

4. Separately, TAB vaccination or infection by influenza virus leads to marked hyperglycosylation reactions. On the other hand, if the reactions follow each other in time, instead of summing, hyperglycosylation reaction cancels global reaction is very inferior to isolated reactions.

5. At the electrophoretic level we can consider that the peaks t, a, b, c and d correspond to homologous fractions but to different specific activities. It is not the same case for peaks t<sub>2</sub>, b<sub>2</sub>, c<sub>2</sub>, especially the last two, whose migration speeds are slightly different.

Table II. Specific activities, expressed as cpm/mg of undialyzable subcellular protein fractions for lots T, A, B, C, D after 1-<sup>14</sup>C-D-glucosamine injection

Lots		T	A	B	C	D
Fractions						
Serum		3500	7288	6768	2118	15,200
Liver	Mb	3000	5500	5830	4860	8800
	Cell sap	1500	1970	3900	1740	3400
Spleen	Mb	255	955	210	750	810
	Cell sap	825	1370	1710	1310	1790

Mb = membrane

6. The effect of the TAB vaccine, alone or pre-influenza, more easily analyzed at the level of serum, leads to similar results in the liver or spleen subcellular fractions (Table II).

The study of in vivo incorporation of 1-<sup>14</sup>C-D-glucosamine and the electrophoretic analysis of serum glycoproteins show that the preliminary injection of an antibacterial vaccine (TAB) very significantly disturbs the hyperglycosylation reaction which normally follows an influenza virus infection<sup>6,7</sup>.

*Résumé.* Les résultats de l'incorporation in vivo de 1-<sup>14</sup>C-D-glucosamine dans le foie et la rate, et l'électrophorèse en gel de polyacrylamide des glycoprotéines sériques, montrent que le vaccin TAB, injecté avant une infection à Myxovirus, perturbe qualitativement et quantitativement la réaction d'hyperglycosylation post-grippale.

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**Effect of Allyl Propyl Disulphide Isolated from Onion (*Allium cepa* L.) on Glucose Tolerance of Ailoxan Diabetic Rabbits**

The antidiabetic property of onion (*Allium cepa*) was first reported by COLLIP<sup>1</sup>. A depancreatized dog was kept alive for 66 days by 3 injections of onion extract during that period. Its blood sugar was controlled and the glycosuria disappeared. Since then many workers<sup>2-8</sup> have found that the hypoglycaemic principle in onion is also effective when given orally and that it can be steam distilled and extracted with ether solvents. Very recently another therapeutic use of onion, viz. fibrinolytic activity has also been reported by GUPTA et al.<sup>9</sup> and MENON et al.<sup>10-12</sup>. Even fried onion has been reported to be effective in lowering the blood glucose levels in clinical diabetes<sup>13,14</sup>. Considering the wide use of this vegetable, a study of the effects of its pure hypoglycaemic principle on experimental diabetes was felt worthwhile in order to elucidate its antidiabetic action. A preliminary study has shown that the volatile hypoglycaemic principle or any other active fraction of onion<sup>5-7</sup> on a single dose is not as effective as tolbutamide in lowering the fasting blood sugar of normal or alloxan diabetic rabbits. This, in addition to the findings of COLLIP, suggests that the principle in onion may be used for a few days to obtain any beneficial result. The present paper deals with the effect of the volatile hypoglycaemic principle, allyl propyl disulphide (APDS), isolated from onion on alloxan diabetic rabbits on a short term therapy.

*Methods.* Allyl propyl disulphide, C<sub>3</sub>H<sub>5</sub>-S-S-C<sub>3</sub>H<sub>7</sub> was isolated from onion by the distillation procedure of PLATENIUS<sup>15</sup>. The active principle was isolated from the steam distillate by repeated extraction with ethylether in presence of 10% (W/V) sodium chloride. The ether extract was evaporated under reduced pressure and the oil left behind was used in this study (50 mg/100 g). The

glucose tolerance test of the 12 rabbits made moderately diabetic with alloxan according to a previous procedure<sup>6</sup> was carried out and they were divided into 2 equal groups. Their body weights were noted (average 1.55 kg). 1 group was kept as control and the other group received APDS (dose 100 mg/kg/day) orally for a period of 15 days and at the end of this period glucose tolerance of both the groups were determined. During the period of experiment all the animals had the same rabbit feed.

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Effect of APDS on fasting blood sugar, glucose tolerance and body weights of alloxan diabetic rabbits after 15 days treatment

	Glucose tolerance test (mean % age increase over fasting blood sugar [FBS])							Urinary sugar test and mean body wt. (kg)
	FBS	1/2 h	1 h	1 1/2 h	2 h	2 1/2 h	3 h	
Before APDS								
Group I	285.0 ± 5.5	23.0 ± 2.5	33.0 ± 3.0	35.0 ± 3.1	34.0 ± 2.8	36.0 ± 3.1	35.0 ± 3.5	1.5 ± 0.05 <sup>a</sup>
Group II	290.0 ± 6.5	25.0 ± 3.0	32.0 ± 2.5	34.0 ± 3.5	35.2 ± 3.2	35.0 ± 2.5	34.0 ± 3.1	1.6 ± 0.04 <sup>a</sup>
After APDS								
Group I								
APDS treated	195.0 ± 4.0 <sup>c</sup>	20.2 ± 1.5	22.5 ± 2.0 <sup>a</sup>	18.1 ± 1.5 <sup>c</sup>	10.5 ± 1.2 <sup>c</sup>	8.2 ± 1.0 <sup>c</sup>	9.1 ± 1.1 <sup>c</sup>	1.75 ± 0.03 <sup>b, e</sup>
Group II								
Control	280.5 ± 5.0	23.1 ± 2.0	31.5 ± 2.5	32.2 ± 2.1	32.0 ± 2.0	33.1 ± 2.5	35.2 ± 3.0	1.52 ± 0.05 <sup>d</sup>

Dose 100 mg/kg/day. Glucose g/kg. Values are mean of 6 rabbits  $\pm$  SE in each group. Student's *t*-test. <sup>a</sup>  $p < 0.05$ ; <sup>b</sup>  $p < 0.01$ ; <sup>c</sup>  $p < 0.001$ . Average body weights of the rabbits before alloxanization was 1.8 kg. After alloxanization it dropped to 1.55 kg. Urinary sugar; <sup>a</sup>  $> 2\%$ ; <sup>c</sup>  $1\%$  or below.

Blood sugar was estimated by the method of ASATOOR and KING<sup>16</sup>, using the low alkaline copper reagent of SOMOGYI<sup>17</sup>. The final body weights and urinary sugar were also noted.

**Results.** The results are given in the Table. The blood sugar rise in both groups before treatment was more or less the same after a glucose load. APDS treatment improved the glucose tolerance of the alloxan diabetic rabbits and reduced their fasting blood sugar values also. The blood sugar rise in the test group was significantly lower at 1 h ( $p < 0.05$ ) and later ( $p < 0.001$ ) up to a period of 3 h as compared to that of the control group. In the untreated group the blood sugar did not fall below its raised level even after 3 h. The treated group appeared more healthy and they gained 200–300 g in weight during this period as against a loss of 50–100 g body weight in the control group. The urinary sugar decreased considerably from 2% to 1% in the treated group.

**Discussion.** The antidiabetic action of this principle from onion is interesting. One possibility is that it may have an insulin sparing or potentiating effect as some insulin may possibly be left in circulation or in the damaged pancreas of the diabetic animal. Another possible mechanism may be the correction of the defect in the carbohydrate metabolism itself as suggested for the action of thiol substances studied by BUTTERFIELD<sup>18, 19</sup>. BUTTERFIELD in his study has suggested that an error in carbohydrate metabolism of the diabetics could be corrected by the administration of thiol substances such as dimercaprol. Thiol substances undergo oxidation reduction very easily in biological systems to give disulphides in equilibrium with each other. APDS being an organic disulphide can reversibly take part in the oxidation reduction process of thiol substances such as reduced glutathione and cysteine which develop oxidation reduction potential<sup>20–25</sup>. Most probably the antidiabetic property of this principle from onion may be related to its effects on this oxidation reduction system as certain-SH group compounds and albumin rich in -SH group may inactivate insulin<sup>26–28</sup>. The oxidation of such -SH group compounds or enzymes by APDS in biological systems may lead to an insulin sparing or potentiating action as postulated previously<sup>7</sup>, and explain the anti-

diabetic property of onion. The effect of the active principle on immunoassayable insulin and blood sugar in human diabetics is under investigation.

**Zusammenfassung.** Beschreibung der hypoglykämischen Wirkung von Alkylpropyldisulfid als wirksames Prinzip der Zwiebel (*Allium cepa*) bei Alloxan-diabetischen Ratten.

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<sup>29</sup> Reprints are available from K. T. AUGUSTI, Dept. Biochemistry, University of Kerala Trivandrum, India.

<sup>30</sup> The authors acknowledge with thanks the facilities offered by the Newcastle University during this investigation.