



Interim Summary Report

EURL-*Salmonella* Proficiency Test Serotyping 2020

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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 37 laboratories participated in this study. These included 29 National Reference Laboratories for *Salmonella* (NRLs-*Salmonella*) in the 27 EU Member States plus the United Kingdom, 2 NRLs of EU-candidate countries, 3 NRLs of EFTA countries, and 3 additional participants to compare with their WGS-based results. 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 25th EURL-*Salmonella* Workshop (online, 17&18 September 2020), 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 PT 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. Thirteen strains (Table 1) represented serovars included in the EURL-*Salmonella* serotyping PTs for the first time.

2.2 Laboratory codes

Each participant was randomly assigned a laboratory code: 1- 34 for the NRLs and 73, 91 and 96 for the additional (WGS) participants.



Table 1. Antigenic formulas of the 21 *Salmonella* strains according to the White-Kauffmann-LeMinor scheme used in the EURL-*Salmonella* PT Serotyping 2020

Strain code	O-antigens	H-antigens (phase 1)	H-antigens (phase 2)	Serovar
S1 ^{a)}	13,23	i	e,n,z ₁₅	Jukestown
S2 ^{a)}	1,6,14,25	z ₄ ,z ₂₃	[e,n,z ₁₅]	Bouso
S3	6,8	z ₁₀	e,n,x	Hadar
S4 ^{a)}	1,4,12,27	z ₂₉	-	Brancaster
S5 ^{a)}	8	d	1,2	Virginia
S6 ^{a)}	9,12	d	z ₆	Zega
S7	1,13,23	g,m,[s],[t]	-	Agbeni
S8 ^{b)}	1,4,[5],12	i	-	1,4,[5],12:i:-
S9 ^{a)}	30	k	e,n,[x],z ₁₅	Odozi
S10 ^{a)}	1,4,12,[27]	l,[z ₁₃],z ₂₈	1,5	Tyresoe
S11 ^{a)}	11	l,v	1,2	Stendal
S12 ^{a)}	4,12,[27]	a	1,5	Hessarek
S13	1,4,[5],12	i	1,2	Typhimurium
S14 ^{a)}	6,7	e,h	1,2	Larochelle
S15	6,7,14	r	1,2	Virchow
S16	1,9,12	g,m	-	Enteritidis
S17 ^{a)}	3,10	b	e,n,x	Benfica
S18	6,7,14	r	1,5	Infantis
S19 ^{a)}	4,12,[27]	b	1,6	Canada
S20 ^{a)}	8,20	z ₃₈	-	Apeyeme
S21 ^{c)}	50	r	1,5,(7)	50:r:1,5 (IIIb)

^{a)} Represented in an EURL-*Salmonella* PT Serotyping for the first time.

^{b)} Typhimurium, monophasic variant as determined by PCR.

^{c)} *Salmonella enterica* subspecies *diarizonae* (optional strain).

2.3 Transport

The parcels containing the strains for typing were sent by the EURL-*Salmonella* on 2 November 2020. 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.

Note that the protocols for recent EURL-*Salmonella* PTs on serotyping also include the following information:

Hendriksen *et al.* (2009) reported that colonial form variation may occur with the expression of the O:6₁ antigen by some serogroup C₂ serovars.

Concerning the EURL-*Salmonella* PTs on serotyping it was decided to consider the serovar pairs involved (e.g. *S. Newport*/*S. Bardo* and *S. Hadar*/*S. Istanbul*) not as distinct serovars, though they should be reported as actually typed by the participants. Nevertheless, typing should include testing for the presence of O:6 antigen.

In practice this means that for example a 6,8:z₁₀:e,n,x typed strain has to be reported as Hadar, and a 8:z₁₀:e,n,x typed strain has to be reported as Istanbul, but that either result is considered as correct.

3. Results

3.1 Serotyping results of the NRLs-*Salmonella*

3.1.1. General comments on this year's evaluation

As decided at the 25th EURL-*Salmonella* Workshop (online, September 2020), Strain S21 was an additional strain to the study. Testing of this strain was optional and results were not included in the evaluation.



3.1.2. Serotyping results per laboratory

The percentages of correct results per laboratory are shown in Figure 1.

The evaluation of the type of errors for O- and H-antigens and for identification of the strains are shown in Figures 2, 3 and 4.

The O-antigens were completely typed correctly by 29 of the 37 participants (78%). This corresponds to 99% of the total number of strains. The H-antigens were completely typed correctly by 31 of the 37 participants (84%), corresponding to 98% of the total number of strains. As a result, 28 participants (76%) gave completely the correct serovar names, corresponding to 97% of all strains evaluated.

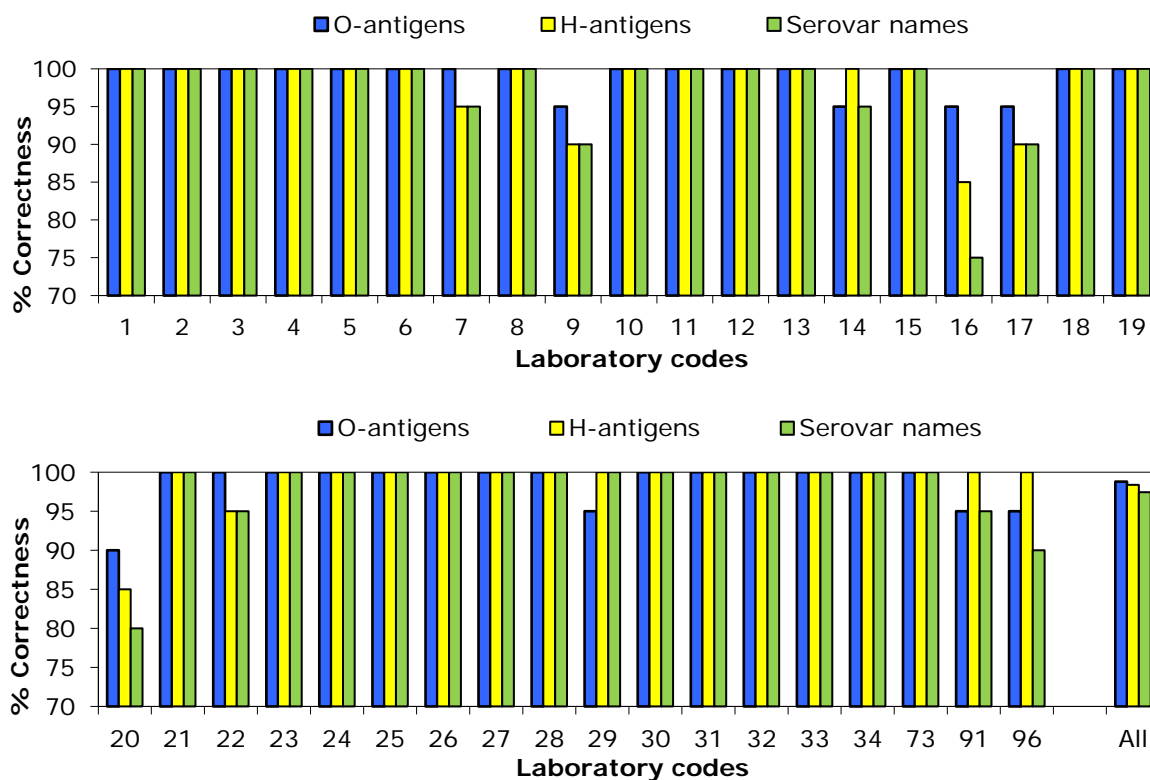


Figure 1. Percentages of correct serotyping results, per participant

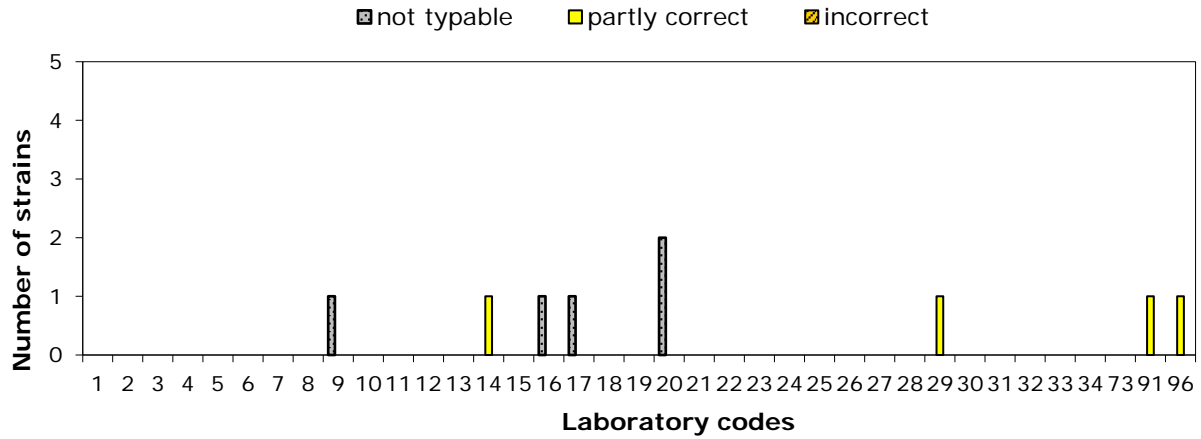


Figure 2. Evaluation of type of errors for O-antigens, per participant

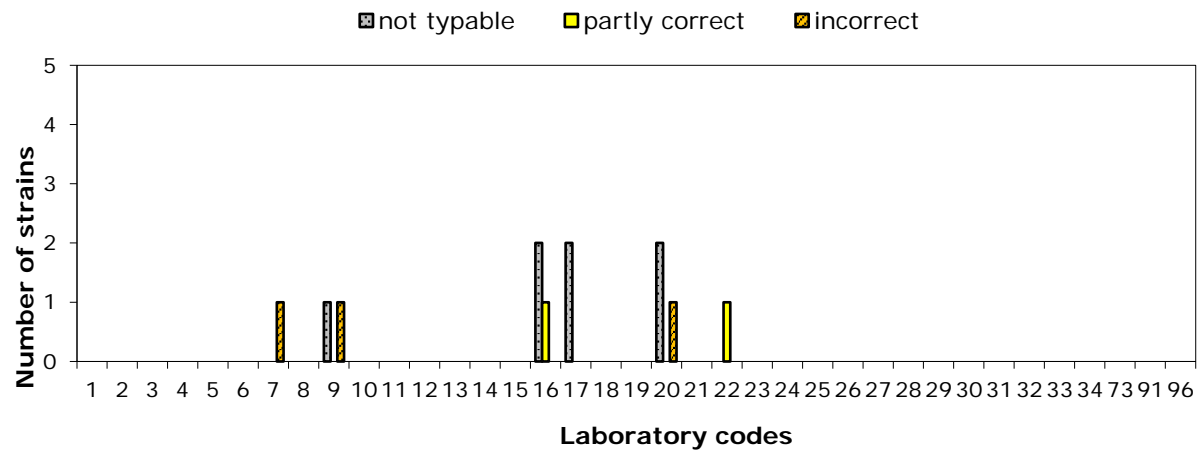


Figure 3. Evaluation of type of errors for H-antigens, per participant

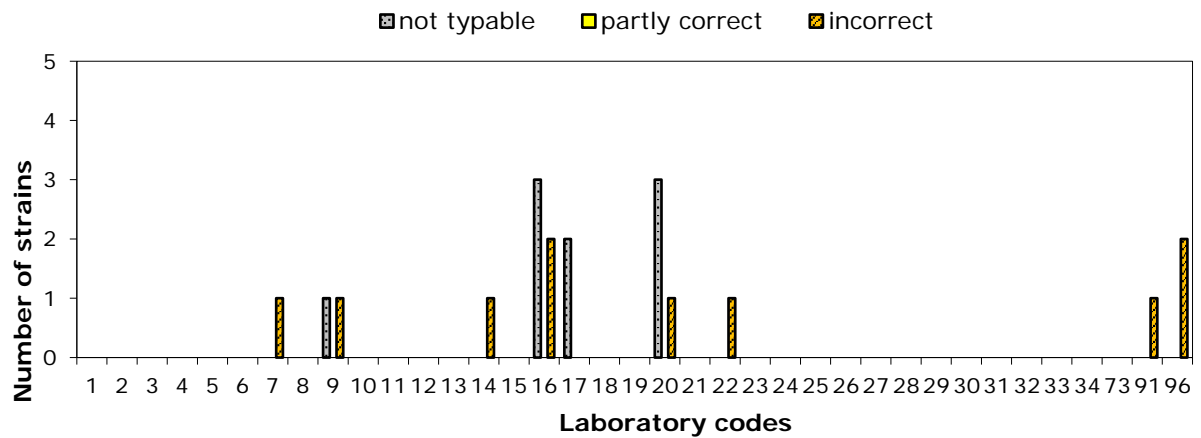


Figure 4. Evaluation of the type of errors in the identification of the serovar names, per participant



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 participant, the next column reports whether the level of good performance was achieved or not.

Overall, the performance of the participants in the PT Serotyping 2020 was very good, including the performance of 4 participants that were submitting WGS-based results. All participants met the level of good performance at the first stage of this PT, and there is no need to organize a follow-up study.

Table 3. Evaluation of serotyping results per NRL

Lab code	Penalty points	Good performance	Lab code	Penalty points	Good performance
1	0	yes	20	1	yes
2	0	yes	21	0	yes
3	0	yes	22	1	yes
4	0	yes	23	0	yes
5	0	yes	24	0	yes
6	0	yes	25	0	yes
7	1	yes	26	0	yes
8	0	yes	27	0	yes
9	1	yes	28	0	yes
10	0	yes	29	0	yes
11	0	yes	30	0	yes
12	0	yes	31	0	yes
13	0	yes	32	0	yes
14	1	yes	33	0	yes
15	0	yes	34	0	yes
16	2	yes	73	0	yes
17	0	yes	91	1	yes
18	0	yes	96	2	yes
19	0	yes			

3.1.3. Serotyping results per strain

Final naming results reported per strain (S1 – S20) and per laboratory are given in Annex A. A completely correct identification was obtained for nine *Salmonella* serovars: Bousso (S2), Hadar (S3), Zega (S6), Typhimurium (S13), Larochele (S14), Virchow (S15), Enteritidis (S16), Benfica (S17), and Infantis (S18).

The reported serovar names for strain 1,4,[5],12:i:- (S8) are also shown in Annex A. Eighteen 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 three participants tried to serotype strain S21, a *Salmonella enterica* subsp. *diarizonae* (II1b). A few laboratories did not have access to the required antisera to finalise this (50:r:1,5).

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

Interestingly, some inconsistencies were seen in the submitted results for strains S3 (Hadar) and S5 (Muenchen), especially by the 4 participants that were using WGS



(laboratory codes 29, 73, 91, and 96). Both serovars belong to the pairs of serovars in *Salmonella* serogroup C₂ which differ only by the minor antigen O:6₁ and that may show variable expression (also described as “colonial form variation”, Hendriksen et al., 2009; Mikoleit et al., 2012). Laboratory 73 reported to confirm separately for presence of O:6, the other 3 laboratories may not have this option in their WGS pipelines/protocols as used. Also see Annex C for further details and explanations.

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 5/3/2021).

Hendriksen, R.S., et al., 2009. WHO Global Salm-Surv External Quality Assurance System for Serotyping of *Salmonella* Isolates from 2000 to 2007. J Clin Microbiol 2009(47): 2729-2736. doi:10.1128/JCM.02437-08

Mikoleit, M., M.S. Van Duyne, J. Halpin, B. McGlinchey, and P.I. Fields, 2012. Variable Expression of O:6₁ in Salmonella Group C₂. J Clin Microbiol 2012(50): 4098-4099. doi:10.1128/JCM.01676-12

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.euralsalmonella.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

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



Annex A. Serotyping results per strain* and laboratory

Lab:	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
REF	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	1,4,[5],12:i:-	Odozi	Tyresoe
1	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,12:i:-	Odozi	Tyresoe
2	Jukestown	Bouso	Istanbul	Brancaster	Muenchen	Zega	Agbeni	1,4,12:i:-	Odozi	Tyresoe
3	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,12:i:-	Odozi	Tyresoe
4	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	1,4,12;i;-	Odozi	Tyresoe
5	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,12:i:-	Odozi	Tyresoe
6	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,12:i:-	Odozi	Tyresoe
7	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,12:i:-	Odozi	Tyresoe
8	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,5,12:i:-	Odozi	Tyresoe
9	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	monophasic Typhimurium	Odozi	Tyresoe
10	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	Typhimurium Monophasic	Odozi	Tyresoe
11	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	monophasic Typhimurium	Odozi	Tyresoe
12	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,12:i:-	Odozi	Tyresoe
13	Jukestown	Bouso	Hadar	Brancaster	Muenchen	Zega	Agbeni	1,4,5,12:i:-	Odozi	Tyresoe
14	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,5,12:i:-	Odozi	Tyresoe
15	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,12:i:-	Odozi	Tyresoe
16	Jukestown	Bouso	Hadar	4,12:HME:-	Virginia	Zega	Agbeni	Typhimurium	OMC:k:e,n,z15	Azteca
17	I:13,23:i:-	Bouso	Hadar	Brancaster	Virginia	Zega	-:gm:-	I:4:i:- (monophasic TM)	Odozi	Tyresoe
18	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,12:i:-	Odozi	Tyresoe
19	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	Typhimurium monophasic variant	Odozi	Tyresoe
20	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,5,12:i:-	?	Tyresoe
21	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	1,4,12; i; -	Odozi	Tyresoe
22	jukestown	bouso	hadar	brancaster	virginia	zega	agbeni	Monophasic Salmonella typhimurium	odozi	tyresoe
23	Jukestown	Bouso	Hadar	Brancaster	Muenchen	Zega	Agbeni	4,12:i:-	Odozi	Tyresoe
24	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4 : i : -	Odozi	Tyresoe
25	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	1,4,12:i:- (mST)	Odozi	Tyresoe
26	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,12:i:-	Odozi	Tyresoe
27	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4, 5, 12: i: -	Odozi	Tyresoe
28	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,5,12:i:-	Odozi	Tyresoe
29	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,(5),12:i:-	Odozi	Tyresoe
30	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	Monophasic Typhimurium	Odozi	Tyresoe
31	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4:i:-	Obdozi	Tyresoe
32	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	Typhimurium, monophasic 4,12 : i -	Odozi	Tyresoe
33	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4:i:-	Odozi	Tyresoe
34	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,12:i:-	Odozi	Tyresoe
73	Jukestown	Bouso	Hadar	Brancaster	Virginia	Zega	Agbeni	4,[5],12:i:-	Odozi	Tyresoe
91	Jukestown	Bouso	Hadar	Brancaster	Muenchen	Zega	Agbeni	Typhimurium - monophasic	Odozi	Tyresoe
96	Juketown	Bouso	Hadar	Brancaster	Muenchen	Zega	Agbeni	I 4,[5],12:i:-	Angoda	Tyresoe
X	0	0	0	0	2	0	0	1	1	1



S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	Lab:
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	REF
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	1
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	2
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	3
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	4
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	5
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	6
Stendal	Lagos	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	7
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	8
Stendal	-	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Uppsala	Apeyeme	9
Stendal	Fulica / Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	10
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	11
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	12
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	13
Stendal	Paratyphi A	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	14
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	15
Stendal	4,12:a:1,5	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	8,20:HME:-	16
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	17
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	18
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	19
Stendal	?	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Uppsala	?	20
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	21
tours	hessarek	typhimurium	larochelle	virchow	enteritidis	benfica	infantis	canada	apeyeme	22
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	23
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	24
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	25
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	26
Stendal	Fulica	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	27
Stendal	Fulica, Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apayeme	28
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	29
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	30
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	31
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	32
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	33
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	34
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	73
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	91
Stendal	Hessarek	Typhimurium	Larochelle	Virchow	Enteritidis	Benfica	Infantis	Canada	Apeyeme	96
1	2	0	0	0	0	0	0	2	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

*Also see the NOTES on Strains S3 and S5 in Annex C.



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	50	r	1,5,(7)	IIIb 50:r:1,5	REF
S-21	50	r	1,5,7	50:r:1,5,7	1
S-21	50	r	1,5,7	IIIb 50:r:1,5,7	2
S-21	50	r	1,5	SIIIb 50:r:1,5	3
S-21	50	r	1,5	Salmonella enterica subspecies diarizonae 50:r:1,5	4
S-21	50	r	1,5,7	50:r:1,5,7	5
S-21	50	-	1,5	50:-:1,5	6
S-21					7
S-21	50	r	5	Salmonella enterica subsp. diarizonae 50:r:1,5(7)	8
S-21	50	r	1,5	IIIb (diarizonae)	9
S-21	61	r	1,5,7		10
S-21	OME	r	1,5,7	OME : r : 1,5,7 (IIIb)	11
S-21	50	r	1,5,7	S. IIIb 50:r:1,5,7	12
S-21	50	r	1,5,7	50:r:1,5,7	13
S-21	50	r	5	IIIb 50:r:1,5,(7)	14
S-21	50	r	1,5	50:r:1,5	15
S-21	-	-	-	-:-:-	16
S-21	50	r	1,5	IIIb:50:r:1,5	17
S-21	50	r	1,5	50:r:1,5	18
S-21	50	r	1,5	IIIb 50 : r : 1,5,(7)	19
S-21					20
S-21	50	r	1,5,7	50; r; 1,5,7	21
S-21	11	r	1,5	senegal	22
S-21	50	r	1,5	(IIIb) 50:r:1,5	23
S-21	?	r	5	OME + : r : 5	24
S-21	50	r	1,5,7	50:r:1,5,7	25
S-21	50	r	1,5	IIIb (diarizonae) - 50:r:1,5	26
S-21					27
S-21	61	r	5	IIIa arizonae	28
S-21	50	r	1,5	Subspecies IIIb	29
S-21	61	r	1,5,7	Diarizonae	30
S-21	50	?	?	Subspec III**	31
S-21	50	r	1,5,7	Salmonella enterica subsp. diarizonae serovar 50 : r ; 1,5,7	32
S-21	50	r	1,5,7	IIIb 50:r:1,5,7	33
S-21	50	r	1,5,7	sg IIIb 50:r:1,5,7	34
S-21	50	r	1,5,7	IIIb 50:r:1,5,(7)	73
S-21	50	r	1,5,7	IIIb 50:r:1,5,(7)	91
S-21	IIIa 50	r	1,5,7	IIIa 50:r:1,5,7	96



Annex C. Details per strain that caused problems or inconsistencies in serotyping

Strain code	O-antigens	H-antigens (phase 1)	H-antigens (phase 2)	Serovar	Lab code
S-1	13,23	i	e,n,z15	Jukestown	REF
S-1	13,23	i	-	I:13,23:i:-	17
S-1	13	i	e,n,z15	Juketown	96
S-3*	6,8	z10	e,n,x	Hadar	REF
S-3	8	z10	e,n,x	Istanbul	2
S-3	8	z10	e,n,x	Hadar	29
S-3	8 (O6 confirmation: +)	z10	e,n,x	Hadar	73
S-3	8	z10	e,n,x	Hadar	91
S-3	8	z10	e,n,x	Hadar	96
S-4	1,4,12,27	z29	-	Brancaster	REF
S-4	4,12	HME	-	4,12:HME:-	16
S-5**	8	d	1,2	Virginia	REF
S-5	6,8	d	1,2	Muenchen	2
S-5	6,8	d	1,2	Muenchen	13
S-5	6,8	d	1,2	Muenchen	23
S-5	8	d	1,2	Virginia	29
S-5	8 (O6 confirmation: -)	d	1,2	Virginia	73
S-5	8	d	1,2	Muenchen	91
S-5	8	d	1,2	Muenchen	96
S-7	1,13,23	g,m,[s],[t]	-	Agbeni	REF
S-7	-	g,m	-	-:gm:-	17
S-8	1,4,[5],12	i	-	1,4,[5],12:i:-	REF
S-8	4,12	i	-	1,4,12;i:-	4
S-8	4,12	i	-	Typhimurium	16
S-9	30	k	e,n,[x],z15	Odozi	REF
S-9	OMC	k	e,n,z15	OMC:k:e,n,z15	16
S-9	OMC	k	e,n,z15	?	20
S-9	30	k	e,n,z15	Obdozi	31
S-9	30	k	e,n,z15	Angoda	96
S-10	1,4,12,[27]	l,[z13],z28	1,5	Tyresoe	REF
S-10	4,5,12,27	l,v	1,5	Azteca	16
S-11	11	l,v	1,2	Stendal	REF
S-11	11	l,z13	1,2	tours	22
S-12	4,12,[27]	a	1,5	Hessarek	REF
S-12	4,12	i	1,5	Lagos	7
S-12	-	-	-	-	9
S-12	4,12	a	1,5	Fulica / Hessarek	10
S-12	2,12	a	5	Paratyphi A	14
S-12	4,12	a	1,5	4,12:a:1,5	16
S-12	?	?	?	?	20



S-12	4, 12	a	-	Fulica	27
S-12	4,12	a	5	Fulica, Hessarek	28
S-17	3,10	b	e,n,x	Benfica	REF
S-17	3,10	b	e,n,x	Benefica	25
S-19	4,12,[27]	b	1,6	Canada	REF
S-19	4	b	1,7	Uppsala	9
S-19	4,12	b	1,7	Uppsala	20
S-20	8,20	z38	-	Apeyeme	REF
S-20	8,20	HME	-	8,20:HME:-	16
S-20	8,20	HMD	-	?	20

	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

*NOTE on Strain S3: According to the protocol of this PT, an 8:z₁₀:e,n,z typed strain should have been reported as "Istanbul" (Laboratory code 2). An "Hadar" named strain would have been expected to show 6,8 for the O-antigen result, therefore an 8 result for the O-antigen is (for this PT) considered as "partly correct" (Laboratory codes 29, 91, and 96).

**NOTE on Strain S5: According to the protocol of this PT, an 8:d:1,2 typed strain should have been reported as "Virginia" and a 6,8:d:1,2 typed strain should have been reported as "Muenchen". Therefore, the 8:d:1,2 results named Muenchen are (for this PT) considered as "incorrect" (Laboratory codes 91 and 96).