1,2,7]	Montevideo
S14 ^{c)}	<u>1</u> ,4,[5],12	i	-	1,4,[5],12:i:-
S15	6,8	d	1,2	Muenchen
S16	6,7, <u>14</u>	r	1,2	Virchow
S17	6,7, <u>14</u>	r	1,5	Infantis
S18 ^{b)}	16	y	1,5	Saphra
S19	<u>1</u> ,13,23	i	l,w	Kedougou
S20	<u>1</u> ,4,[5],12,[27]	g,s,t	[1,2]	Kingston
S21 ^{d)}	48	g,Z ₅₁	-	IV 48:g,Z ₅₁ :-

a) Potentially contaminated with an *E. coli* strain. Results strain S9 were excluded from the evaluation.

b) Represented in an EURL-Salmonella PT Serotyping for the first time.

c) Typhimurium, monophasic variant as determined by PCR.

d) *Salmonella enterica* subspecies *houtenae* (optional strain).

2.3 Transport

The parcels containing the strains for typing were sent by the EURL-Salmonella on 4 November 2019. All samples were packed and transported as Biological Substance Category B (UN 3373) and transported by a door-to-door courier service.

2.4 Evaluation of the serotyping results

The evaluation of the serotyping results as mentioned in this report is described in Table 2.



Table 2. Evaluation of serotyping results

Results	Evaluation
Auto-agglutination or, Incomplete set of antisera (outside range of antisera)	Not typable
Partly typable due to incomplete set of antisera or, Part of the formula (for the name of the serovar) or , No name serovar	Partly correct
Wrong serovar or, Mixed sera formula	Incorrect

In 2007, criteria for 'good performance' in an interlaboratory comparison study on serotyping were defined (Mooijman, 2007). Penalty points are given for incorrect typing of strains, but a distinction is made between the five most important human health-related *Salmonella* serovars (as indicated in EU legislation, also sometimes referred to as 'top-5'), and all other strains:

- 4 penalty points: Incorrect typing of *S. Enteritidis*, *S. Typhimurium* (including the monophasic variant), *S. Hadar*, *S. Infantis* or *S. Virchow*, or assigning the name of one of these 5 serovars to another strain.
- 1 penalty point: Incorrect typing of all other *Salmonella* serovars.

The total number of penalty points is calculated for each NRL-*Salmonella*. The criterion for good performance is set at less than four penalty points. All EU Member State NRLs not meeting the criterion of good performance (four penalty points or more) have to participate in a follow-up study.

3. Results

3.1 Serotyping results of the NRLs-*Salmonella*

3.1.1. General comments on this year's evaluation

As decided at the 24st EURL-*Salmonella* Workshop, Strain S21 was an additional strain to the study. Testing of this strain was optional and results were not included in the evaluation.

Selection, preparation and shipment of the strains to the participants is always carried out with utmost care, and includes various quality control steps, including purity and typeability. This year however, at least 10 participants reported strain S9 to be a mixed culture. Internal investigations confirmed that this strain was contaminated with an *E. coli* strain. Therefore, results for strain S9 were excluded from the evaluations.

3.1.2. Serotyping results per laboratory

The evaluation of the type of errors for O- and H-antigens and for identification of the strains are shown in Figures 1, 2 and 3. The percentages of correct results per laboratory are shown in Figure 4.

The O-antigens were typed correctly by 32 of the 35 participants (91%). This corresponds to 99% of the total number of strains. The H-antigens were typed correctly by 27 of the 35 participants (77%), corresponding to 97% of the total number of strains. As a result, 26 participants (74%) gave the correct serovar names, corresponding to 97% of all strains evaluated.

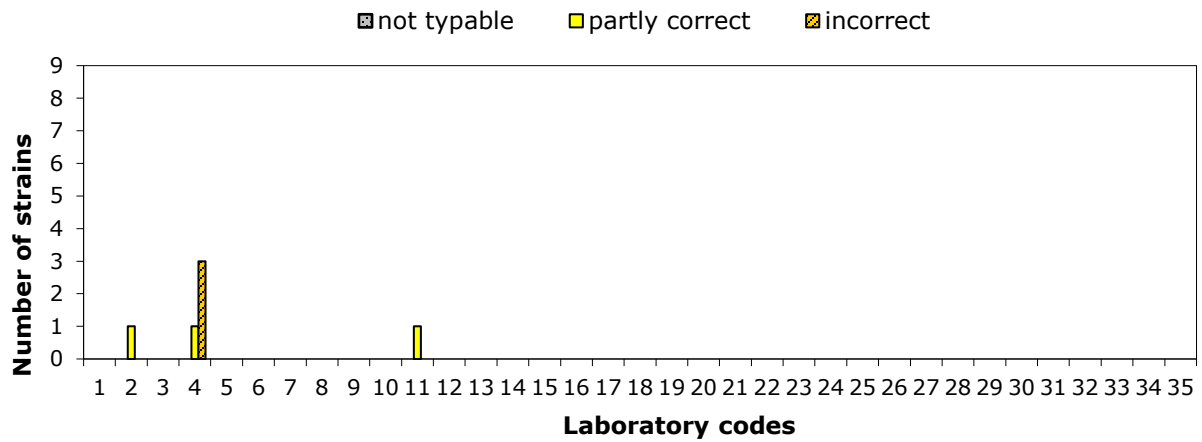


Figure 1. Evaluation of type of errors for O-antigens, per NRL

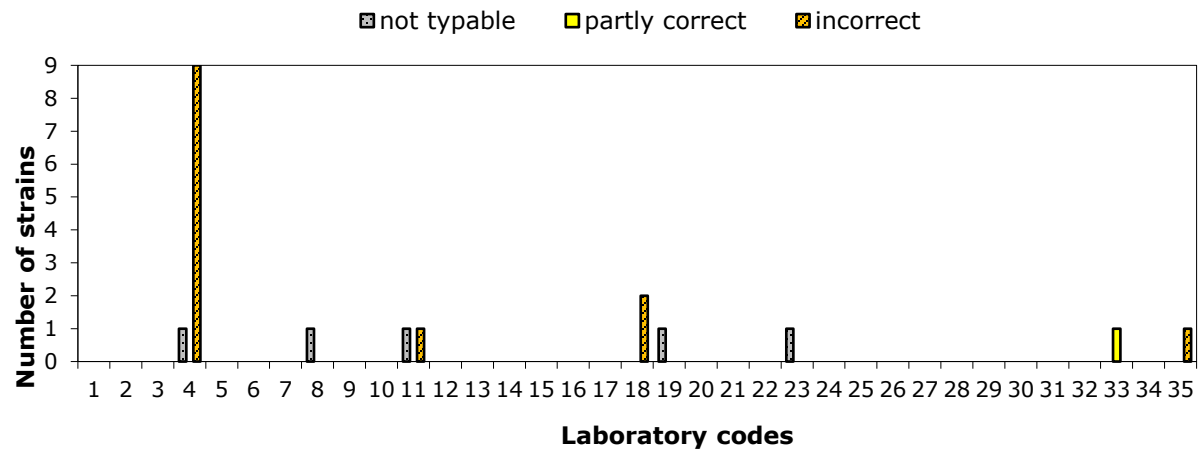


Figure 2. Evaluation of type of errors for H-antigens, per NRL

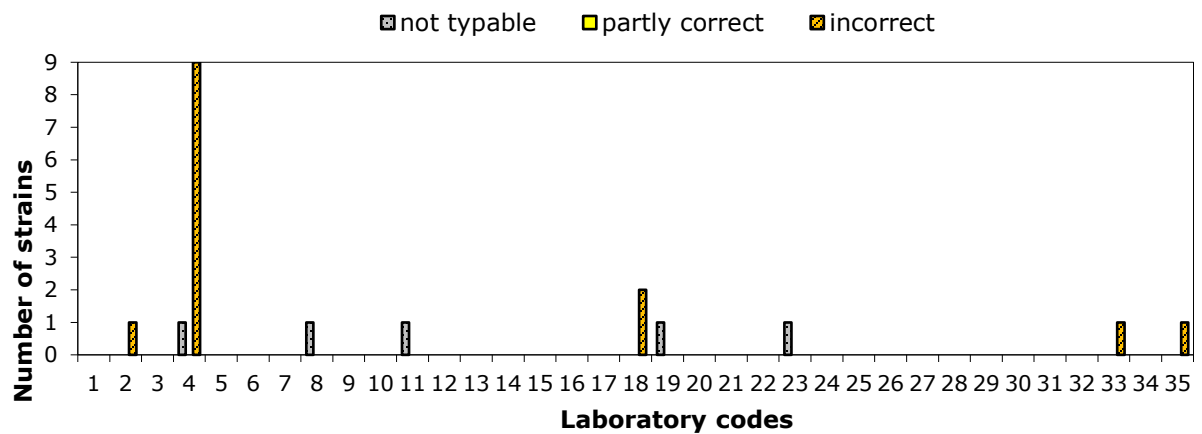


Figure 3. Evaluation of the type of errors in the identification of the serovar names, per NRL

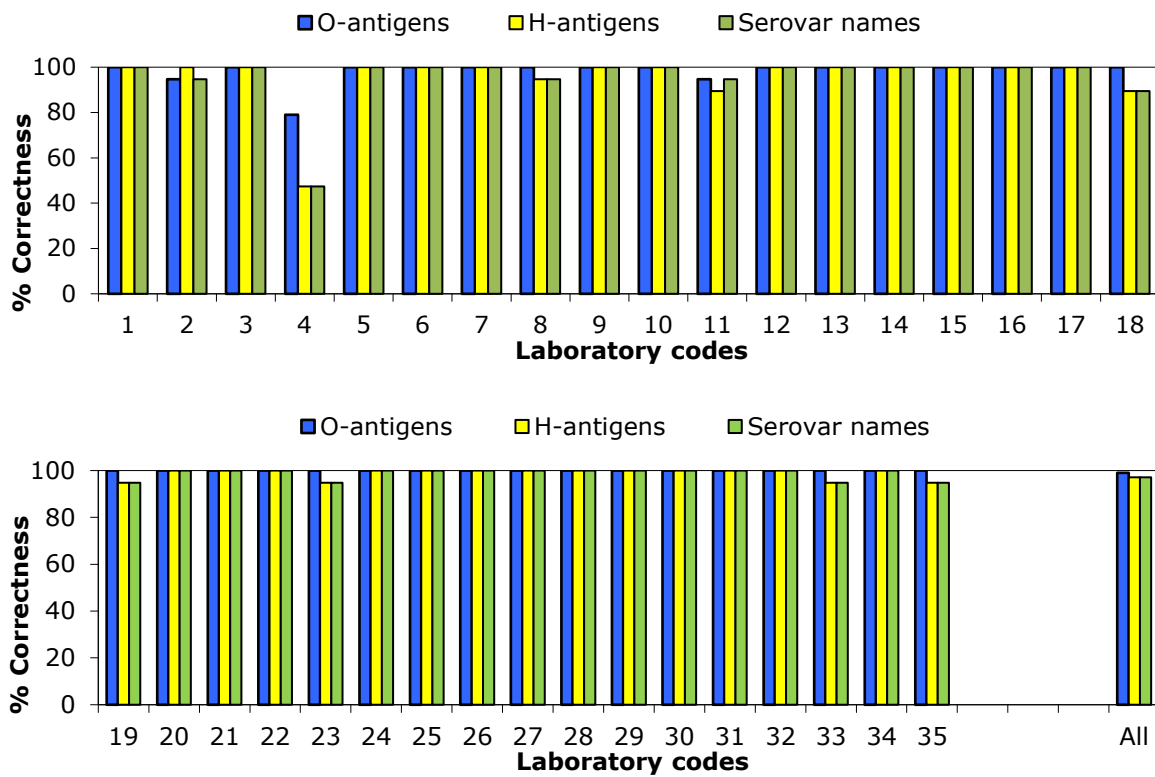


Figure 4. Percentages of correct serotyping results, per NRL

For each NRL the number of penalty points was determined using the guidelines in section 2.4. Table 3 shows the number of penalty points for each NRL, the next column reports whether the level of good performance was achieved or not. Overall, the performance of the NRLs in the PT Serotyping 2019 was very good. Notably, Lab 4 was an exception (18 penalty points), but this NRL was only participating for the second time and is still quite new and learning in the field of serotyping. Two participants (Lab 4 and Lab 35) did not meet the level of good performance at the first stage of the study and a follow-up study and/or training for these (non-EU MS) laboratories may be organised.



Table 3. Evaluation of serotyping results per NRL

Lab code	Penalty points	Good performance	Lab code	Penalty points	Good performance
1	0	yes	19	0	yes
2	1	yes	20	0	yes
3	0	yes	21	0	yes
4	18	NO	22	0	yes
5	0	yes	23	0	yes
6	0	yes	24	0	yes
7	0	yes	25	0	yes
8	0	yes	26	0	yes
9	0	yes	27	0	yes
10	0	yes	28	0	yes
11	0	yes	29	0	yes
12	0	yes	30	0	yes
13	0	yes	31	0	yes
14	0	yes	32	0	yes
15	0	yes	33	1	yes
16	0	yes	34	0	yes
17	0	yes	35	4	NO
18	2	yes			

3.1.3. Serotyping results per strain

Overall results found per strain (S1 – S20) and per laboratory are given in Annex A. A completely correct identification was obtained for seven *Salmonella* serovars: Poona (S3), Enteritidis (S5), Montevideo (S13), Virchow (S16), Infantis (S17), Saphra (S18), and Kingston (S20). Another eight serovars were completely correctly named, when the results of Lab 4 (new participant) would not have been taken into account.

Five participants did not have access to the required but less common antiserum z₃₈ for strain S4 (*S. Fresno*, 9,46:z₃₈:-) leading to the five 'not typable' results for the H-antigens and the serovar names (Table 2 and Table 3).

The reported serovar names for strain 1,4,[5],12:i:- (S14) are shown in Annex A. Fifteen participants used a PCR method to confirm this strain to be a monophasic Typhimurium strain.

Details on the additional and optional strain S21 are given in Annex B. All but five participants tried to serotype strain S21, a *Salmonella enterica* subsp. *houtenae* (IV). A few laboratories did not have access to the required antisera to finalise this (48:g,z₅₁:).

Details on the strains that caused problems in serotyping are shown in Annex C.



References

Grimont, P.A.D. and Weill, F-X., 2007. Antigenic formulae of the *Salmonella* serovars, 9th ed. WHO Collaborating Centre for Reference and Research on *Salmonella*. Institute Pasteur, Paris, France. https://www.pasteur.fr/sites/default/files/veng_0.pdf (accessed 14/2/2019).

Mooijman K.A., 2007. The twelfth EURL-*Salmonella* workshop; 7 and 8 May 2007, Bilthoven, the Netherlands. National Institute for Public Health and the Environment, Bilthoven, the Netherlands. Report no.: 330604006 (http://www.eurlsalmonella.eu/Publications/Workshop_Reports).

List of abbreviations

EFTA	European Free Trade Association
EU	European Union
EURL- <i>Salmonella</i>	European Union Reference Laboratory for <i>Salmonella</i>
NRLs- <i>Salmonella</i>	National Reference Laboratories for <i>Salmonella</i>
REF	Reference
RIVM	National Institute for Public Health and the Environment

Contacts

Wilma Jacobs-Reitsma: wilma.jacobs@rivm.nl

Anjo Verbruggen: anjo.verbruggen@rivm.nl

Kirsten Mooijman: kirsten.mooijman@rivm.nl

EURL-*Salmonella* website: www.eurlsalmonella.eu

National Institute for Public Health and the Environment (RIVM)
 Centre for Zoonosis and Environmental microbiology (Z&O/ internal mailbox 63)
 Antonie van Leeuwenhoeklaan 9
 P.O. Box 1, 3720 BA Bilthoven, The Netherlands



Annex A. Serotyping results per strain and laboratory

Lab:	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11
REF	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
1	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
2	Hadar	Coeln	Poona	Elomrane	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
3	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
4	Hadar	Typhimurium	Poona	9,46:-:-	Enteritidis	Newlands	Typhimurium	Binche	Typhimurium	Virchow	Uganda
5	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Ouganda
6	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
7	S. Hadar	S. Coeln	S. Poona	S. Fresno	S. Enteritidis	S. Meleagridis	S. Stanley	S. Agona	S. Typhimurium	S. Nigeria	S. Uganda
8	S. Hadar	S. Coeln	S. Poona	9,46 : ? :-	S. Enteritidis	S. Meleagridis	S. Stanley	S. Agona	S. Typhimurium	S. Nigeria	S. Uganda
9	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	-:-:-	Nigeria	Uganda
10	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
11	Hadar	Coeln	Poona	9:-:-	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
12	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
13	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
14	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
15	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
16	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
17	Hadar	Coeln	Poona	Frenso	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
18	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	London
19	Hadar	Coeln	Poona	9,46:?	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
20	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
21	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
22	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
23	Hadar	Coeln	Poona	9,46:-:-	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
24	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
25	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
26	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Escherichia coli	Nigeria	Uganda
27	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Blockley	Nigeria	Uganda
28	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
29	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
30	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
31	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
32	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
33	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Sinstorf
34	Hadar	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
35	Bonariensis	Coeln	Poona	Fresno	Enteritidis	Meleagridis	Stanley	Agona	Typhimurium	Nigeria	Uganda
X	1	1	0	1	0	1	1	1	n.d.	1	2



S12	S13	S14	S15	S16	S17	S18	S19	S20	Lab:
Rubislaw	Montevideo	1,4,[5],12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	REF
Rubislaw	Montevideo	4,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	1
Rubislaw	Montevideo	4,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	2
Rubislaw	Montevideo	4,5,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	3
Mountmagnet	Montevideo	Typhimurium	Chennai	Virchow	Infantis	Saphra	Idikan	Kingston	4
Rubislaw	Montevideo	Typhimurium monophasic variant	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	5
Rubislaw	Montevideo	4,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	6
S. Rubislaw	S. Montevideo	4 : i : -	S. Muenchen	S. Virchow	S. Infantis	S. Saphra	S. Kedougou	S. Kingston	7
S. Rubislaw	S. Montevideo	4,5,12 : i : -	S. Muenchen	S. Virchow	S. Infantis	S. Saphra	S. Kedougou	S. Kingston	8
Rubislaw	Montevideo	4,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	9
Rubislaw	Montevideo	4,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	10
Rubislaw	Montevideo	Monophasic Typhimurium 4:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	11
Rubislaw	Montevideo	1,4,5,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	12
Rubislaw	Montevideo	4,5,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	13
Rubislaw	Montevideo	4:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	14
Rubislaw	Montevideo	4,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	15
Rubislaw	Montevideo	4,12:i:- (monophasic Salmonella Typhimurium)	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	16
Rubislaw	Montevideo	4,5,12;i;-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	17
Rubislaw	Montevideo	Monophasic Salmonella Typhimurium	Manhattan	Virchow	Infantis	Saphra	Kedougou	Kingston	18
Rubislaw	Montevideo	4,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	19
Rubislaw	Montevideo	4:i:-, Monofasisk Typhimurium	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	20
Rubislaw	Montevideo	monophasic Typhimurium	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	21
Rubislaw	Montevideo	4,5,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	22
Rubislaw	Montevideo	S.Typhimurium monophasic	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	23
Rubislaw	Montevideo	4, 5, 12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	24
Rubislaw	Montevideo	1,4,5,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	25
Rubislaw	Montevideo	SI, 4,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	26
Rubislaw	Montevideo	4,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	27
Rubislaw	Montevideo	4,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	28
Rubislaw	Montevideo	4:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	29
Rubislaw	Montevideo	4,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	30
Rubislaw	Montevideo	4,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	31
Rubislaw	Montevideo	4,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	32
Rubislaw	Montevideo	4,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	33
Rubislaw	Montevideo	4,12:i:-	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	34
Rubislaw	Montevideo	Typhimurium, monophasic (4,12:i:-)	Muenchen	Virchow	Infantis	Saphra	Kedougou	Kingston	35
1	0	1	2	0	0	0	1	0	X

- remark (e.g. spelling error)
- not typable (e.g. antisera not available, rough strain)
- partly correct; in the naming: no penalty points
- incorrect; in the naming: 1 penalty point
- incorrect; in the naming: 4 penalty points

X = number of deviating laboratories (by penalty points) per strain

Results for Strain S21 are given in Annex B

**Annex B. Details on serotyping results strain S21**

Strain code	O-antigens	H-antigens (phase 1)	H-antigens (phase 2)	Serovar	Lab code
S-21	48	g,z51	-	IV 48:g,z51:-	REF
S-21	48	g,z51	-	48:g,z51:-	1
S-21	48	g,z51	-	48:g,z51:-	2
S-21	48	g,z51	-	IV 48:g,z51:-	3
S-21	9,46	g,m,s	-	Macclesfield	4
S-21	48	g,z51	-	48 : g,z51 : - (subsp. houtenae)	5
S-21	48	g,z51	-	Salmonella enterica subsp. houtenae, 48:g,z51:-	6
S-21	48	g,z51	-	Salmonella enterica subspecies arizonae	7
S-21					8
S-21	48	g,z51	-	48:g,z51:-	9
S-21	48	g	-	Houtenae	10
S-21	48	g,z51	-	IV:48:g,z51:-	11
S-21	48	g,z51	-	48:g,z51:-	12
S-21	48	g,z51	-	IV houtenae	13
S-21	48	g,z51	-	IV 48:g,z51:-	14
S-21	48	g,z51	-	48:g,z51:-	15
S-21	48	g,z51	-	S. enterica subsp. houtenae 48:g,z51:-	16
S-21	48	g,z51	-	48;g,z51;-	17
S-21					18
S-21					19
S-21	48	g	-	Subspec IV, Antigenicformula=48:g:-	20
S-21	48	g	z51	48 : g : z51 (IV)	21
S-21	48	g,z51	-	Salmonella enterica subsp. houtenae 48:g,z51:-	22
S-21	-	-	-	-:-	23
S-21					24
S-21	48	g,z51	-	48:g,z51:-	25
S-21	48	g, z51	-	SIV, 48:g,z51:-	26
S-21	48	g,z51	-	48:g,z51:-	27
S-21	48	g,z51	-	S.IV 48:g,z51:-	28
S-21				?	29
S-21	48	g,z51	-	48:g,z51:-	30
S-21	48	g,z51	-	48:g,z51:-	31
S-21	48	g,Z51	-	sg II 48:g,Z51:-	32
S-21	-	g	-	-:g:-	33
S-21	48	g,z51	-	S. IV. 48:g,z51:-	34
S-21	48	g,z51	-	Salmonella enterica subsp. houtenae serovar 48 : gz51 : -	35



Annex C. Details per strain that caused problems in serotyping

Strain code	O-antigens	H-antigens (phase 1)	H-antigens (phase 2)	Serovar	Lab code
S-1	6,8	z10	e,n,x	Hadar	REF
S-1	6,8	i	e,n,x	Bonariensis	35
S-2	<u>1</u> ,4,[5],12	y	1,2	Coeln	REF
S-2	4,5,12	i	2	Typhimurium	4
S-3	<u>1</u> ,13,22	z	1,6	Poona	REF
S-3	13,22	z	1,2	Poona	11
S-4	9,46	z38	-	Fresno	REF
S-4	9	z38	-	Elomrane	2
S-4	9,46	-	-	9,46:-:-	4
S-4	9,46	?	-	9,46 : ? :-	8
S-4	9	-	-	9:-:-	11
S-4	9,46	?	?	9,46:?	19
S-4	9,46	-	-	9,46:-:-	23
S-6	3,{10}{15}{15,34}	e,h	l,w	Meleagridis	REF
S-6	3,10	e,h	e,n,x	Newlands	4
S-7	<u>1</u> ,4,[5],12,[27]	d	1,2	Stanley	REF
S-7	4,5,12	i	2	Typhimurium	4
S-8	<u>1</u> ,4,[5],12	f,g,s	[1,2]	Agona	REF
S-8	47	z4,z23	l,w	Binche	4
S-10	6,7	r	1,6	Nigeria	REF
S-10	6,7,14	r	2	Virchow	4
S-11	3,{10}{15}	l,z13	1,5	Uganda	REF
S-11	3,10	l,z13	1,5	Ouganda	5
S-11	3,10	l,v	1,6	London	18
S-11	3,10	l,v	1,5	Sinstorf	33
S-12	11	r	e,n,x	Rubislaw	REF
S-12	21	r	-	Mountmagnet	4
S-14	<u>1</u> ,4,[5],12	i	-	1,4,[5],12:i:-	REF
S-14	4,5,12	i	2	Typhimurium	4
S-15	6,8	d	1,2	Muenchen	REF
S-15	4,12	d	z35	Chennai	4
S-15	6,8	d	1,5	Manhattan	18
S-19	<u>1</u> ,13,23	i	l,w	Kedougou	REF
S-19	1,13,23	i	5	Idikan	4

Reference strain
remark (e.g. spelling error)
not typable (e.g. antisera not available, rough strain)
partly correct; in the naming: no penalty points
incorrect; in the naming: 1 penalty point
incorrect; in the naming: 4 penalty points