

ALLERGY FOR CORN AND ITS DERIVATIVES: EXPERIMENTS WITH A MASKED INGESTION TEST FOR ITS DIAGNOSIS*†

MARY HEWITT LOVELESS, NEW YORK, N. Y.

THIS symposium on food allergy is the outgrowth of recent widespread medical and lay interest aroused by claims^{1,2} that cereals and also their derivative starches, syrups, sugars,³ oils, and even their grain alcohols,⁴ are important excitants of allergy. The subject entered prominently into hearings before the Federal Food and Drug Administration in 1949, when the advisability of labeling salad dressings, breads, and other edible preparations was discussed from the allergenic angle. At this time, Randolph testified that such manifestations as unexplained headache, fatigue, drowsiness, chilliness, and pulling or aching of the muscles might originate from chronic or masked allergy for such regularly ingested foods as corn, wheat, milk, and eggs.

In anticipation of these Washington hearings, the writer interviewed 19 members of the American Academy of Allergy, from various sections of the country, to learn that only 0.12 per cent of their patients were considered susceptible by clinical standards to kernel or ground corn. No convincing instance of hypersensitivity to ingested oil or sugar could be found, and only a rare case of allergy for starch—one being recalled by Spain and another by Walzer. So great was the disparity between these opinions and those of Rinkel, Randolph, and Rowe, that a search for the underlying reason was instituted. Two steps were taken. First, a canvass was made by questionnaire of specialists in allergy and pediatric allergy to gain a more considered and extensive impression of the frequency of corn allergy. Second, an objective diagnostic procedure was devised whereby individuals suspected of hypersensitivity could be subjected to standard feeding tests with whole corn and subsequently with its derivative starch and syrup. The cornstarch pudding employed for the latter could not be distinguished in appearance, taste, or texture from 2 control puddings made of cane-sweetened starch obtained from tapioca or from arrowroot. The aim was to exclude psychogenic and other extraneous factors. These "blindfold" tests were used by 11 allergists on 25 individuals who gave suggestive histories for susceptibility to corn.

MATERIAL AND METHODS

Ingestion Materials: Mush.—As a check on the validity of the history, a feeding of precooked corn-meal mush (degerminated Quaker corn meal), sweetened with "Frodex," a dried corn syrup, was advocated as a preliminary or a final step in the ingestion studies. This ready-to-serve meal was prepared, as were the puddings, by an independent manufacturer in New York City (National Starch Products Inc., to whose Mr. Vincent Marsilia and Miss Mary Bak-

*From The New York Hospital and Department of Medicine, Cornell University Medical College, New York, N. Y.

†Presented before the Sixth Annual Meeting of the Academy of Allergy, Los Angeles, Calif., on March 6-8, 1950.

kovitch the writer is very grateful for their preparation of 67 packages). The mush consisted of 13.6 Gm. of dry meal to which were added 32.1 Gm. of dried syrup containing dextrose, maltose, and such higher sugars as triose and biose. The corn meal in each feeding carried 180 mg. of protein nitrogen and the syrup added another 2.2 mg. As is the case of the puddings, this test meal was posted in a refrigerated carton to the physician just prior to the arrival of the patient, the request being made through the writer's office. Before the next feeding in the series was prepared, all details of the earlier test were in the writer's hands. Each carton was labeled with an individualized code number, so that the patient, his physician, and the author remained in ignorance as to its contents until the entire series had been completed.

The puddings each contained 10 Gm. of starch. In the case of the tapioca and the arrowroot samples, the sweetener was 20 Gm. of cane sugar, whereas 66.6 Gm. of Frodex could be incorporated into the cornstarch pudding with an equal sweetening effect. As flavoring agents, 0.3 Gm. of salt and 0.3 Gm. of citric acid were included in each pudding, 0.03 Gm. of benzoate of soda being added as preservative. When requested, synthetic wild cherry flavoring was also employed in a volume of 6 drops.

The nitrogen content of the cornstarch pudding was estimated at 4.8 mg. protein nitrogen for the starch and 4.2 mg. for the Frodex, giving a total of 9 mg. In the case of the control puddings, the content of protein in their starches being $\frac{1}{3}$ to $\frac{2}{3}$ that of cornstarch and the sweetener being used in smaller proportion, the total amount of protein nitrogen in the feeding was about 4.2 mg. Hence, the cornstarch meal possessed over twice the protein of the placebo meals and might have been expected, therefore, to be more allergenic if its activity were dependent on contaminating nitrogen.

Ingestion Procedure.—The routine of Rinkel and Randolph was followed as accurately as possible in its several details, corn and its derivatives being carefully excluded from the diet for at least 4 days preceding any feeding. Tapioca and arrowroot, though more rarely ingested, were also prohibited. Wherever it could be safely recommended, the patient took the suspected allergen for 4 days prior to the period of elimination. He came in fasting, was allowed to rest seated for one-half hour before the start of the experiment. All suggestive signs and symptoms were sought and recorded for the 2-hour test period, as well as for the 2-day period before and after the ingestion. The subjects were also advised to avoid, or at any rate to record, any exposure to drugs, allergens, or other factors which might color the outcome of the test.

FINDINGS

Incidence of Allergy for Whole Corn (Kernel or Meal).—Table I is based on the replies received from 56 physicians who answered the questionnaire. The data have been segregated according to the frequency with which allergy for whole corn was encountered. For 45, the incidence amounted to only 0.16 per cent, or 1 case in 600, among a population of 45,500 individuals. Five additional physicians reported 82 cases in a total of 5,200 patients, giving an incidence 10 times higher and doubling the over-all figure. Another 4 found

59 instances in 1,700, bringing the average to 0.39 per cent for a population of 52,500 subjects.

The findings of the last 4 contributors are individually listed since they differ strikingly from the others. Rinkel, for example, has published a study of 200 patients with suspected hypersensitivity for whom he diagnosed corn as the etiologic factor in 16 per cent. We have taken the liberty of multiplying this population by 5 to make it comparable with those covered by the questionnaire. The same step was taken for Randolph who reported an incidence of 20 per cent in a group of his hypersensitive subjects at the 1949 hearing before the Food and Drug Administration. Rowe's response to the questionnaire was that he encountered 25 to 30 per cent of such cases among 1,200 patients. Finally, Crandall recorded 170 instances among 565 subjects, an incidence of 30 per cent.

It will be noted that the last 4 clinicians make the diagnosis of corn allergy about 100 times more frequently than the average allergist represented by the first group. It is hoped that some possible explanations for this disparity will be found in the results of our experiments with controlled feeding, to be presented below.

TABLE I. INCIDENCE OF CLINICAL ALLERGY FOR WHOLE CORN OR CORN MEAL

ALLERGISTS	PATIENTS OBSERVED	NO. CORN- ALLERGIC	INCIDENCE (%)	CUMULATIVE TOTALS		
				PATIENTS OBSERVED	NO. CORN- ALLERGIC	INCIDENCE (%)
45*	45,573	75	0.16	45,573	75	0.16
5*	5,220	82	1.57	50,793	157	0.30
4*	1,700	59	2.88	52,493	216	0.39
Rinkel†	1,000	160	16.0	53,493	376	0.7
Randolph†	1,000	200	20.0	54,493	576	1.06
Rowe	1,200	300	25.0	55,693	876	1.57
Crandall	565	170	30.0	56,258	1,046	1.86

*Members or Fellows of the American Academy of Allergy of whom 15 were certified internists; 3 were certified pediatricians.

†From the August-September, 1949, Hearing before the Federal Food and Drug Administration.

Ingestion Studies.—Table II summarizes the findings of ingestion tests carried out on 25 individuals who gave a history suggestive of allergy for whole corn. The data have been segregated into 3 sections, depending on the clarity of the diagnosis. Group A refers to 13 individuals whose allergy seemed the most certain, confirmation of the history being found by means of ingestion tests with our standard mush meal in 5 instances, with feeding tests devised by other allergists in 5 other cases, and on the basis of convincing histories for the remaining three. Details for the experiments on all but two of the members of this group are to be found in the recorded hearings before the Food and Drug Administration of 1949 as well as in the current issue of this journal under the investigators' names.

The outcome of experiments with these 13 clear-cut instances of corn allergy can be briefly summarized in the following statements. Eleven of the subjects gave entirely negative responses to masked feedings with cornstarch. Of the 2 who reacted to the cornstarch puddings, one (JM) did so on one occasion but failed to do so during an earlier ingestion experiment. The manifestation, consisting of abdominal cramps which occurred 7 hours after the feeding, was of

moderate severity and lasted for 4 hours. The first trial had elicited only a suggestion of "gassy indigestion" after 10 hours. In contrast, the standard mush feeding had provoked marked cramps within one-half hour. Had the pudding test been reproducible, one could have accepted this as an example of cornstarch allergy, attributing the relative delay in symptoms to the lesser amount of protein in the cornstarch as compared with whole corn meal. The lack of reproducibility, however, somewhat weakens one's convictions.

The other instance of cornstarch reaction was much more convincing. Patient MB developed asthma of moderate intensity within 1 hour of receiving a pudding, later identified as containing cornstarch. After 7 days, another such pudding reproduced the manifestation in marked form and a third experiment confirmed the diagnosis of cornstarch allergy. This woman showed unmistakable reactions to whole corn meal, developing prompt contact responses of the mouth and throat as well as immediate severe asthma.

Tapioca sensitivity was noted in one of the 13 patients of Group A, the patient being MB referred to above. She experienced severe asthma within 1 hour after the masked feeding on one occasion and promptly after ingestion on another.

Arrowroot starch caused a moderately severe gastrointestinal disturbance in 1 patient, and mild asthma in another. The first subject was observed by Shulman who reported that diarrhea had occurred in 48 hours and had lasted 2 hours, after she had been given the arrowroot pudding. Rawling's patient felt somewhat nauseated at once and became mildly asthmatic within one-half hour. Both symptoms subsided quickly. The long interval involved in the first instance and the mild, transitory nature of the reaction in the second patient weaken the interpretation of these findings as evidence of allergy to arrowroot.

Of these 5 instances of response to the starch puddings, only 2 are really convincing, those of the patient, MB, who reacted to both corn and tapioca. If so few cases are to be found among a group of patients of such highly selective character, the incidence must indeed be low among the general population. The suitability of the 13 individuals in Group A for the feeding experiments with cornstarch is made evident by their unequivocal clinical sensitivity toward whole corn. Table II reveals that 5 of them developed marked asthma, 7 various degrees of gastrointestinal disturbance, 8 nasal manifestations of allergy, 2 urticaria or atopic eczema, and 1 marked headache. With the possible exception of the latter, all these are classical expressions of allergy. Furthermore, they occurred promptly after the cereal had been eaten, 9 being noted within one-half hour and the rest within 5 hours. Although headache is a borderline manifestation, in the case of Sheldon's patient it was evoked in 30 minutes and was of extreme severity, so that it could be accepted as presumably allergic in origin.

Concerning the other derivatives of corn, none of the 11 individuals tested with syrup, sugar, or oil gave any sign of untoward effect, even on repeated feedings. One patient was also negative to the intravenous administration of dextrose. The involvement of cane sugar can be excluded from consideration since each of the several subjects responding to 1 starch pudding was fully tolerant of the other pudding which contained the same sweetener. This also applies to the flavoring and preservative used in all puddings.

PHYSICIAN	PATIENT	BASIS OF DIAGNOSIS	SYMPTOMS					ONSET IN HRS.	CORN- STARCH	TAPIOCA	ARROW- ROOT	CORN SYRUP	CORN SUGAR	CORN OIL
			ASTHMA	G.I.	NASAL	SKIN	HEADACHE							
Group A: 13 Patients With Excellent Ingestion Result and/or History for Corn Allergy														
Sheldon	1*	Trial		++	++		+++	1/2	0			0	0	0
Sheldon	2*	Trial			++			1/2	0			0	0	0
Sheldon	3*	History	+++					1/2	0			0	0	0
Sheldon	4*	Trial		+	+			1/4	0,0			0	0	0
Sheldon	5*	History		+++	++			3/4	0			0	0	0
Sheldon	6*	History		+++	+++			1	0			0	0	0
Rawling	1*	Trial	+++	+++	+	eye		3	0+		0+	0	0	0
Cazort	KEP†	Musht†		+++				1/4	0+	0+		0	0	0
Halpin	CH*	Trial	+++	+++	+++			1/4	0+			0 i.v.	0	0
Bernton	2*MB	Musht†	+++					1/4	++++	++++	0+	0	0	0
Conn	JK	Musht†			+++			5	++++	++++	0+	0	0	0
Shulman	JM	Musht†	+++	+++				1/2	++++	++++	0+	0	0	0
Rawling	2	Musht†	+++	+	+			1/2	++++	++++	++	0	0	0
Total	13	{ 5 Trial 5 Musht†	5	7	8	2	1	1/4-5	2 pos.	1	2	9 neg.	8 neg.	8 neg.
Group B: 10 Patients With Pair Ingestion Result and/or History for Corn Allergy														
Bernton	1*	Musht†			+			6	0+	0+	0+			
Lazar	PB	Musht†	+++					12	0+	0+	0+			
Black	CB	Musht†	++					3 1/2	++++	++++	++			
Altose	BC	Musht†	+		+			24	++++	++++	0+			
Altose	JS	Musht†			++	++		chronic	++++	++++	0+			
Cazort	LO	History	+++	++				2-3	0+	0+	0	0		0
Cazort	MCK	History	+++	+++	++			12	++++	++++	0+			
Cazort	RU*	History	+++	+++				12	0+	0+	0			
Cazort	AR	Starch	+++	+++	+++			2-24	3	1	1			
Black	WBC	History?	+++	+++	+++									
Total	10	5 Musht†	7	2	3	4								
Group C: 2 Patients With Possible History but Negative Ingestion Test														
Loveless	AN	Musht†	0				0		+	+++	+++			
Loveless	AHR	Musht†					±		+++	0	0			
Grand Total	25	{ 12 Musht† 5 Trial	12	9	11	6	1	1/4-24	7	3	4	10 neg.	8 neg.	9 neg.

These findings confirmed the claims of Rinkel and Randolph and the observations of Walzer and Spain that cornstarch can act as an ingestant allergen, rather to the surprise of the investigating physicians. The starches of tapioca and probably also of arrowroot can play a similar role. The convincing example found in Bernton's patient can be examined in detail in the August-September hearings of the Food and Drug Administration for 1949 and seen in synoptic form in Table III.

TABLE III. INGESTION STUDIES ON ASTHMATIC PATIENT, MB (BERNTON)

MATERIAL INGESTED	AMOUNT FED (GM.)	NO. OF TRIALS	ASTHMA INDUCED	INTERVAL IN MIN.
Corn meal*	13.6	1	+++	several
Dextrose	12.0	3	0	
Cornstarch*	10.0	3	++,+++	3 - 55
Corn oil	30.0	2	0	
Corn syrup	30.0	2	0	
Arrowroot starch*	10.0	3	0	
Potato starch*	10.0	1	0	
Tapioca starch*	10.0	2	+++	15 - 55

*Loveless standard pudding or mush.

The failure of most patients in this group of definite whole corn sensitivity to react to cornstarch can be demonstrated by the case of Halpin. This 27-year-old woman gave a history of immediate edema of lips and tongue as the result of ingesting kernel and ground corn on 2 occasions. Severe urticaria, dyspnea, cough, and wheeze shortly developed and were followed by diarrhea and collapse which required 3 administrations of epinephrine for their control. The standard mush feeding was contraindicated in this severe case. The subject submitted to pudding tests with cornstarch on 2 occasions and with arrowroot on 1, and remained symptom-free. She not only tolerated ingestions of corn syrup, corn oil, and corn sugar but also took the latter by vein equally well. These findings are summarized in Table IV.

The young college student, KE, of Cazort is another example of extreme hypersensitivity toward kernel corn in combination with complete tolerance for large doses of each derivative by mouth. In keeping with his history, mush provoked immediate "tingling, burning, and a thick feeling in the mouth and throat." Severe abdominal cramps and urticaria were present some hours later. On the contrary, no untoward effects followed the taking of masked puddings in which the starches of corn, tapioca, or arrowroot were present. Similarly, corn oil, syrup, and sugar were taken in masked form without incident.

Six other individuals gave equally convincing results when tested by Sheldon with his own types of masked feeding. All these clearly corn-reactive patients proved to be fully tolerant of the starch and syrup of corn, and those given corn sugar and oil were similarly negative. Patient 1, investigated by Rawling with his own method of trial feeding with whole corn, like that of Conn who employed our standard mush, is an acceptable member for Group A in spite of the somewhat delayed appearance of manifestations. Both individuals were given cornstarch pudding, as well as 1 or more control puddings, without significant effect.

TABLE IV. INGESTION STUDIES ON PATIENT C. BY DR. HALPIN

DATE	PRECEDING SYMPTOMS	MATERIAL INGESTED	SYMPTOMS				
			ASTHMA	NAUSEA	DIARRHEA	URTICARIA	EDEMA
1946	0	Corn bread†	+++ 1/4 hr.	+++	+++	+++ 1/4 hr.	+++*
		Corn on cob†	+++ 1/4 hr.	+++	+++	+++ 1/4 hr.	+++*
1948	0	Glucose 10 % intravenously	0	0	0	0	0
		Corn oil	0	0	0	0	0
		Corn sugar	0	0	0	0	0
		Corn syrup	0	0	0	0	0
7/27/49	0	Cornstarch	0	0	0	0	0
1/10/50	0	Cornstarch	0	0	0	0	0
6/29/49	0	Arrowroot	0	0	0	0	0

*Lips and tongue.

†Small portion of a serving.

TABLE V. INGESTION STUDIES ON PATIENT AN

DATE	PRECEDING SYMPTOMS	MATERIAL INGESTED	SYMPTOMS						
			ASTHMA		HEADACHE		FATIGUE		VERTIGO
				HRS.P.C.		HRS.P.C.		HRS.P.C.	
11/23/49	0 0 for 1 hr.	Mush*	±	3/4 - 1 1/4	0		0	0	5 1/2 - 6
10:30		Corn on cob	±	1/4 - 2 1/4	0		0	0	
12:40		Corn starch*	+	1 - 5	0		+++	++	
11/18/49		Arrowroot*	++	5 - 2 1/2	0		0	0	
11/9/49	Fatigue ++ 0 0 0	Tapioca*	++	1 - 2 1/2	0		0	0	0
12/2/49		Tapioca	0	0	0		0	0	
1/31/50		Arrowroot crackers	0	+++	1/4 - 1 1/2		0	0	
2/3/50		Saline 1 c.c.	+	1/2 - 1 3/4	+		1/4 - 1 3/4	0	
2/8/50	Asthma ±	Saline 1 c.c.	+	1/2 -	+++		5 min. - 1	+	0
10:00	Asthma ±						1 -	0	
11:45									

*Loveless standard test meal.

When these 2 experiments are included with those described above for Group A, it is apparent that the large proportion of patients clearly susceptible to whole corn is unquestionably tolerant of its derivative starches and sugars, this being the observation for 11, and possibly 12, of the 13 test subjects.

Group B furnishes less valuable evidence because in general its responses to ingested corn were either mild in degree or delayed in development. Five of its members were diagnosed by ingestion test with our standard mush, whereas the history alone was used as the basis for diagnosis for the other 5. In spite of these shortcomings, some weight may be placed on the negative responses of 7 of the subjects to cornstarch and to such other corn derivatives as were employed. The anomalous situation encountered in the experiments with 2 of the patients, who appeared more reactive to starch than to meal, is worthy of further investigation. The third case listed as positive for cornstarch by the pudding test is difficult to interpret both from the viewpoint of the feeding result and the history. This 30-month-old baby (AR) was suspected of being cornstarch-allergic by its mother and was known to be reactive to both corn and cottonseed flours by inhalation. The only ingestion experiment done was one with cornstarch pudding. Three hours later a few hives had developed on the knee, and by 12 hours the eruption was generalized and mild asthma was present. The latter became so severe by the next morning that the child was hospitalized. It was unfortunate that control and whole corn ingestion studies were refused after this development.

Group C was composed of 2 of the author's patients who deserve brief mention because their symptoms resembled those classed as allergic by Randolph but not generally accepted as such by the profession. These responses were elicited by the derivatives but not by whole corn.

Table V summarizes the findings with An, a woman who was having asthma almost daily which was considered to be caused by several danders, house dust, and foods. After her first ingestion test with arrowroot pudding, she suffered an attack of moderately severe asthma. Nine days later the ingestion of cornstarch pudding was shortly followed by marked fatigue and mild asthma. After their disappearance some 4 hours later, a short spell of vertigo was noted. Her subsequent examination with standard mush and fresh kernel corn failed to duplicate these manifestations aside from a suggestion of mild asthma, which was surprising in view of the fact that larger doses of the hypothetical allergens in corn must have been involved. Interpretation of this woman's reactions was again made difficult by her failure to develop, at home, symptoms of asthma which followed the taking of tapioca in the office. Furthermore, arrowroot appeared to elicit asthma of moderate severity 5 hours after she ate a masked pudding under our observation but when she tried arrowroot crackers at home a severe, brief headache was the result. Suspecting by now that factors other than our test meal allergens were operative, we subjected her to a feeding experiment with saline solution which she believed to be an allergenic extract. This gave rise to mild asthma by 30 minutes and to headache almost immediately. Fatigue of slight degree was also reported. Without the repeated tests and the saline control, this woman would have been considered allergic to all 3 of the starch puddings, especially if the diagnosis had been guided by the criteria of Rinkel and Randolph.

For comparable reasons, one might have been misled by the initial cornstarch reaction of AH. His persistent fatigue was increased as also was his headache by this masked pudding test. Repetition of the ingestion in 2 weeks yielded a negative result except for a suspicion of fatigue. Still a third experiment provoked no complaints whatsoever. These 2 essentially negative responses to cornstarch are consistent with his tolerance of both mush and kernel corn. It was important to the understanding of this case that repeat tests be carried out.

DISCUSSION

A survey of 56 allergists and pediatric allergists throughout the country revealed that for all but a few physicians clinical allergy for whole corn is a rarity which is encountered 100 times less frequently than Rinkel, Randolph, Rowe, and Crandall have reported. Some explanations for this disparity have been uncovered by our experiments with objective feeding tests. It was found that extraneous factors, especially of psychologic origin, can complicate the diagnosis unless the patient is subjected to repeated studies, to masked ingestions, and to placebo meals.

Whereas no evidence was found for the allergenicity of corn oil, syrup, or sugar, clinical reactions were, to our surprise, encountered following the controlled ingestion of the several starches employed for these studies. The clinical significance of this type of hypersensitivity would not appear, however, to have the practical importance assigned to it by Randolph and his school. For one thing, its occurrence was rare even among our group of patients who were selected on the basis of their marked allergy for whole corn and who were tested with relatively huge ingestant doses of starch. Randolph has claimed that provocative amounts of starch allergen escape from paper cartons into milk, sauerkraut, and frozen foods. It seems unlikely that our cornstarch-reactive cases would have been affected by such traces. At any rate, the incidence of clinical susceptibility ought to be far lower with such small amounts of this substance than with the 10 Gm. of cornstarch involved in our puddings.

Presumably any allergenicity of starch, syrups, and sugars would be referable to contaminating proteins carried along from the whole cereal into the derivatives. Starch itself would probably not be antigenic in view of its prompt breakdown into smaller molecular substances by enzymes present in all biologic fluids. Furthermore, the proteins of whole corn would also be reduced considerably in activity because of the drastic treatment involved in the preparation of the derivatives, including heating and strong acidification.

Theoretically, bacteria might play a role in contributing antigens to corn derivatives. It is known, for example, that *B. macerans* is introduced during the preparatory process. In addition, it might be found that this organism, like the streptococcus, can synthesize dextrans, which have been shown to possess immunological activity.⁵ Before any of these theories can be accepted, it will be necessary to support them by controlled experimental evidence.

It would seem that the chief cause of the disagreement among allergists concerning the frequency of food allergy must relate to the diagnostic criteria employed. The individual feeding procedures of Rinkel and Randolph, as well as

the elimination diets of Rowe, were introduced because the cutaneous test was found to be unreliable in this type of hypersensitivity. Although they constitute a step in the right direction, these methods fail to take into account the influence of extraneous factors, particularly those of psychologic origin. Consequently, an abnormally high incidence of positive results would be expected. Furthermore, there has recently been added to the diagnostic list a considerable variety of new symptoms. Although such an increase in the scope of allergy may eventually be found justifiable, this can only be decided after a scientific diagnostic procedure has been devised. To attempt to set up a new method simultaneously with the introduction of new symptomatology is tantamount to testing the validity of one unknown by the use of another. There is, then, an urgent need at the moment for the creation of an adequate diagnostic technique. The adequacy should be firmly established by its application to only those patients whose diagnosis is unequivocal. The members of Group A fulfilled this requirement in the "blindfold" ingestion procedure described in this article, their diagnoses resting on the speed and classical form of their reactions to whole corn. It is true that the psychologic factor was not excluded due to the impossibility of masking the characteristic taste and appearance of the unrefined cereal. However, the mush feeding was only a screening technique to confirm a straightforward history, and the psychologic factor was effectively controlled in the masked ingestion procedure associated with the pudding tests for starch and sugar allergy.

SUMMARY

1. A poll of allergists revealed that clinical symptoms from ingested corn were encountered in only 0.16 per cent of their 45,000 patients. This stands in marked contrast to an incidence of 16 to 30 per cent reported by Rinkel, Randolph, Rowe, and Crandall.

2. "Blindfold" ingestion studies associated with placebo meals were done in 25 patients with histories suggestive of corn allergy. A few instances of reaction to large feedings of the starches of corn, tapioca, and arrowroot were encountered, but no case of susceptibility for corn syrup, sugar, or oil. The symptoms of several patients were found to be psychogenic rather than due to the suspected food.

3. An appeal is made for the introduction of controlled, objective methods to the study of food allergy.

The writer wishes to thank the physicians who cooperated to make this study possible, and to acknowledge aid of Misses C. Spearing and A. Ryan as well as Mrs. H. Rice.

REFERENCES

1. Rinkel, H. J., Randolph, T. G., and Zeller, M.: *Food Allergy*, Springfield, Ill., 1950, Charles C Thomas, Publisher.
2. Rowe, A. H.: *Elimination Diets and the Patient's Allergies*, Philadelphia, 1944, Lea & Febiger.
3. Randolph, T. G., Rollins, J. P., and Walter, C. K.: Allergic Reactions Following the Intravenous Injection of Corn Sugar (Dextrose or Glucose), *J. Lab. & Clin. Med.* **34**: 1741, 1949.
4. Randolph, T. G.: Concepts of Food Allergy Important in Specific Diagnosis, *J. ALLERGY* **21**: 471, 1950.
5. Hehre, E. J., and Neill, J. M.: Formation of Serologically Reactive Dextrans by Streptococci from Subacute Bacterial Endocarditis, *J. Exper. Med.* **83**: 147, 1946.