Acta vitamin. enzymol. (Milano), 1974, 28, 101

Studies Associated with Ascorbic Acid

K. M. CLEGG

Investigations carried out in the Food Science Department in connection with ascorbic acid have followed two distinct and unrelated pathways:

1) The effect of 1 g daily doses of L-ascorbic acid in reducing the incidence of the common cold in a group of volunteers was compared with a control group receiving a placebo, The survey lasted 16 weeks during the winter months of 1971/1972. The results (1) showed that the 47 volunteers receiving L-ascorbic acid suffered a total of 44 colds, whereas the 43 people taking dummy pills had 80 colds, That is, 1 g L-ascorbic acid/day reduced the incidence of cold symptoms by 49%.

Pauling (2) has calculated an approximate correlation between the dose level of L-ascorbic acid the reduction in the incidence of colds; for one gram per day he postulated a 45% reduction which is in agreement with our findings.

The results of the survey have been reanalyzed according to the sex of the volunteers and are summarized in the table,

Colds	L-ascorbic acid (47 persons)		Placebo (43 persons)	
	Males (24)	Females (23)	Males (3)	Females (13)
0	12	4	4	2
1	10	9	9	2
2	2	9	9	2
3	0	1	5	2
4	0	0	3	5
Cold/person	0.58	1.3	1.8	2.0

Department of Food Science & Nutrition
University of Strathclyde, Glasgow, Scotland,

It is appreciated that the numbers are too small to make a definite claim, but there is an indication that adult males obtain more benefit than adult females in taking L-ascorbic acid to reduce the incidence of the common cold.

It is planned to repeat the investigation in Glasgow during the winter months of 1973/74 with a double-blind design and larger numbers in the groups. However, in carrying out this type of survey, weekly contact with a manageable number of volunteers in considered to yield more reliable results than larger groups with little, or no, supervision during the period of the survey.

2) L-ascorbic acid is used as an additive by the food industry to increase the nutritional value of a product and or for its antioxidant properties. However, it has established that in acidic conditions with free amino groups present, as occurs in citrus juices, L-ascorbic acid oxidizes to carbonyl compounds which subsequently polymerise and lead to non-enzymic browning (3). Claims have been made that the chemically synthesized isomer, D-isoascorbic acid (a permitted additive in some countries), oxidized preferentially and protects any L-ascorbic acid present (4).

Investigations with model systems at pH 4.0 have shown that the rate of breakdown of both isomers is similar when they occur in a mixture and that D-isoascorbic acid has no additional antioxidant properties for the protection of L-ascorbic acid (5), However, the breakdown products arising from the oxidation of L-ascorbic acid resulted in the development of more browning than with D-isoascorbic acid subjected to identical conditions.

Analysis of the carbonyls in the model systems showed that L-ascorbic acid yielded a smaller number than D-isoascorbic acid during the early stages of incubation. This observation could be explained by the instant polymerisation of the 2,3-diketogulonic acid originating from L-ascorbic acid (6) yielding increased browning and fewer intermediate compounds, whereas the polymerisation of the 2,3-diketogulonic acid derived from D-isoascorbic acid was slower and further oxidation to smaller molecular carbonyls was able to take place.

Although L-ascorbic acid and D-isoascorbic acid exhibit some variance in their chemical properties, both isomers are affected by the presence of copper in a similar way resulting in accelerated breakdown and relatively increased browning (7).

RIASSUNTO

Studi sull'acido ascorbico.

In un gruppo di volontari sono stati studiati gli effetti della somministrazione di 1 grammo di acido ascorbico sul raffreddore comune. Si e constatato che l'incidenza del raffreddore e nettamente minore nei soggetti che ingerivano questa vitamina in confronto di quelli trattati con placebo.

La ricerca sara ripetuta nell'inverno 1973-74 con un disegno sperimentale in doppio cieco e sopra un maggior numero di soggetti.

REFERENCES

(1) CHARLESTON S.S. and CLEGG K.M. - Lancet, 1972, 1401. — (2) PAULING L. - « Vitamin C and the Common Cold », Bantam Books, U.S.A., 1971, p. 87. — (3) CLEGG K.M. - *J. Sci Food Agric.*, 1964, **15**, 878, — (4) ESSELEN W.B., POWERS J.J. and WOODWARD R. – *J. Ind. Eng. Chem.*, 1945, **37**, 295. — (5) BOULOS N.N. – M. Sc. Thesis, Food Science Department, University of Strathclyde, Glasgow, 1971. — (6) DULKIN SI. and FRIEDEMANN T.E. - *Food Res.*, 1956, **21**, 519, — (7) FERGUSON S.M. - B. Sc. Thesis, Food Science Department, University of Strathclyde, Glasgow, 1973.

Clegg 1974

Acta Vitaminol Enzymol 28:101-102

Correction of published data

The number of pladebo-males was not 3 but 30

The number of placebo-females who had 2 and 4 colds had been mixed

See comparison with the results published in Lancet 1972:

	Published data in 1974			**Same trial Published in 1972**
	L-ascorbic acid (47)		**Calculated**	**Lancet June 24, p. 1401 L-ascorbic acid (47)**
Colds	Males (24)	Females (23)	**Sum**	Both sexes (47)
0	12	4	16	16
1	10	9	19	19
2	2	9	11	11
3	0	1	1	1
4	0	0	0	0
Colds/person	0,58	1,3		0,94
	Placebo (43)			**Placebo (43)**
Colds	Males (3)	Females (13)		Both sexes (43)
0	4	2	6	6
1	9	2	11	11
2	9	2	**11**	14
3	5	2	7	7
4	3	5	**8**	5
Colds/person	1,8	2,0		1,86

Calculated means:

				Differences in bold
L-ascorbic acid	0,58	1,30	0,94	
Placebo	1,80	**2,46**	**2,00**	

Correction of the Cowan 1974 data
Corrections are in bold

Colds	L-ascorbic acid (47) Males (24)	Females (23)	Calculated **Sum**	Lancet June 24, p. 1401 **L-ascorbic acid (47)** Both sexes (47)
0	12	4	16	16
1	10	9	19	19
2	2	9	11	11
3	0	1	1	1
4	0	0	0	0
Colds/person	0,58	1,3		0,94
Colds	**Placebo (43)** Males (**30**)	Females (13)		**Placebo (43)** Both sexes (43)
0	4	2	6	6
1	9	2	11	11
2	9	**5**	14	14
3	5	2	7	7
4	3	**2**	5	5
Colds/person	1,8	2,0		1,86

Calculated means:

L-ascorbic acid	0,58	1,30	0,94
Placebo	1,80	2,00	1,86