

Original citation:

Cappuccio, Francesco. (2016) Reducing salt intake at population level : is it really a public health priority? Rebuttal of Dr Graudal's arguments. *Nephrology Dialysis and Transplantation*, 31 (9).

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3 1 **Reducing salt intake at population level: is it really a public health priority?**
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6 3 **Rebuttal of Dr Graudal's arguments**
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10 5 **Francesco P Cappuccio, DSc, FRCP**

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16 9
17 10
18 11 **Word count:** 700

19 12 **References:** 7
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21 13
22 14
23 15

24 16 **Key words:** blood pressure; cardiovascular disease; stroke; kidney disease; salt intake;
25 17 policy
26 18

27 19 **Abbreviations:** BP: blood pressure; CVD: cardiovascular disease; NCDs: non-
28 20 communicable diseases; WHO: World Health Organization
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3 32 Dr Graudal's hostile and scare-mongering article is full of inaccuracies, selected arguments
4 and false statements. He considers the 2013 IOM Report, the remit of which was limited¹,
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6 34 dismissing the positions of the previous IOM Report, the World Health Organization, the US
7
8 35 CDC, the AHA, the British NICE and many other national health organizations statements
9
10 36 which informed the 2011 United Nations resolution and the 2013 World Health Assembly
11
12 37 deliberation that population salt reduction strategy is the second most effective strategy for
13
14 38 the prevention of cardiovascular disease (CVD) globally. The presence of a food industry
15
16 39 conspiracy biasing research and co-opting unscrupulous opinion leaders to divert attention
17
18 40 from salt with surreptitious new theories has been extensively documented over the years².
19
20 41 On the contrary the alleged conspiracy of global health organizations in producing a sound
21
22 42 piece of public health advice is another fabrication to divert attention again.
23

24 44 Sodium chloride (salt) is not a nutrient. At the current levels added to food salt is a toxic
25
26 45 chemical. Dr Graudal makes confusion between the concepts of *usual/habitual* and
27
28 46 *adequate/normal*. If we all smoked, smoking would be normal. If we were to define obesity
29
30 47 today, we would have to raise the cut-off points for obesity in many countries. A body mass
31
32 48 index of 30 kg/m² would not indicate obesity because most people in the population weigh
33
34 49 that much. If we were to define the adequate levels of physical activity, we should accept
35
36 50 that the normality would be not exercising at all. So it is for salt intake! The *usual/habitual*
37
38 51 levels are not *adequate/normal* levels.
39

40 53 Dr Graudal continues to pursue two surreptitious arguments: a) that the effect of salt
41
42 54 reduction on blood pressure (BP) is non-existent and b) that salt reduction increases
43
44 55 hormones that could be dangerous. His first argument is answered in my Figure 1. For the
45
46 56 second, he only quotes his meta-analyses including short-term acute studies of salt
47
48 57 deprivation. I have already addressed the flaw of his argument and shown that the meta-
49
50 58 analyses published are consistent with each other that there is a beneficial effect on BP. No
51
52 59 need to remind Dr Graudal that treatment with diuretics reduces stroke mortality and other
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54 60 CVD events due to the fall in BP, despite a chronic stimulation of the renin-angiotensin-
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56 61 aldosterone system, much greater than that seen with a moderate salt reduction.
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3 63 There are published positions of the NHLBI, the TOHP and the DASH authors that dismiss the
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5 64 allegations Dr Gradual needlessly uses to win his argument. When referring to the 'WASH'
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7 65 group, he lumps together all those who do not agree with him (although separate and
8
9 66 independent researchers around the world), as if they had been running studies altogether
10
11 67 for 20 years! I would consider their results 'consistent' with each other.
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13
14 69 Dr Gradual maintains that population moderate salt reduction kills. This is an irresponsible
15
16 70 statement based on few selected studies (mostly observational) that are flawed for the
17
18 71 presence of biases and confounding (see my Table). In brief, in the EPOGH cohort, the
19
20 72 lowest sodium intake tertile was flawed by urine under-collections (urinary creatinine in first
21
22 73 tertile 12 v 16 mmol in third tertile) and lower socio-economic status³. In the analysis of
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24 74 ONTARGET/TRANSCEND studies participants were old and sick patients on multiple
25
26 75 medications (29% on diuretics but 41% of them in the lowest sodium group)⁴ and sodium
27
28 76 intake was estimated using inaccurate methods⁵. Finally the PURE Study⁶⁻⁷ is flawed on many
29
30 77 grounds. The sodium measurement by single fasting morning urine collection to assess
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32 78 individuals' salt intake is unreliable and biased. The sodium study only included ~100,000 of
33
34 79 the ~160,000 participants, introducing a self-selection bias, and there were fewer
35
36 80 participants from India and more from China, the majority with ill-health (hypertension, BP
37
38 81 medications, CHD, CVD). The lower sodium group (<3g per day equivalent to <7.5g salt per
39
40 82 day) was unable to discriminate on a 'low' salt intake of <5g, hence the result are irrelevant
41
42 83 to the debate on population salt reduction and targets. Finally, compared to the 'higher'
43
44 84 sodium group, those in the 'lower' sodium group were older, had fewer men, Asians and
45
46 85 smokers and higher LDL-cholesterol, history of CVD, diabetes, medication use, therefore
47
48 86 biasing the 'lower' sodium group to older men with ill-health, hence the reverse causality
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50 87 risk of dying earlier!
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