

Epidemiology and Clinical Features of Food Allergenicity in China

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Outlines

- **Epidemiology**
- **Diagnosis of food allergy**
- **Common food allergen**
- **Allergenic components of food allergens**
- **Further Investigation**

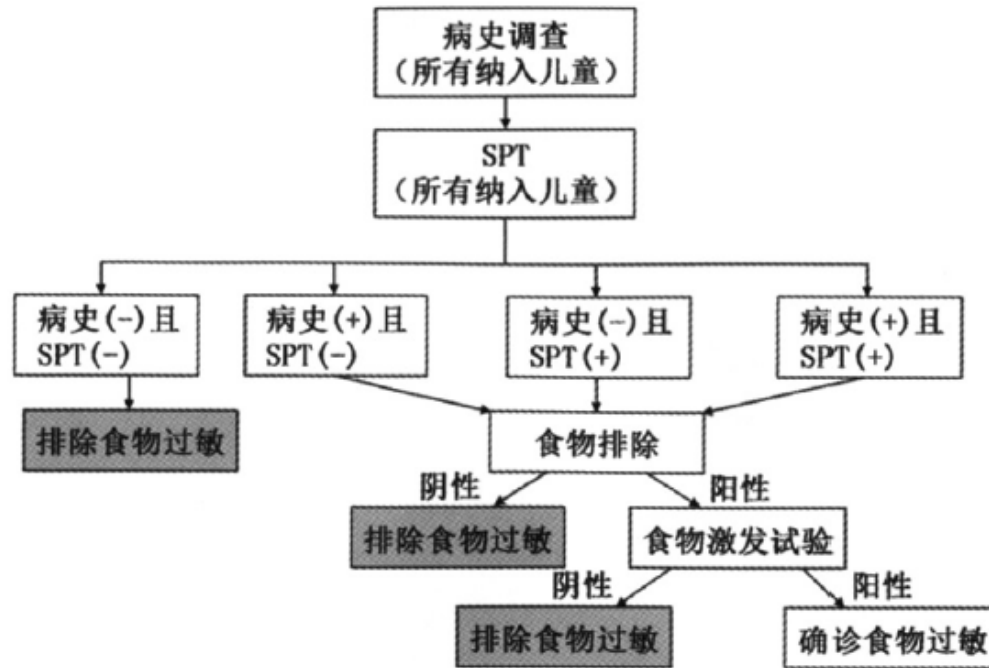
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Epidemiology

- Total 314 normal infants and young children (0~24 months old) were recruited in this study from Dept. of Primary Care, Chongqing Children Hospital
- 0~12 months old: 250 cases, 12~24 months old: 64 cases
- Male: female = 181: 133
- Diagnosis of food allergy based on questionnaire, SPT, elimination test and food challenge test
- 10 cases dropped out (response rate: 96.8%)
- Results:
 - Prevalence: 5.2 % in 0~24 months old group: 6.1 % in 0~12 months old group
 - Allergenic food: hen's egg, cow milk, soy bean, peanut, fish, mandarin

Epidemiology



注: SPT: 皮肤点刺试验

图1 诊断流程图

Epidemiology

表 1 不同年龄 FH 小儿调查、试验结果

年龄 (月)	调查 人数	问卷回答 FH		SPT 测试 FH			OFC 试验			校正 OFC 发生率(%)
		阳性数	阳性率(%)	例数	阳性数	发生率(%)	例数	阳性数	发生率(%)	
< 12	250	36	14.4	250	25	10.0	18	11	4.4	6.1
12~24	64	7	11.0	64	6	10.0	3	0	0	0
合计	314	43	13.7	43	31	9.9	21	11	3.5	5.2

Epidemiology

表2 11例FH小儿的临床症状及致敏食物

病例(序号)	性别	年龄(月)	临床表现	致敏食物
1	女	3.8	风团	牛奶
2	男	4.1	湿疹、打喷嚏	鸡蛋
3	女	4.5	拒奶	牛奶
4	女	5.6	湿疹	广柑、鸡蛋
5	男	6.1	湿疹	牛奶、鸡蛋、大豆
6	男	6.3	湿疹	鸡蛋
7	男	6.5	湿疹	鸡蛋
8	女	7.3	湿疹	牛奶、鸡蛋
9	女	7.7	湿疹	鸡蛋
10	男	8.8	风团	鸡蛋
11	男	9.3	湿疹、风团 吐泻、眼睑水肿	牛奶、鸡蛋、 鱼、花生

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Epidemiology

- Totally 1687 cases of 0~2 years old Children were recruited in this study from Dept. of Primary Care in Chongqing (550 cases), Zhuhai (573 cases) and Hangzhou (481 cases) , 83 cases dropped out
- Diagnosis of food allergy based on questionnaire, SPT, elimination test and food challenge test
- The diagnosis were confirmed by food challenge tests among 100 cases: 40 cases in Chongqing, 33 cases in Zhuhai, 27 cases in Hangzhou
- Prevalence: 6.2%, 7.3% in Chongqing, 5.8% in Zhuhai, 5.6%in Hangzhou
- Allergenic food: hen's egg (3.0~4.4%), cow milk (0.83~3.5%), shrimp (0.17~0.42%), fish (0.17~0.21%)

Epidemiology

表1 纳入研究各年龄组儿童例数

城市	调查例数			失访例数	纳入研究例数
	合计	~1岁	~2岁		
重庆	581	497	84	31	550
珠海	615	559	56	42	573
杭州	491	383	108	10	481
合计	1687	1439	248	83	1604

表2 病史调查各年龄组主要症状例数

症状	重庆		珠海		杭州		合计
	~1岁	~2岁	~1岁	~2岁	~1岁	~2岁	
皮肤症状	39	30	41	4	22	5	141
胃肠道症状	8	1	8	1	2	-	20
呼吸道症状	-	-	-	-	-	-	-

Epidemiology

表3 3城市儿童FE及OFC检测阳性例数

城市	检测例数	FE (+)	OFC (+)	SPT(+)			SPT(-)		
				病史(-)	病史(+)	OFC(+)	病史(-)	病史(+)	OFC(+)
重庆	88	65	40	26	37	34	-	25	6
珠海	45	43	33	21	7	21	-	17	12
杭州	55	44	27	30	19	25	-	6	2

表4 OFC阳性儿童各症状例数

城市	OFC阳性	皮肤症状	呕吐	呕吐+拒奶	腹泻	拒奶
重庆	40	34	3	1	1	1
珠海	33	31	1	1	-	-
杭州	27	26	1	-	-	-
合计	100	75	5	2	1	1

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Epidemiology

- 10672 cases of 6~11 year old children were randomly recruited in this study in Beijing, 5828 cases from urban area, 4727 cases from suburb
- Response rate: 87 %
- Europrevall Project phase one questionnaire
- Self-reported prevalence of food allergy: 10.3% in Beijing, 11.9 % in urban area, 8.2 % in suburb
- Percentage of children who reported over 4 food related adverse events: 2.0 % in urban area, 0.9 % in suburb

Epidemiology

表 1. 研究人群概况及应答率

城市	调查人数			平均年龄 (岁)	应答率 (%)	调查学 校个数	调查月份
	男	女	合计				
城区	3045	2903	5948	8.2	81	9	2007. 10-2008. 1
郊区	2456	2268	4724	8.5	99	7	2007. 11-2008. 1

表 1: 研究人群食物过敏的报告率 (%)

地区	答卷人数	因为食物引起疾 病人数 (%)	进食食物引起疾病的 频次多于 4 次 (%)	进食食物引起疾病的频 次 2-4 次 (%)
北京城区	5948	709 (11.9)	120 (2.0)	308 (5.1)
北京郊区	4724	387 (8.2)	43 (0.9)	157 (3.3)
χ^2		39.7*	21.17*	22.42
P		0.000	0.000	0.000

Epidemiology

表 II: 食物过敏人群的过敏常见症状

	北京城区	北京郊区	χ^2	<i>P</i>
答卷人数	709	387		
皮肤起皮疹或瘙痒	458 (65%)	198 (51%)	18.81*	0.000
口唇咽喉部痒感刺痛或红肿	228 (32%)	120 (31%)	0.15	0.69
腹泻或呕吐 (食物中毒除外)	156 (22%)	129 (33%)	16.7*	0.000
打喷嚏、流鼻涕或鼻塞	90 (13%)	46 (12%)	0.15	0.69
眼部发红、疼痛或流泪	47 (7%)	16 (4%)	2.77	0.1
头痛或头晕	40 (6%)	42 (11%)	9.81	0.001
、呼吸困难	31 (4%)	16 (4%)	0.03	0.85
吞咽困难	7 (1%)	12 (3%)	6.56	0.01
晕倒或眩晕硬	7 (1%)	11 (3%)	5.53	0.02
关节僵硬	2 (0.2%)	4 (1%)	2.6	0.1

* $P < 0.01$

Epidemiology

表 III: 食物过敏人群的引起过敏的食物

	北京城区	北京郊区	χ^2	<i>P</i>
答卷人数	709	387		
虾	143 (20%)	50 (13%)	9.07	0.002
芒果	112 (16%)	52 (13%)	1.10	0.29
螃蟹	65 (9%)	10 (2.5%)	17.01	0.0000*
桃子	44 (6%)	38 (10%)	4.72	0.02
鸡蛋	25 (3.5%)	8 (2%)	1.80	0.17
羊肉	34 (4.3%)	3 (0.7%)	12.00	0.000*
乳类	11 (1.5%)	14 (3.6%)	7.87	0.005

* $P < 0.01$

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Diagnosis of food allergy

- 173 cases suspected food allergy; age: 1~24 months old (average age 9.39 ± 5.67 months old)
- All cases underwent SPT and open food challenge tests
- 271 open food challenge tests performed, in which 123 were positive, 99 cases were diagnosed as food allergy
- The sensitivity and specificity of SPT with a cut-off value $\geq 3\text{mm}$ were ranged from 71% to 81%, from 31% to 51% respectively
- SPT mean wheal diameters that were 100% diagnostic for egg white ($\geq 8.5\text{mm}$), egg yolk ($\geq 5.5\text{mm}$), cow milk ($\geq 5.5\text{mm}$)

Diagnosis of food allergy

表 1 各种食物 OFC 阴性、阳性次数

食物抗原	OFC	OFC 阳性	OFC 阴性
蛋白	93	45	48
蛋黄	90	37	53
牛奶	88	41	47
合计	271	123	148

表 2 OFC 诱发的主要症状及次数($n = 123$)

食物抗原	皮肤症状	胃肠道症状	呼吸道症状	其他
蛋白	40	3	-	1
蛋黄	36	1	-	-
牛奶	31	8	2	1
合计	107	12	2	2

Diagnosis of food allergy

表3 SPT 疹团 MD 诊断价值比较

食物抗原	MD(mm)	敏感度	特异度	PPV	NPV
蛋白	≥3.0	0.87	0.31	0.54	0.71
	≥4.0	0.84	0.49	0.61	0.77
	≥5.0	0.73	0.73	0.72	0.74
	≥6.0	0.73	0.83	0.80	0.77
	≥7.0	0.51	0.90	0.82	0.66
	≥8.0	0.36	0.98	0.94	0.62
	≥8.5	0.29	1.00	1.00	0.60
蛋黄	≥3.0	0.76	0.57	0.55	0.77
	≥4.0	0.59	0.91	0.81	0.76
	≥5.0	0.51	0.96	0.90	0.74
	≥5.5	0.32	1.00	1.00	0.68
牛奶	≥3.0	0.71	0.55	0.58	0.68
	≥4.0	0.63	0.80	0.72	0.71
	≥5.0	0.56	0.94	0.88	0.71
	≥5.5	0.49	1.00	1.00	0.69

Diagnosis of food allergy

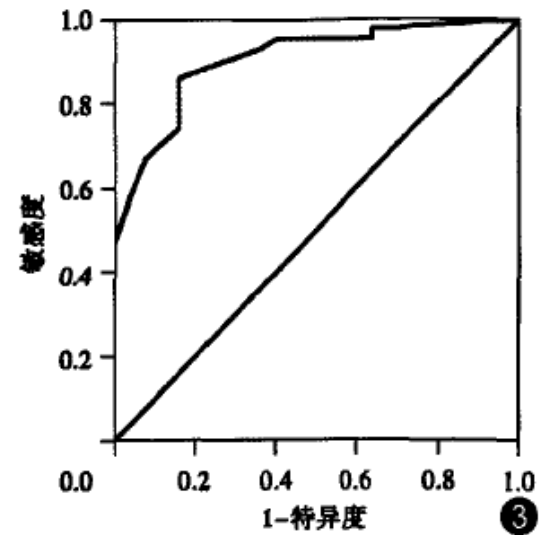
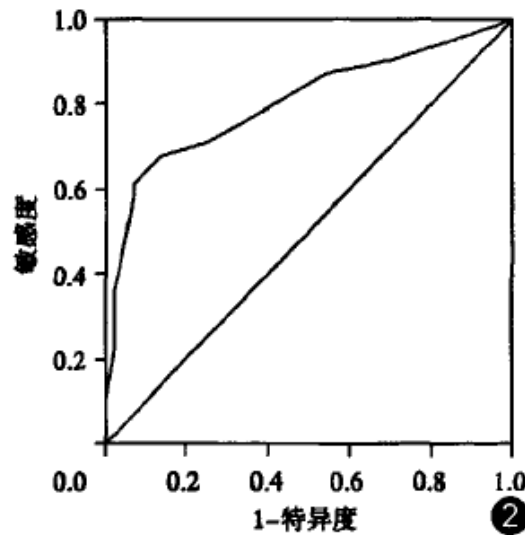
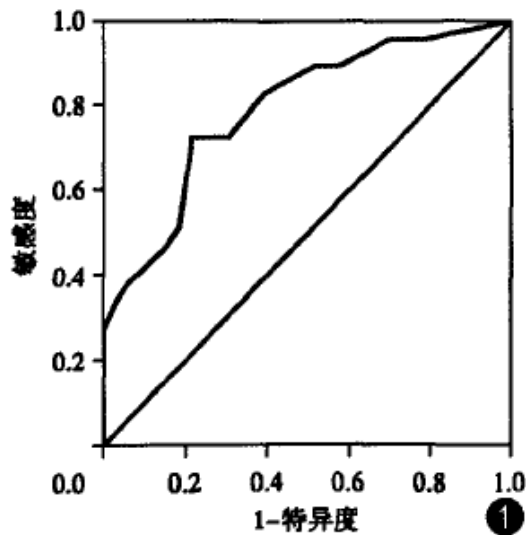


图1 蛋白 ROC 曲线 AUC =0.794 图2 蛋黄 ROC 曲线 AUC =0.804 图3 牛奶 ROC 曲线 AUC =0.904

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Diagnosis of food allergy

- 88 0~6 years old children suffered from allergic diseases; male: female = 46: 42, average age: 2.7 ± 1.4 years old
- SPT, sIgE detection as screening tests and DBPCFC for confirmation of diagnosis of food allergy
- 16 case sIgE (+) among 25 SPT (+) , 14/16 DBPCFC (+); 2 cases DBPCFC (+) among 9 SPT (-)
- The PPV and NPV of food allergy diagnosis according to SPT (+) sIgE (+) or SPT (+) sIgE (-) were 87.5%, 77.8% respectively

Diagnosis of food allergy

表 1 88 例过敏性疾病儿童食物过敏原皮肤点刺及 sIgE 检测结果

组 别	例数	年龄 (岁)	皮试阳性 例数(%)	SPT(+) sIgE(+) 例数	SPT(+) sIgE(-) 例数
呼吸道症状组	32	3.5 ± 2.7	6(18.7)	4	2
皮肤症状组	43	1.1 ± 0.8	16(37.2)	11	5
消化道症状组	13	3.2 ± 1.4	3(23.1)	1	2

表 2 皮肤点刺试验阳性、sIgE 阳性或阴性组 DBPCFC 结果(n)

组 别	DBPCFC 阳性	DBPCFC 阴性	阳性 预计值	阴性 预计值
SPT(+)sIgE(+)	14	2	87.5%	77.8%
SPT(+)sIgE(-)	2	7		

Diagnosis of food allergy

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Common Food Allergens in China

Children: hen's egg, milk, soy bean, peanut

Adult:

1. **hen's egg, milk**
2. **Sea food: fish, shrimp, crab, shellfish**
3. **meat: livestock, fowl**
4. **oil crops: soy bean, peanut, sesame seed, sunflower seed**
5. **Nuts: cashew, pistachio, hazel nut, almond**
6. **Fruits: peach, apple, pear, kumquat, lychee**
7. **Vegetable: hyacinth bean, celery**
8. **Cereal: wheat (gluten), buckwheat**
9. **Food Additives*: tartrazine, MSG, sulphite**

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Common food allergen

20 万项次过敏原特异性 IgE 检测结果

表 2 单价食物过敏原阳性检出量排序

Table 2 Sequencing of positive test quantity of univalent food allergen

编号	过敏原 [△]	检测量(项次)	阳性检出量(项次)	阳性率(%)
1	虾(f24, Shrimp)	2 233	511	22.9
2	小麦(f4, Wheat)	1 809	483	26.7
3	桃(f95, Peach)	605	400	66.1*
4	鸡蛋清(f1, Egg white)	1 299	382	29.4
5	牛奶(f2, Milk)	1 516	381	25.1
6	花生(f13, Peanut)	1 332	374	28.1
7	大豆(f14, Soya bean)	1 459	310	21.2
8	苹果(f49, Apple)	462	269	58.2
9	玉米(f8, Maize)	647	237	36.6
10	蟹(f23, Crab)	1 508	213	14.1
11	荞麦(f11, Buckwheat)	551	211	38.3
12	面筋(f79, Gluten)	1 198	210	17.5
13	芝麻(f10, Sesame seed)	474	150	31.6
14	大蒜(f47, Garlic)	468	134	28.6
15	梨(f94, Pear)	218	129	59.2
16	榛子(f17, Hazel nut)	197	108	54.8
17	大米(f9, Rice)	431	86	20.0
18	芒果(f91, Mango)	492	84	17.1
19	番茄(f25, Tomato)	358	79	22.1
20	樱桃(f242, Cherry)	136	74	54.4

Common food allergen

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编号	过敏原 [△]	检测量(项次)	阳性检出量(项次)	阳性率(%)
21	鸡蛋黄(f75, Egg yolk)	614	73	11.9
22	燕麦(f7f, Oat)	261	69	26.4
23	开心果(f203, Pistachio)	155	61	39.4
24	胡桃(f256, Walnut)	176	58	33.0
25	荔枝(f348, Litchi)	157	56	35.7
26	鸡蛋(f245, Egg)	367	55	15.0
27	杏(f237, Apricot)	88	55	62.5
28	香蕉(f92, Banana)	183	51	27.9
29	腰果(f202, Cashew nut)	159	51	32.1
30	芹菜(f85, Celery)	211	44	20.9
31	小扁豆(f235, Lentil)	153	44	28.8
32	李子(f255, Plum)	85	44	51.8
33	大麦(f6, Barley)	142	41	28.9
34	葡萄(f259, Grape)	154	40	26.0
35	猪肉(f26, Pork)	330	39	11.8
36	草莓(f44, Strawberry)	136	39	28.7
37	鱼[(鳕鱼)f3, Fish(cod)]	1 024	36	3.5 [#]
38	西瓜(f329, Watermelon)	147	36	24.5
39	橙(f33, Orange)	174	35	20.1
40	猕猴桃(f84, Kiwi fruit)	158	34	21.5

△过敏原括号内文字指试验代码、英文或拉丁文名称；* 桃阳性率最高(66.1%)；#鱼阳性率最低(3.5%)

Pollinosis with Food Allergy

- 17 cases of polinosis with food allergy were reported for the first time in China
- Allergenic pollens were all summer-autumnal weed pollens such as *Artemisia* pollen
- Common allergenic food allergens: Legume food, peach, sunflower seed, lychee, grape, apple etc
- Majority in general symptoms, minority in only OAS (1/17、 3/50 in two patients groups respectively)
- Cross-reactivity between peach, longan, sunflower seed, walnut, peanut, soy bean, grape, tomato and *Artemisia* and *Humulus scandens* pollen respectively

Wang Lianglu & Wen Zhaoming. Chin J Microbiol Immunol, 1998, 18(supplement 1, the 3rd special issue on Allergology): 29

Wang Lianglu, Wen Zhaoming, et al. Chin J Microbiol Immunol, 2001, 21(supplement 1, the 4th special issue on Allergology): 67

Wen Zhaoming, Ye Shitai. Natl Med J China, 2002, 82: 626

Wheat-dependent Exercise-induced Anaphylaxis

- The diagnosis of WDEIA were confirmed among 15 cases in PUMC Hospital
- All patients with history of intake food made from wheat flour 0.5~6 hr prior to anaphylaxis
- Experienced 3.2 allergic shock attacks in average prior to be diagnosed
- 13/15 wheat sIgE (+) , 15/15 gluten sIgE (+)
- 5/5 wheat and gliadin SPT (+)

Wheat-dependent Exercise-induced Anaphylaxis

表 1 WDEIA 患者病史、皮肤点刺试验和 IgE 水平

Table 1 Case history, skin prick test, and IgE level of the WDEIA patients

病例	性别	年龄 (岁) ^a	病程 (年) ^b	发作次数 (次) ^c	荨麻疹 (年)	皮肤点刺试验 ^d		IgE (kU/L)	
						水溶蛋白	醇溶蛋白	小麦 (f4)	面筋 (f79)
1	男	35	4	2	15	++	++	1.35	8.52
2	男	33	2	7	8	++	++	0.92	1.20
3	女	38	2	2	8	++	++	0.49	3.80
4	女	31	1	2	2	++	++	1.32	1.62
5	男	17	2 个月	6	0	++	++	1.59	11.70
6	女	46	7	数十次	10	ND	ND	0.67	2.50
7	女	39	4	2	4	ND	ND	0	1.27
8	女	45	4	2	10	ND	ND	0.8	1.50
9	男	51	4	3	4	ND	ND	0.62	2.19
10	女	45	1	4	0	ND	ND	<0.35	0.47
11	男	61	6	4	6	ND	ND	0.86	2.09
12	女	28	2	4	2	ND	ND	0.95	0.77
13	男	20	1	1	5	ND	ND	2.64	8.21
14	男	18	3	2	10	ND	ND	0.54	3.43
15	女	35	1	2	10	ND	ND	2.48	4.21

WDEIA: 小麦依赖-运动诱发的严重过敏反应; a. 严重过敏反应初次发作年龄; b. 严重过敏反应初次发作到临床确诊的时间, 平均 (2.81±1.99) 年 (2 个月-7 年); c. 来本院就诊前, 除 1 例发作数十次无法统计外, 其他患者平均发作 3.2 次 (1-7 次); d. 只在部分患者 (5 例) 进行了皮肤点刺试验; ND: 未检测

Wheat-dependent Exercise-induced Anaphylaxis

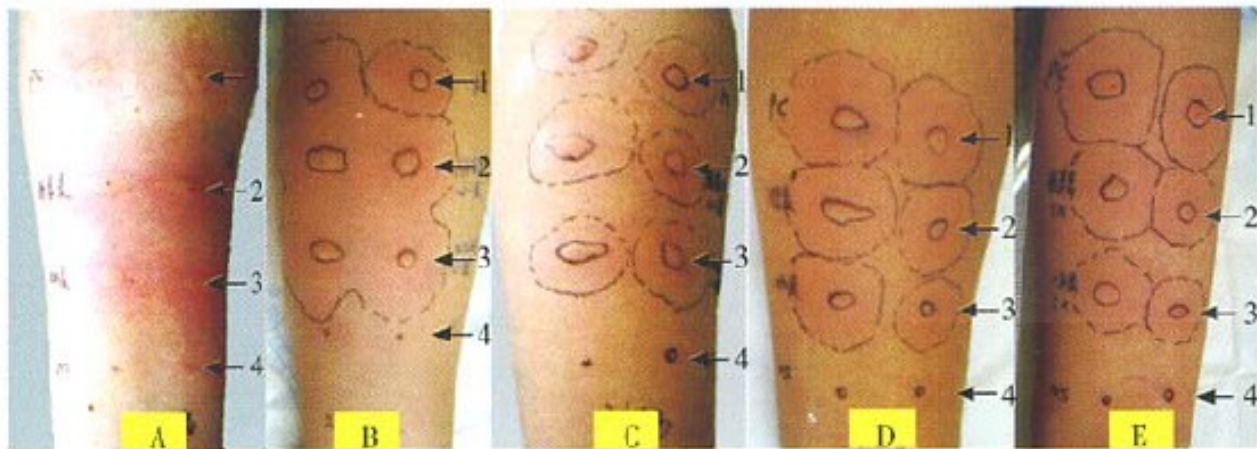


图 1 水溶蛋白和醇溶蛋白皮肤点刺试验

Fig 1 Skin prick test of wheat and gliadin

1. 组胺 (阳性) 对照; 2. 醇溶蛋白; 3. 水溶蛋白; 4. 阴性对照

所有患者均在同一侧前臂进行重复皮肤点刺试验

Pericarpium Zanthoxyli induced Anaphylaxis

- The diagnosis of *Pericarpium Zanthoxyli* (pricklyash berry, Sichuan pepper) allergy were confirmed among 15 cases in PUMC Hospital
- Immediate reaction, symptoms initiated within 30 minutes after alimentation
- 14/15 anaphylaxis (5 /15 allergic shock), 14/15 initiated with OAS
- 15/15 with cashew and or pistachio allergy
- 10/10 Sichuan pepper seed SPT +++ ~ +++++; 3/10 Sichuan pepper peel SPT +~++, 7/10 negative
- 13/13 Sichuan pepper seed sIgE positive; 2/13 Sichuan pepper peel sIgE positive, 11 /13 negative

Pericarpium Zanthoxyli induced Anaphylaxis

花椒严重过敏反应及花椒致敏组分分析

表1 花椒过敏患者花椒皮和花椒籽特异性 IgE、点刺试验及合并过敏食物

Table 1 Results of sIgE and skin prick test with *pericarpium zanthoxyli* allergy and the coallergy foods

	特异性 IgE		点刺试验		合并过敏食物
	花椒皮	花椒籽	花椒皮	花椒籽	
1	ND	ND	-	+++	腰果 开心果
2	<0.35/0	21.9/4	-	++++	腰果 开心果 橘子 榛子 芝麻
3	1.48/2	66.5/5	++	++++	腰果 开心果
4	<0.35/0	5.3/3	ND	ND	腰果 开心果 橘子 燕麦
5	<0.35/0	23.7/4	ND	ND	腰果 开心果 芝麻
6	<0.35/0	23.6/4	ND	ND	开心果 松子 橘子 金橘
7	<0.35/0	54.3/5	ND	ND	腰果 开心果 芝麻 杏仁
8	0.96/2	13.9/3	+	++++	腰果 杏仁 橘子
9	<0.35/0	42.7/4	+	++++	腰果 开心果 榛子 橘子 花椒芽
10	<0.35/0	3.3/2	-	+++	腰果 开心果
11	<0.35/0	18.7/4	-	++++	腰果 开心果 橘子 金橘 芝麻 虾蟹
12	<0.35/0	32.2/4	-	++++	腰果 核桃 芝麻 杏仁 橘子 金橘 猕猴桃
13	<0.35/0	8.78/3	ND	ND	腰果 巴西果 榛子
14	<0.35/0	48.9/4	-	++++	腰果 开心果 芝麻 杏仁 芒果
15	ND	ND	-	++++	开心果 橘子 金橘

ND: 未检测; /后为分级数

Outlines

- **Epidemiology**
- **Diagnosis of food allergy**
- **Common food allergen**
- **Allergenic components of food allergens**
- **Further Investigation**

Allergenic components of food allergens

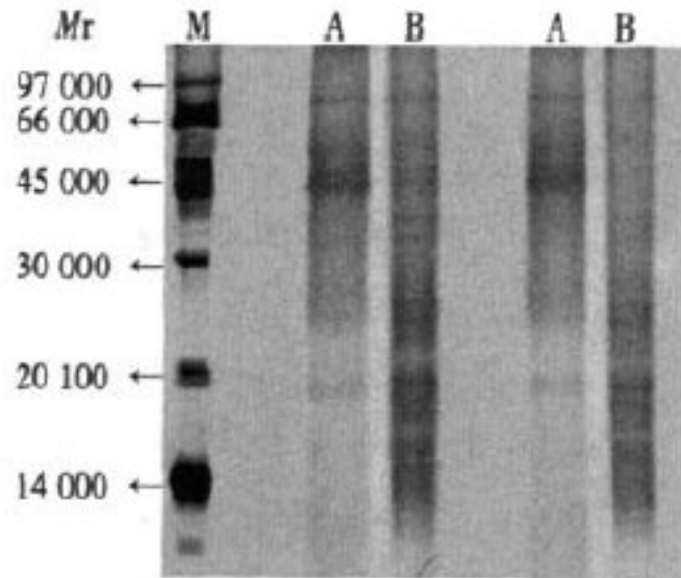


图 1 花椒皮和花椒籽浸液 SDS-PAGE 图谱

Fig 1 SDS-PAGE image of pericarpium zanthoxyli peel and seed extractions

M. 蛋白标准品; A. 花椒皮变应原浸液; B. 花椒籽变应原浸液; Mr. 相对分子质量

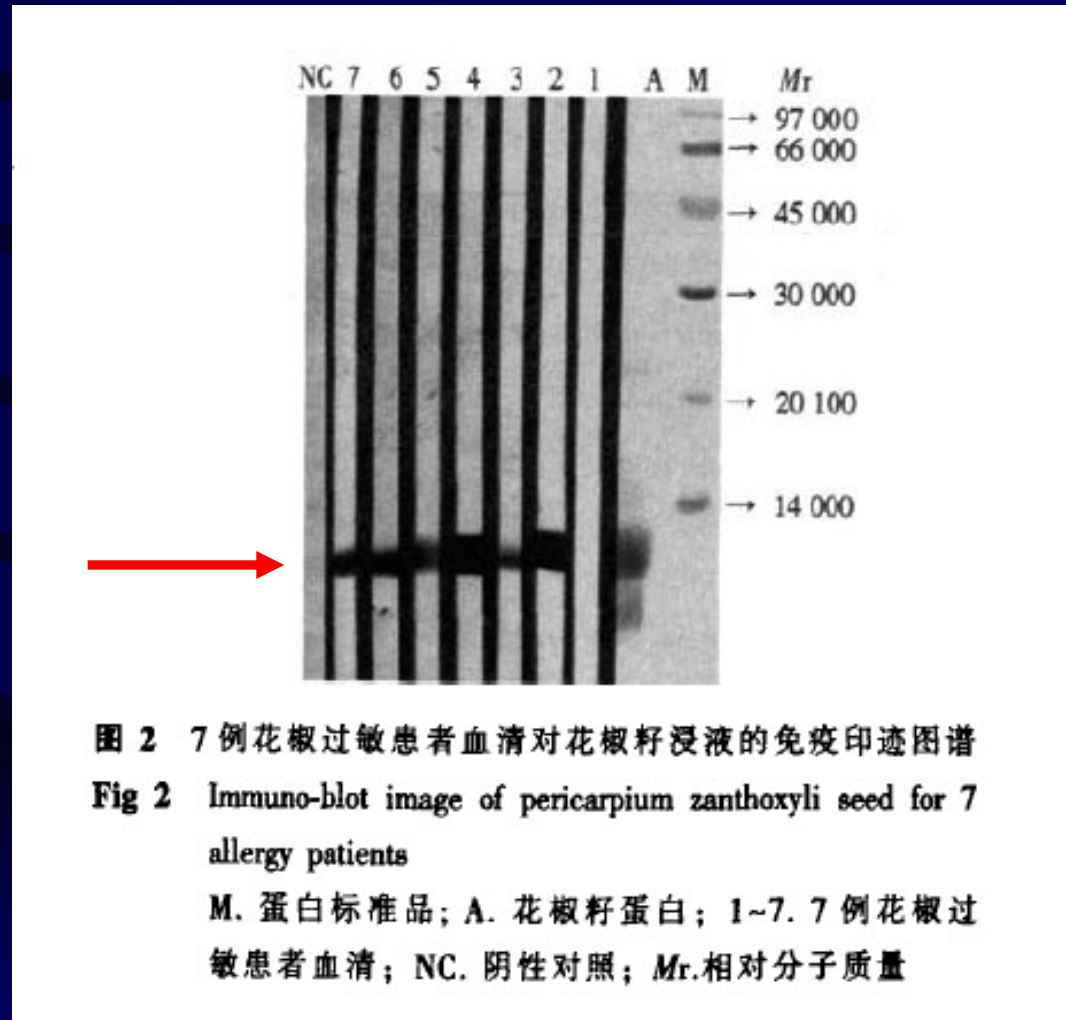
Allergenic components of food allergens

表 2 花椒籽免疫印迹分析结果

Table 2 Immuno-blot analysis result of pericarpium zanthoxyli seed

印记条带编号	病例编号	结合条带 (M_r)
1	6	无
2	7	11 400~12 400
3	2	11 400
4	3	11 400~12 500
5	8	11 400
6	9	11 400
7	12	11 300

Allergenic components of food allergens



Allergenic components of food allergens

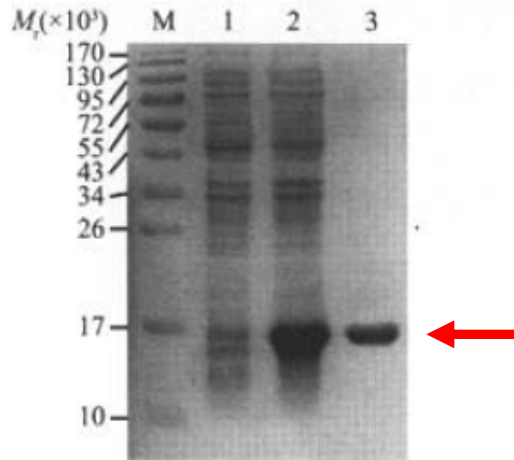


图1 重组蛋白的诱导表达

注: M: 标准相对分子质量蛋白; 1: IPTG 诱导前; 2: IPTG 诱导后; 3: 纯化后的重组蛋白

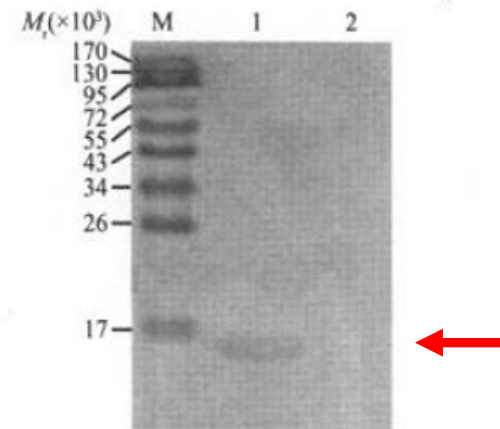
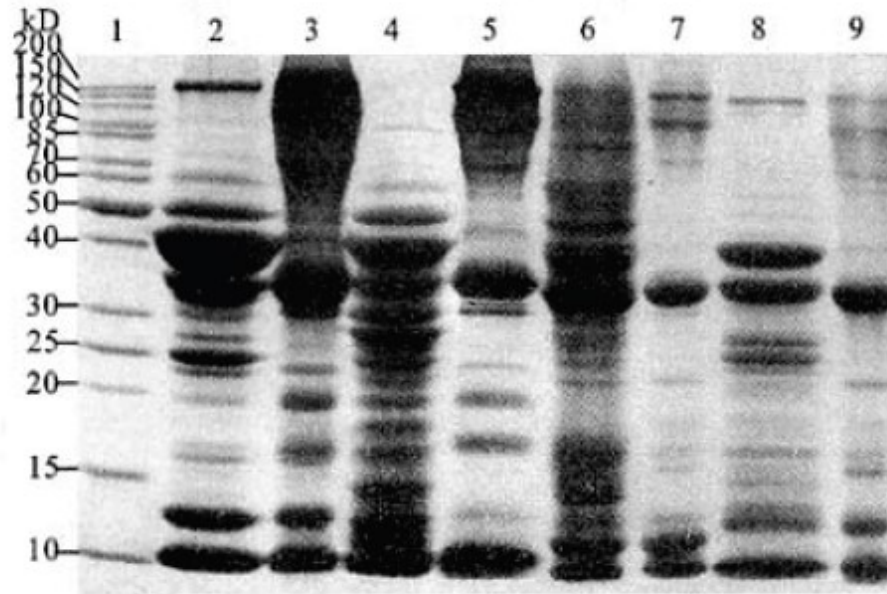


图2 菠萝 profilin 纯化后免疫印迹结果

注: M: 标准相对分子质量蛋白; 1: 阳性血清; 2: 阴性血清

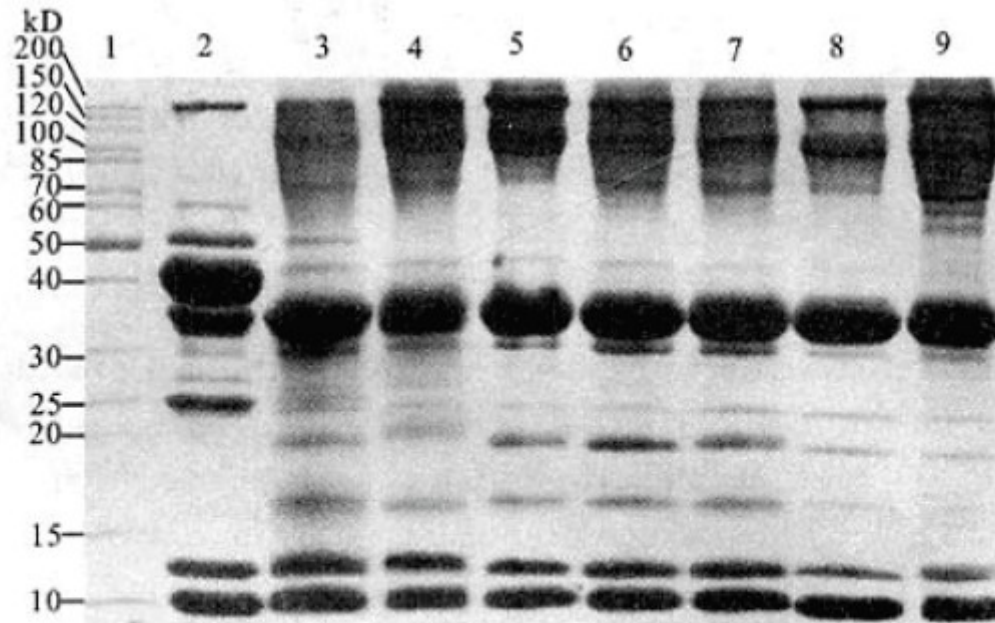
Allergenic components of food allergens



1: 蛋白 marker; 2: 生鲑鱼; 3: 熟鲑鱼; 4: 生鲤鱼; 5: 熟鲤鱼;
6: 生鲈鱼; 7: 熟鲈鱼; 8: 生金线鱼; 9: 熟金线鱼

图 1 4 种鱼类生熟总蛋白电泳图

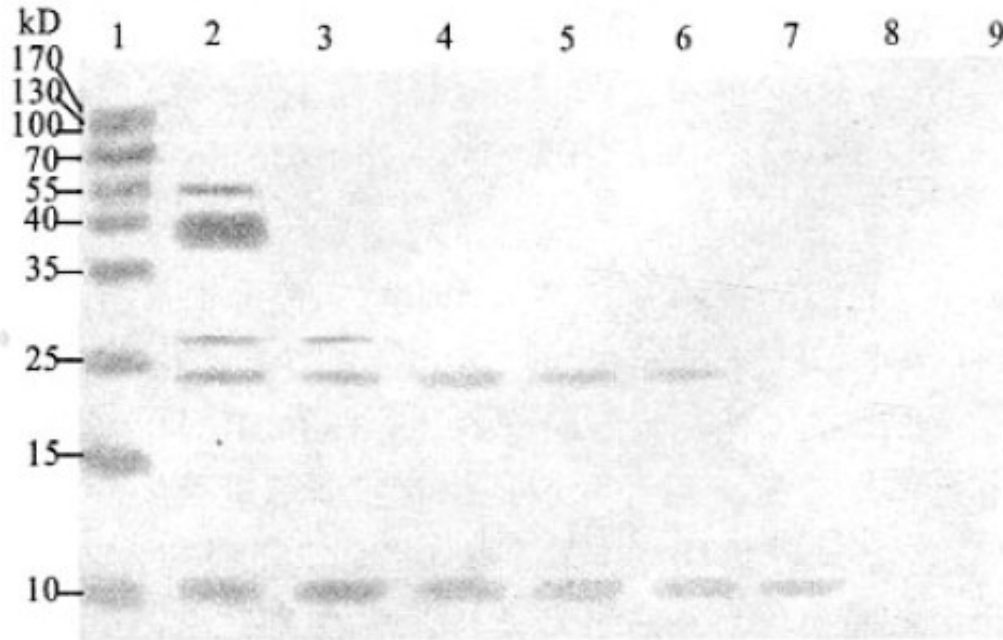
Allergenic components of food allergens



1:蛋白 marker;2:生鲢鱼;3:70 ℃ 10 min;4:80 ℃ 10 min;5:90 ℃ 10 min;
6:100 ℃ 5 min;7:100 ℃ 10 min;8:100 ℃ 20 min;9:100 ℃ 60 min

图2 鲢鱼经不同温度及时间处理后总蛋白电泳图

Allergenic components of food allergens



1: 预染 marker; 2: 生鲢鱼; 3: 70 °C 10 min; 4: 80 °C 10 min; 5: 90 °C 10 min;
6: 100 °C 5 min; 7: 100 °C 10 min; 8: 100 °C 20 min; 9: 100 °C 60 min

图3 鲢鱼经不同温度及时间处理后总蛋白印迹图

Outlines

- **Epidemiology**
- **Diagnosis of food allergy**
- **Common food allergen**
- **Allergenic components of food allergens**
- **Further Investigation**

Further Investigation

- **Study on Epidemiology**
- **Identification of common food allergens**
- **Food provocation test**
- **Study on Allergenic components of food allergens**
- **Animal model of food allergy**
- **Oral immunotherapy**

*Thank you for
attention !*

