

Correlation of the Turbo-MP RIA with ImmunoCAP FEIA for Determination of Food Allergen-Specific Immunoglobulin E

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Abstract. It has been reported that in vitro measurement of food-specific IgE can be used to accurately predict food allergy and reduce the risk associated with double-blinded placebo-controlled food challenges (DBPCFC). Our objective was to assess the performance characteristics of the Hycor Turbo-MP quantitative radioimmunoassay for food-specific IgE and to determine this method's comparability to another assay, the Pharmacia ImmunoCAP fluorescence enzyme immunoassay (FEIA). The dynamic range of the Turbo-MP assay is 0.05 to 100 IU/ml, compared to 0.35 to 100 IU/ml for the FEIA. Performance characteristics of the Turbo-MP assay (ie, reproducibility of the calibration curve, within-run precision, total precision, parallelism, and linearity) were determined using samples from the Hycor serum bank. The precision (CV) of IgE calibrator replicates was <10%. The total precision (CV) of the Turbo-MP assay ranged from 8.8% to 18.4% for specific IgE concentrations between 0.28 to 31.4 IU/ml. Testing of serial dilutions of sera with IgE specificities for egg white, cow's milk, codfish, wheat, peanut, and soybean showed that the assay is linear over the entire dynamic range. Serial dilution data (slopes of 1.01 to 1.10) showed parallelism to serial dilutions of the IgE calibrator (slope of 0.96). The Turbo-MP and FEIA methods were both used for quantitative assays of food-specific IgE in 457 serum samples obtained from a clinical reference laboratory. Comparison of specific IgE results by the Turbo-MP and FEIA methods for 6 major food allergens exhibited a slope of 0.99 (0.92 to 1.03) with a correlation coefficient of 0.81.

Keywords: immunoglobulin E, specific IgE assay; radioimmunoassay; food allergy

Introduction

Allergic reactions to foods are increasing in prevalence in many populations around the world, posing significant challenges in diagnosis and treatment [1]. Accurate diagnosis of food allergy depends on a clinical history, physical examination, elimination diet, and the "gold standard" test, double-blind placebo-controlled food challenge (DBPCFC). However, DBPCFC is cumbersome, costly, and potentially hazardous to the patient. IgE-mediated reactions represent the majority of allergic responses to foods and elevated levels of food-specific IgE are often associated with clinical

symptoms, especially in pediatric subjects [2,3]. Measurements of food-specific IgE may prove to be a valuable diagnostic approach that can reduce dependence on food challenge procedures [4]. Sampson et al [5,6] observed that the ability to use specific IgE tests to accurately identify individuals with food allergy might facilitate avoiding challenge testing in a significant number of cases. Other investigators have reported the use of quantitative specific IgE measurement to accurately predict food reactivity [7]. Much of this work was done with the Pharmacia ImmunoCAP fluorescence enzyme immunoassay (FEIA) system, which is based on the Phadebas technology [8,9].

Standardization of test results remains an important goal for in vitro allergy diagnostic testing. Performance standards for quantitative IgE tests have been published and describe expectations

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of the scientific community [10]. Ideally, specific IgE tests should report results in identical units that are traceable to the WHO International IgE Reference 75/502 and quantitative results across all test systems should be reproducible and correlate well. Several commercially available IgE assays are FDA-cleared as quantitative, with multi-point calibration systems based on WHO International IgE Reference 75/502. These tests have a dynamic range of 0.35 to 100 IU/ml.

The Turbo-MP procedure, a quantitative radio-immunoassay for allergen-specific IgE, has been developed by Hycor. This technique uses high quality allergen source materials and robotic equipment to enable high volume processing (ie, >10,000 tests per day). The Turbo-MP and FEIA methods are quantitative systems that use multi-point calibration; they are based on the same immunochemical principles and yield analytically similar results. In this report, we describe the performance characteristics of the Turbo-MP assay and its correlation with FEIA for measurements of food-specific IgE in serum specimens.

Materials and Methods

Turbo-MP reagents were from Hycor (Garden Grove, CA) and the assay was performed according to the manufacturer's directions. FEIA reagents were from Pharmacia Diagnostics (Uppsala, Sweden) and the assay was performed according to the manufacturer's directions. The assays were performed at Hycor (Garden Grove, CA) and the Laboratory Corporation of America (Burlington, NC).

Turbo-MP assay. The basic operating principle is essentially the same for both the Turbo-MP and FEIA methods. For calibration, both systems use a multi-level standard curve traceable to WHO International Reference Preparation 75/502 and an activated cellulose solid phase with covalently bound anti-human IgE. Hycor calibrators are made from dilutions of a WHO IRP 75/502-traceable stock of IgE diluted in equine serum, with levels of 0.35, 0.70, 3.5, 17.5, and 100 IU/ml. ^{125}I -labeled anti-human IgE is prepared using a chloramine-T method, with a resulting specific activity of 19 to 21 $\mu\text{Ci}/\mu\text{g}$. Hycor allergens and anti-IgE calibrator solid phases have a stability of ≥ 1 year, and are manufactured by covalently attaching proteins to aminophenylthioether-activated cellulose discs (Schleicher and Schuell, Keene, NH). Patient samples, calibrators, and controls (50 μl) are incubated with allergen or calibrator solid phases for 18 hr at 2-8°C. The extended incubation of the Turbo-MP method allows specific IgE binding to reach steady state equilibrium. Incubation at 4°C thermodynamically drives the antigen-antibody binding interaction, which

enhances IgE binding and increases the radioactive counts, while minimizing the amount of solid phase used. After sample incubation, the discs are washed 3-times with a 2.5-ml wash volume and are then incubated with 25 μl of ^{125}I -labeled anti-human IgE for 3 hr at room temperature. Another wash is performed, as before, and the radioactivity on the discs is determined using a gamma counter (Capintec, Inc., Ramsey, NJ). After correction for background, the counts on the calibrator discs are used to construct a calibration curve. Interpolation on the curve between 0.35 and 100 IU/ml is achieved by a least squares best fit to the 4-parameter logistic log function. Extrapolation between 0.05 and 0.35 IU/ml is based on a linear projection between a zero point (defined as 15% of the counts on the 0.35 IU/ml calibrator) and the 0.35 IU/ml calibrator.

ImmunoCAP FEIA assay. Patient samples, calibrators, and controls (50 μl) are incubated with the allergen or calibrator solid phase for 30 min. After washing, the solid phase is incubated with a human anti-IgE β -galactosidase conjugate for 150 min. After another series of washes, a fluorogenic substrate is incubated with the solid phase for 10 min, after which 400 μl of a stop solution is added. The reactions are conducted at room temperature and the endpoints are read by fluorimetry. The standard curve is generated using WHO IRP 75/802 traceable calibrators at 0.35, 0.70, 3.5, 17.5, 50, and 100 IU/ml. Calibration data are fit with a cubic spline function and patient and control values are interpolated on the standard curve to report results from 0.35 to 100 IU/ml.

Detection limit. The limit of detection was defined as that level of IgE that can be statistically distinguished from non-specific background (NSB). Four Turbo-MP assays were performed using allergen discs and a serum containing no human IgE (equine serum, Equitech-Bio, Inc., Kerrville, TX) and the mean $\pm$ SD of the counts was determined and used to calculate the upper 95% confidence limit for NSB.

Assay precision. Intra-assay precision was determined by replicate testing of serum samples with specificities for egg white, cow's milk, codfish, wheat, peanut, and soybean. For each allergen, 3 sera were chosen from the Hycor serum bank on the basis of preliminary in vitro tests using the Turbo-MP assay. Two assays were performed in duplicate on each of 20 separate working days for a total of 40 assays and 80 data points for each serum sample. Within-run precision and total precision data were calculated as coefficients of variation (CV) according to the National Committee for Clinical Laboratory Standards (NCCLS) guideline for user evaluation of analytical precision [11].

Dilution linearity and parallelism. Serum samples with specificities for 6 major food allergens (egg white, cow's milk, codfish, wheat, peanut, and soybean) were selected from the Hycor serum bank for this study. The serum samples were serially diluted from 2-fold to 8,192-fold using equine serum as diluent. The same dilutions were made using the 100 IU/mL IgE calibrator. The undiluted and diluted serum samples and calibrator were assayed using the Turbo-MP system; the

quantitative data were plotted against the inverse of the dilution factor and slopes were determined by least-squares linear regression. All quantitative results were converted by multiplying the value in IU/ml by the dilution factor and the mean, CV, and inter-dilution CV were calculated for each dilution series.

Comparability with another method. Comparison of Turbo-MP and FEIA quantitative data was performed using sera ($n = 457$) obtained from a clinical laboratory (Laboratory Corporation of America). These samples were from patients with suspected food allergy that were referred for testing by their attending physician or allergist. The samples were stored in aliquots at -20°C for ≤ 6 mo before testing, and each aliquot was tested only once, to minimize degradation due to multiple freeze-thaw cycles. The samples were selected using 2 criteria: (1) specificity to the allergens addressed in this study, and (2) specific IgE levels that covered the dynamic range of the in vitro assays. Specific IgE levels for egg white, cow's milk, codfish, wheat, peanut, and soybean were measured using both assays and the quantitative results of the assays were compared by the procedure of Passing and Bablok [12].

Results

Calibration and analytical sensitivity. Fig. 1 shows the performance of the Turbo-MP calibration system within one run. Quantitation between 0.35 and 100 IU/ml was achieved by least-squares regression using the 4-parameter logistic log function. Quantitation of levels <0.35 IU/ml was done by linear interpolation from 0 to 0.35 IU/ml, where the zero point was determined by measuring the average background signal for all allergens using equine serum. The CV of calibrator replicates was $<10\%$. The inset shows a plot of counts per min obtained by testing duplicate dilutions of the 0.35 IU/ml calibrator, demonstrating that the data closely approximate a linear response from 0.05 to 0.35 IU/ml ($r = 0.99$).

Solid phase and detection limit. The solid phase used in the assay consisted of cellulose activated by the aminophenylthioether method. The detection limit for Turbo-MP, based on replicate assays using equine serum as the test sample, was found to be 0.04 IU/ml and the dynamic range of the assay was set at 0.05 to 100 IU/ml.

Assay precision. Within-run precision (CV) of the Turbo-MP assay was $<10\%$ for specific IgE concentrations <15 IU/ml, and $<16.5\%$ for concentrations

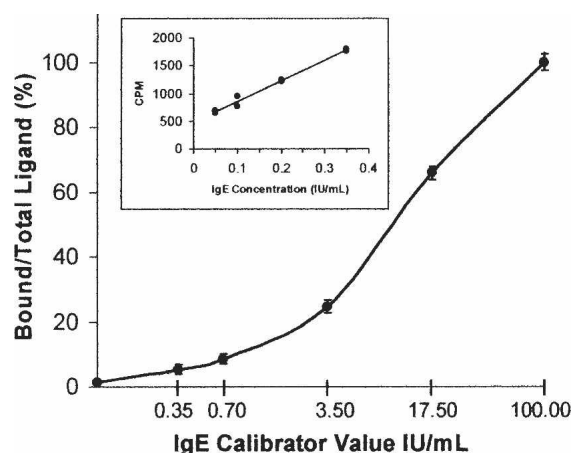


Fig. 1. Turbo-MP calibration curve. Five IgE calibrators were run with a replication of 10 and the radioactive counts bound, expressed as % of total counts, was plotted against calibrator level in IU/ml. The data points represent the average for each calibrator and the bars represent 1 SD (in some cases the error bars are smaller than the data symbol and cannot be seen). The smooth curve was generated by a least-squares best fit to the 4-parameter logistic log function. Calculation of results below the 0.35 IU/ml calibrator was done by linear interpolation between 0 and 0.35 IU/ml. The analytical detection limit of the assay was determined to be 0.04 IU/ml (data not shown). Quantitative results were reported with a dynamic range of 0.05 to 100 IU/ml. The inset shows duplicate results from dilutions of the 0.35 IU/ml calibrator, which are fit by linear regression with a correlation coefficient (r) of 0.99.

≥ 15 IU/ml. The total precision (CV) was $<15\%$ for concentrations <15 IU/ml, and $<20\%$ for concentrations ≥ 15 IU/ml (Table 1). These results were equivalent to the precision guidelines published by the NCCLS. The precision profile (Fig. 2) suggests that the total precision approaches 20% CV at both ends of the dynamic range, with a minimum CV near 3 IU/ml. At the reference laboratory, the vast majority of test results by the Turbo-MP assay are <12.5 IU/ml, where the assay precision is optimal.

Assay parallelism. The concentration of allergen-specific IgE was determined in serially diluted serum samples with specificities for egg white, cow's milk, codfish, wheat, peanut, and soybean. The data obtained using Turbo-MP show that the assay has a linear dose-response over the dynamic range of 0.05 to 100 IU/ml (Fig. 3). The undiluted samples had the following specific IgE levels in IU/ml: egg white, 79.3; cow's milk, 51.0; codfish, 10.0; wheat, 9.3; peanut, 83.3; and soybean, 18.5. The slopes of all of the allergen data sets were from 1.01

Table 1. Within-run precision and total precision of the Turbo-MP assay for food-specific IgE levels.

Allergen ^a	Mean (IU/ml)	Within-run CV	Total CV
Egg white	0.38	8.9%	10.1%
	2.4	6.0%	8.8%
	11.7	9.8%	11.8%
Cow's milk	1.16	10.7%	11.8%
	6.3	7.8%	11.0%
	16.4	11.9%	14.1%
Codfish	0.34	8.9%	11.8%
	17.7	15.3%	16.9%
	30.2	16.5%	18.4%
Wheat	0.35	8.0%	8.8%
	8.1	8.8%	10.1%
	31.4	12.7%	15.9%
Peanut	0.38	7.8%	10.6%
	4.1	9.1%	10.2%
	16.1	11.6%	12.7%
Soybean	0.28	9.7%	11.4%
	8.7	9.3%	9.8%
	18.5	12.3%	17.9%

^a Allergen discs (F1, F2, F3, F4, F13, F14) manufactured by Hycor.

Table 2. Dilutional linearity and precision of the Turbo-MP assay for food-specific IgE levels.

Allergen	Slope	SE	Inter-dilution %CV
Egg white	1.09	0.02	17.6
Cow's milk	1.02	0.02	12.9
Codfish	1.10	0.04	20.6
Wheat	1.01	0.02	18.0
Peanut	1.05	0.05	12.9
Soybean	1.03	0.02	14.7
IgE standard	0.96	0.02	22.2

The Turbo-MP serial dilution data (Fig. 3) were analyzed by linear regression and the slopes (0.96 to 1.10) and standard errors (SE) are tabulated. The inter-dilution CV was determined for values between 0.05 and 100 IU/mL. Specific IgE values for each dilution series were corrected for dilution to extrapolate to the concentration in the undiluted serum.

to 1.10 (Table 2), and the slope of the IgE calibrator dilutions was 0.96. The close agreement of the slopes of allergen-specific IgE data and the calibrator dilution data demonstrate that Turbo-MP assay measures changes in specific IgE that are accurately expressed in terms of WHO International Units.

Turbo-MP versus FEIA. The comparison of quantitative results of both assays was conducted on serum samples with specificities for allergens representing the most common food allergies (Fig. 4). The assortment of samples was chosen to have results evenly distributed between 0.35 and 100

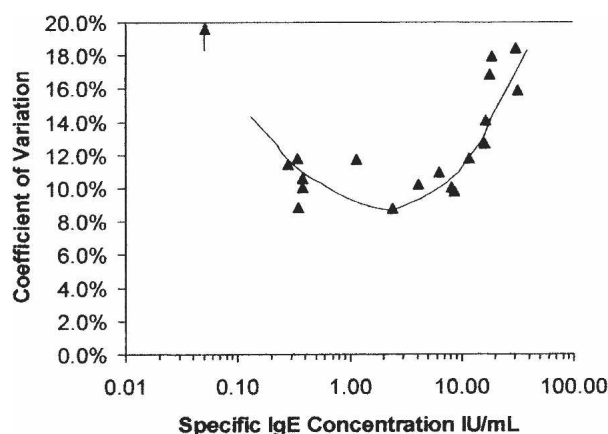


Fig. 2. Total precision profile. An NCCLS EP5 precision study of the Turbo-MP assay was conducted using 18 serum bank samples, representing specificities for 6 food allergens (egg white, cow's milk, codfish, wheat, peanut, and soybean). The symbols represent the interassay CV (total precision) and the curved line is a precision profile fitted to the data points. The horizontal line indicates the 20% interassay CV that defines functional sensitivity, with an arrow showing where this line is intersected at 0.05 IU/mL.

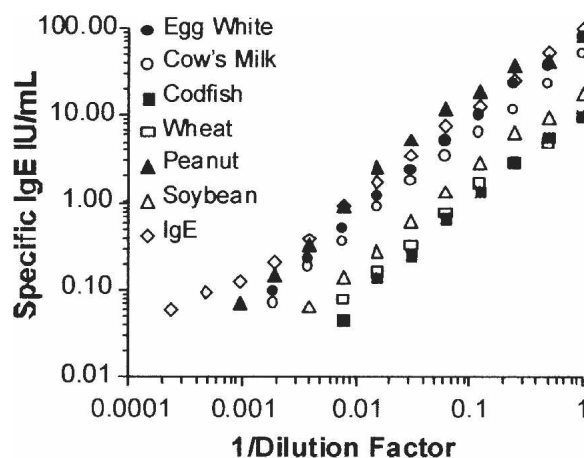


Fig. 3. Parallelism. Serial dilutions of sera were tested for IgE specific for egg white, cow's milk, codfish, wheat, peanut, and soybean. Data points represent the average quantitative results for duplicate tests at each dilution.

IU/ml for the purposes of analytical correlation with ImmunoCAP, which does not report values less than 0.35 IU/ml. The data set consisted of 457 paired results between 0.35 and 100 IU/ml for both methods. The slope of this comparison was close to the ideal value of 1.0, and the intercept was 0.08. The quantitative results are almost symmetrically distributed around the line representing ideal assay agreement. The data show that in some cases one

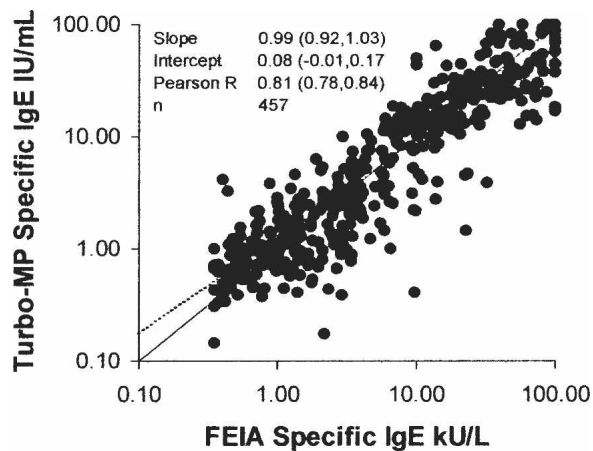


Fig. 4. Methods comparison. Serum samples were tested for IgE specific for major food allergens (egg white, cow's milk, codfish, wheat, peanut and soybean) using the Turbo-MP and FEIA assays. FEIA test results with a value of less than 0.35 IU/ml were not plotted. The solid line represents ideal test agreement ($X = Y$) and the dashed line represents the regression line. Slope, intercept, and correlation coefficient (r) are shown, with 95% confidence limits in parentheses.

assay yields a higher level of specific IgE than the other assay for a given serum sample, and in other cases the converse is true. The results in this study covered the dynamic range of both assays from 0.35 to 100 IU/ml. The data show that, considering the analytical imprecision of both methods, the results produced by the assays correlate well. Fig. 5 shows the data comparisons for each allergen plotted separately. For egg white, cow's milk, codfish, wheat, peanut and soybean the slope values were 1.05, 0.76, 0.87, 0.82, 1.37, and 1.13, respectively. The intercept values in each case were at or near the ideal value of zero (on the log-log plots deviation from an intercept of zero is shown by deflection of the regression curve from a straight line). Qualitatively, the individual plots show data points that are scattered near and around the line that represents ideal correlation. Therefore, for each of these allergens, the quantitative results obtained by the Turbo-MP method demonstrated good agreement with those by the FEIA method.

Discussion

Food allergy is complex in its clinical manifestations and diagnosis [13,14]. The measurement of food-specific IgE by in vitro testing or by skin testing has

been used to screen patients with suspected food allergy [4,15-18]. Recent research suggests that quantitative decision thresholds can be used to predict food hypersensitivity or its absence with a high degree of confidence [1]. Sampson and Ho [5] conducted a retrospective study based on 196 children and adolescents, all of whom had atopic dermatitis. The specific IgE levels for 6 allergens were measured (egg, cow's milk, peanut, fish, soy, and wheat) using the FEIA method. The sensitivity and specificity of specific IgE test results for the diagnosis of food allergy were determined with respect to DBPCFC results obtained from medical records. Using receiver operator curve (ROC) analysis, decision points (specific IgE levels) were chosen that resulted in 90 or 95% positive predictive accuracy (based on an arbitrarily chosen prevalence of 10%) of reactivity to DBPCFC (the highest positive predictive accuracies that could be obtained for wheat and soy were 75% and 50%, respectively). Another set of decision points was selected resulting in 90 or 95% negative predictive accuracy; the highest negative predictive value for peanut was 85%, which suggests that a higher negative predictive value might be obtained if a cut-off <0.35 IU/ml was used. A high decision point could be defined above which 95% positive predictive accuracy is obtained, and a low decision point below which 95% negative predictive accuracy is obtained. Sampson [6] then used these decision points in a prospective study of 100 children and adolescents referred to the clinic for allergy testing. This study showed that the previously determined decision point for positive predictive accuracy allowed correct identification of individuals with food allergies as determined by DBPCFC or convincing clinical history [6]. Sampson [5,6] observed that the ability to use specific IgE tests to accurately identify individuals with food allergy may make it possible to avoid challenge testing in a significant number of cases. However, Sampson also recognized that individuals with levels between the decision points should be challenge-tested, and those with levels below the lower thresholds still have a finite probability of reactivity and may require challenge-testing. Thus, establishing valid upper and lower decision points that define high positive and negative predictive accuracy should

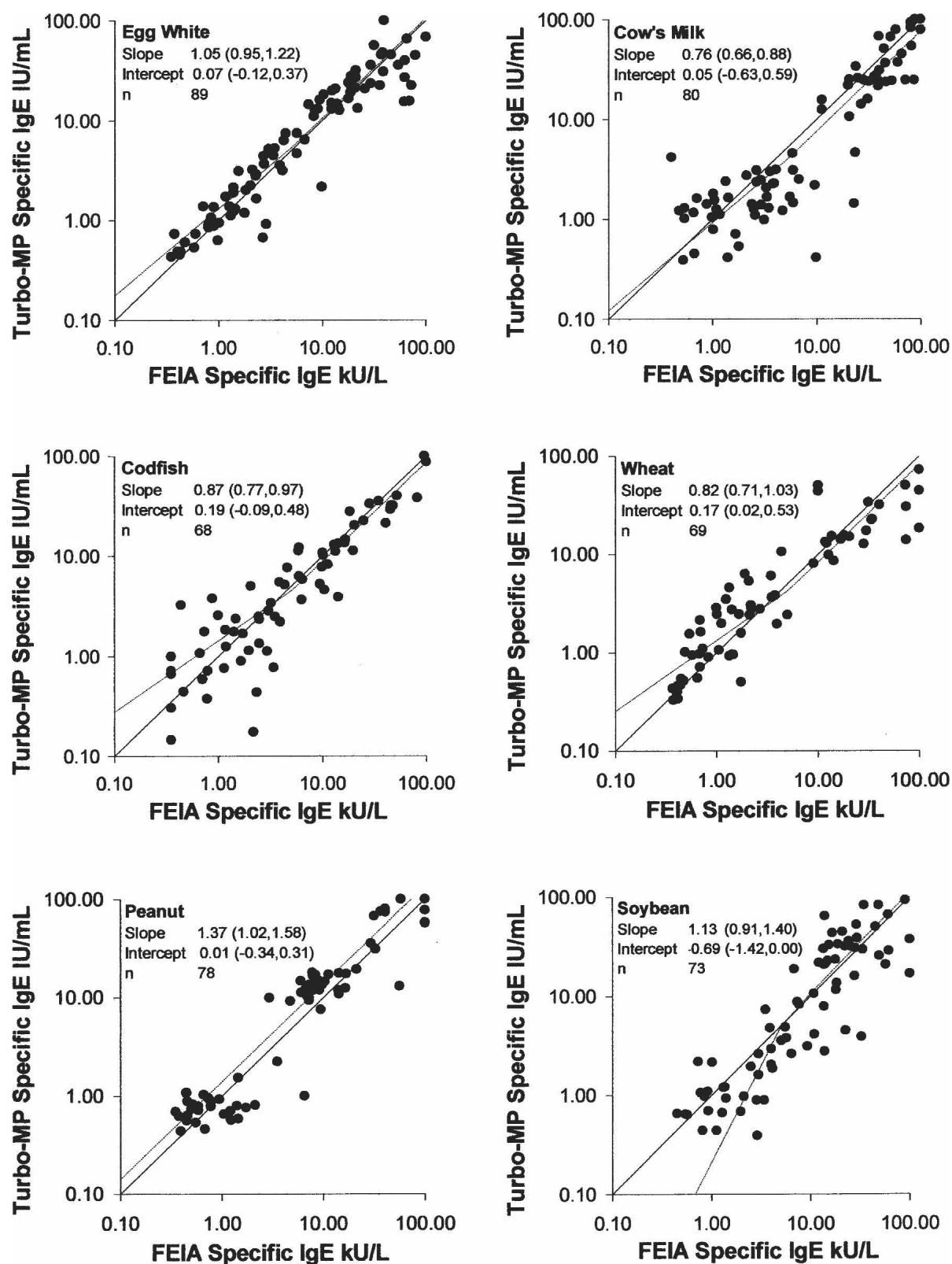


Fig. 5. Methods comparison by allergen. Data for each allergen were individually plotted to show the agreement between the Turbo-MP and FEIA methods. FEIA test results with a value <0.35 IU/ml were not plotted. In all plots the solid line represents ideal test agreement ($X = Y$) and the dashed line represents the regression line. Slopes, intercepts, and correlation coefficients (r) are shown, with 95% confidence limits in parentheses

prove to be an important contribution to the diagnosis of food allergy.

The first part of this study investigated the performance characteristics of the Turbo-MP assay. The analytical threshold was determined by testing multiple allergens with equine serum and calculating the 95% confidence limit of the non-specific signal. This validated the analytical threshold of 0.05 IU/ml. Routine quality assurance testing demonstrated that known negative human serum samples exhibit specific IgE values below this threshold with any solid phase food allergen reagent used in this study, regardless of the total IgE level (data not shown). In this study the total precision (CV) values of results from samples with specific IgE levels of <15 IU/ml were typically less than 15%. At specific IgE levels up to 30 IU/ml the total precision CV was <20%. The functional sensitivity of an assay can be defined as the lowest analyte level that can be reliably determined with an interassay CV of $\leq 20\%$. A plot of the interassay CV values (Fig. 2) shows a biphasic profile, where the imprecision of the assay approaches 20% at either end of the dynamic range and shows a minimum CV near 3 IU/ml. The data in this study suggest that the functional sensitivity of the Turbo-MP assay is <0.10 IU/ml. Costongs et al [19] reported that, using the FEIA assay, total CV values of samples with aeroallergen specificities (0.44 to 72.1 IU/ml) were 7.3 to 17.2%. Total CV profiles of Turbo-MP and FEIA assays are congruent <11 IU/ml, with Turbo-MP total CV values trending higher above this level, although still remaining <20%. The total precision profile of the Turbo-MP assay is similar to the Immulite 2000 assay reported by Li et al [20]. Their precision profile, based on patient sera with IgE specificities to 12 allergens including 2 foods, showed a minimum CV of about 5% at approximately 5 IU/ml; the CV approached 20% at 0.1 IU/ml.

The data in Table 2 and Fig. 3 show that Turbo-MP demonstrates good linearity and parallelism over the entire analytical range of the assay (0.05 to 100 IU/ml specific IgE) [16]. Parallelism of data from serial dilutions of serum samples and IgE calibrator indicates an absence of matrix effects and demonstrates the ability of the assay to analyze patient samples in a way that is identical to the

calibration system for a variety of food allergens. Fig. 3 shows that the assay yields results that are linear down to the stated detection limit of 0.05 IU/ml. In this study the binding capacity of the solid phase was not limiting for the samples with the highest levels of specific IgE (egg white, 79.3 IU/ml; peanut, 83.3 IU/ml; and cow's milk, 51.0 IU/ml). The inter-dilution CV values (Table 2) show the ability of the Turbo-MP assay to correctly predict the concentration of allergen specific IgE in an undiluted sample, based on tests of various dilutions of that sample.

The second part of this study investigated the quantitative agreement of results obtained with the Turbo-MP and FEIA assays with emphasis on food allergens. While there are technical differences between the 2 methods in the shape of the solid phase, the length of incubations, and the detection method, they should produce comparable results since the basic operating principles are the same. RIA methods with extended incubations have been shown to be somewhat more sensitive than EIA methods and, in fact, the Hycor Turbo-MP is able to detect specific IgE levels as low as 0.05 IU/ml, well below the detection limit of 0.35 IU/ml for the FEIA method [21]. For specific IgE concentrations of ≥ 0.35 IU/ml, quantitative comparisons demonstrate that the Turbo-MP and FEIA methods are similar in their ability to report food-specific IgE levels in patient sera, with the results scattered symmetrically about the line representing ideal analytical agreement. The slopes of the individual allergen data sets (Fig. 5) were 0.76 to 1.37, with most values between 0.82 and 1.05. In each case, the data scatter near and around the line of identity. The small sample size may contribute some error in estimating the slope of the quantitative relationship and it is expected that larger sample size may resolve this issue. This is supported by the fact that the composite plot (Fig. 4) has a slope of 0.99. Li et al [20] reported a similar relationship between the quantitative results of the Immulite 2000 and FEIA assays. In a comparison of 169 pairs of results obtained with sera having specificities to aeroallergens, foods, molds, and latex, Li et al [20] observed a slope of 0.99, an intercept of 1.99, and a correlation coefficient of 0.86. Li et al [20] concluded that their data showed good correlation.

We likewise conclude that for concentrations above 0.35 IU/ml the test results of the Turbo-MP and FEIA methods correlate well.

In recent years, several industry initiatives have been undertaken with the goal of improving the comparability of specific IgE methods, both within and among assay manufacturers. NCCLS developed a consensus document (I/LA20-A) that established criteria for assay design, performance, standardization, and quality assurance [10]. A significant recent advance was the introduction of quantitative testing that uses calibration materials traceable to the World Health Organization (WHO) International Reference Preparation (IRP) serum. The FEIA and Turbo-MP methods give quantitative results based on multi-point calibration curves that can be traced to WHO IgE IRP 75/502.

Technological advancements and consensus guideline-based standardization have significantly improved the quality and comparability of today's new FDA-cleared quantitative specific IgE methods. However, it should be noted that the inherent nature of allergens will continue to limit the extent of clinical comparability of specific IgE results. Foods used in specific IgE testing are composed of complex mixtures of proteins and other components [22,23]. Each lot of food extract used in assay production is subject to variations that can affect specific IgE binding [21]. Despite relatively standardized processes of allergen production, it is impossible to avoid some variation [21]. Hycor selects allergen raw materials for use in the Turbo-MP assay by a variety of methods, including testing with an extensive serum bank to assess correlation with the FEIA method. It is useful to note that DBPCFC testing may have the same potential variability in sources of allergen.

Several clinical studies have established the use of food-specific IgE measurements to accurately predict reactivity in patients with suspected food allergy. For example, the threshold for predicting clinical egg allergy was determined by different research groups to be 0.35, 1.5, 6.0, or 17.5 IU/ml, depending on the population tested in each case [5,8,9,24]. Likewise, the threshold for predicting peanut allergy in 2 different patient populations was found to be 15 and 57 IU/ml [5,25]. These studies underscore the fact that decision thresholds

are highly dependent on the population being tested. It is clear that increased IgE levels are positively correlated with increased risk of serious reactions. Most of these studies used the de facto benchmark methodology (FEIA) to measure specific IgE and compared these results with DBPCFC. Our study demonstrated that Turbo-MP is a robust, reproducible assay, with test results that show close correlation with results obtained by the FEIA method. Therefore, results of the Turbo-MP assay can be used to determine food allergy in the same manner as has been established using the FEIA method.

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