Accreditation and Quality Assurance (2019) 24:65–71
https://doi.org/10.1007/s00769-018-1363-3

GENERAL PAPER

Establishment of proficiency testing programs in the Philippines

Leah C. Dajay[1] · Teresita R. Portugal[1] · Jolly C. Climaco[1] · Ma. Rachel V. Parcon[1] · Mildred A. Udarbe[1] · Rose Elaine E. Placio[1] · Prudencio E. Adona Jr.[1]

Received: 5 February 2018 / Accepted: 14 November 2018 / Published online: 27 November 2018

Abstract
In order to improve the competitiveness of Philippine food products in the global market, the Department of Science and Technology—Food and Nutrition Research Institute initiated proficiency testing (PT) programs on some nutrition labeling components using food matrices commonly exported by the country. The institute realized the need to organize affordable, accessible and reliable PTs designed to address the needs of the local testing laboratories. FNRI organized several PT rounds on different food matrices for the analyses of proximates, minerals, total dietary fiber, saturated fatty acids, cholesterol and vitamin C. More than 20 laboratories (government and private) participated in these PT programs, which helped them obtain/sustain their accreditation to ISO/IEC 17025:2005. In February 2013, the Proficiency Testing Laboratory (PTL) was accredited to ISO/IEC 17043:2010 by the Thailand Bureau of Laboratory Accreditation. This strengthened its credibility by being recognized as the first accredited PT provider in the Philippines. Initially, the scope of the accredited PTs included the analysis of proximates and minerals in infant formula. It was extended to include five different food matrices (infant formula, milk powder, wheat flour, corn-based snack food and powdered concentrate-water-based flavored drinks) for nutrition labeling parameters. The PTL continuously organizes new PT rounds to expand its scope of accreditation.

Keywords Proficiency testing · Proximate · Minerals · Infant formula · Milk powder · Wheat flour · Corn-based snack food · Powdered concentrate-water-based flavored drinks

Introduction

The full implementation of the Association of Southeast Asian Nation (ASEAN) Free Trade Agreement in 2015 increased the demand for credible testing laboratories that consistently produce quality data. To ensure the accuracy and reliability of results, laboratories must implement an appropriate program to address their needs in quality assurance verification and continuous performance monitoring. Laboratories should therefore establish the traceability of their methods and the competence of the analysts involved.

According to ISO/IEC 17025:2005, the use of certified reference materials (CRMs) or standard reference materials (SRMs) and control charting can be used to monitor the quality of measurements performed and immediately investigate any problems as soon as they occur. However, participation in PT programs is another tool to evaluate the laboratory's performance [1]. The Philippine Accreditation Bureau hosted by the Department of Trade and Industry (DTI-PAB) requires testing laboratories to participate in PT schemes to obtain and sustain ISO/IEC 17025:2005 accreditation and to use RMs to provide internationally comparable test results.

However, PT and RMs are only provided by few expert laboratories in developed countries (e.g., the USA, Australia and several European countries). These RMs and PTs are barely affordable to most of the local testing laboratories in the Philippines. Furthermore, they do not meet specific needs in terms of food matrices and analytes.

DOST-FNRI, as the focal point on nutrition labeling component analyses, took the lead in organizing affordable, accessible and reliable PTs responsive to the needs of local testing laboratories. The institute initiated PT provision on some nutrition labeling components using food matrices commonly exported by the country. Since 2006, several PT

Presented at the Eurachem PT Workshop, October 2017, Portoroz, Slovenia.

✉ Leah C. Dajay
leah_castillo1084@yahoo.com

[1] Department of Science and Technology (DOST), Food and Nutrition Research Institute (FNRI), Gen. Santos Ave., Bicutan, 1631 Taguig City, Manila, Philippines

rounds were organized on proximate and mineral analyses in wheat flour, powdered tonic food drink and dried shrimp and total dietary fiber (TDF), and moisture analyses in wheat flour [2, 3]. These PTs were provided to most of its local and international PT participants for free.

The FNRI-PTL applied for ISO/IEC 17043:2010 accreditation in August 2012 to the Thailand Bureau of Laboratory Accreditation in order to enhance its credibility and obtain international recognition as food PT provider. It was accredited on February 2013, as the first PT provider in the Philippines, for its PT round in infant formula on proximate (moisture, fat, protein, ash) and mineral (sodium, iron, calcium) analyses. Since then, the FNRI-PTL consistently organized one to two annual PT rounds using new food matrices and/or measurands to sustain and expand the scope of its accreditation as PT provider.

Materials and methods

Regular provision of proficiency testing

Preparation of proficiency test item

Infant formula was the chosen food matrix for the first PT organized by FNRI-PTL in compliance with ISO/IEC 17043:2010 requirements [4]. The following samples were collected by PTL for each of the PT rounds: (a) 10 cans (ca. 900 g each) of infant formula powdered milk obtained from a local milk manufacturing company (FNRI PT 11-01 and FNRI PT 16-01); (b) four cans (ca. 2.5 kg each) of milk powder obtained from a supermarket (FNRI PT 12-01); (c) 25 kg of wheat flour obtained from the manufacturing plant (FNRI PT 14–01); (d) 15 kg of unflavored corn nuts obtained from a manufacturing company (FNRI PT 14-02); and (e) 19 packs (ca. 520 g each) of orange-flavored powdered concentrate collected from the supermarket (FNRI PT 15–01).

The different proficiency test items were prepared following the specific standard operating procedures of FNRI-PTL depending on the nature and type of matrix (including grinding and sieving, when necessary, mixing, coning, subdividing and sealing using vacuum and/or heat sealers). Samples were packed in a pre-labeled laminated aluminum foil packet. The amount of sample per packet depended on the total estimated mass necessary to conduct all the analyses in duplicate. The estimated mass is doubled to consider possible repeat of analysis, if necessary.

Systematic sampling was conducted to allot test items for homogeneity testing, stability testing and its contingency. Random sampling was conducted to select samples for distribution to PT participants, while surplus samples were used as reference materials/quality control test materials. All samples were stored under ambient conditions except for powdered concentrate which was stored under refrigeration. Storage condition for the candidate proficiency test items were determined based on the subsequent trial runs conducted prior to actual preparation of the item.

Characterization of proficiency test item

Homogeneity testing Ten randomly selected proficiency test items were analyzed in duplicate by subcontracted laboratories for all the parameters included in the PT round. The subcontractors that reported results in the frame of the homogeneity (and stability) studies either were accredited according to ISO 17025 for the specific analyses, or had their measurement capabilities proven by acceptable scores obtained in relevant PTs. The statistical evaluation of homogeneity studies was performed according to ISO 13528 [5] and Fearn and Thompson [6].

Stability testing Three randomly selected proficiency test items, stored at appropriate temperature conditions for a period of time (i.e., 1.5 and 3 months for infant formula, wheat flour and corn-based snack food; 1.5 and 4 months for milk powder; and 2 months for powdered concentrate), were analyzed in duplicate for all relevant measurands by the same subcontracted laboratories, using the same experimental conditions applied in the frame of the homogeneity study.

Conduct of proficiency testing

Invitation of participants Local testing laboratories from the government, and private commercial testing services, industry quality control units and academes, as well as foreign laboratories were invited to participate in each PT round.

Distribution of proficiency test items A laminated aluminum foil packet of the test item and various documents (e.g., Sample Receipt Form, Instructions to Participants, Method Details Form, and Results Sheet) were sent to each participant by courier or express mail service. Each laboratory was assigned a unique code number that was used throughout the scheme to preserve confidentiality of the PT results. Since local courier service does not allow any dry ice to be incorporated in the sample, transport stability analysis was performed to measure the possible loss of analyte in the sample, specifically in powdered concentrate that requires refrigeration. Three packs of test item were either stored at controlled condition simulating transport conditions, or sent to the farthest participant for return to the provider immediately. The samples were analyzed for at least moisture to determine its short-term stability.

Analysis of test items and reporting of results The registered PT participants were instructed to analyze the relevant measurands using their own routine method. Participants were given 1 month to submit their results together with their method details. They were also requested to report their estimated measurement uncertainty (MU).

Statistical evaluation of results and performance evaluation The statistical evaluation of the results reported by the participants and the performance evaluation according to z or z' score were conducted in accordance with the FNRI Proficiency Testing Supplement on Statistical Procedures 2011 and 2016 based on the ISO 13528 [5] and the IUPAC Harmonized Protocol [7] as described by Portugal et al. [2, 3].

Distribution of final PT report and certificate of participation Prior to the issuance of final PT report and certificate of participation, an interim report was released presenting the tabulated results and performance scores of the participants. This report was communicated to the participants to verify the correctness of encoded analytical data, statistical evaluation of results and performance evaluation.

ISO/IEC 17043:2010 accreditation and expansion of scope

Establishment of FNRI-PTL ISO/IEC 17043:2010 quality management system (QMS)

The FNRI-PTL QMS was established in compliance with the management system requirement of the ISO/IEC 17043:2010 standard. All documents that form part of its management system (internally generated or from external sources), such as the Quality Manual, Standard Operating Procedures (SOPs), Work Instructions, normative references, PT Protocols, and Statistical Supplement, were generated and controlled. The QMS was implemented according to the scope of the PT activities. The legal identity of the organization and responsibilities of the staff involved were defined. Regular conduct of internal audit and management reviews were also established.

Assessment of the FNRI-PTL ISO/IEC 17043:2010 QMS and continuous expansion of its scope of accreditation

The Thailand Bureau of Laboratory Accreditation hosted by the Department of Science and Service (DSS-BLA) was the accreditation body chosen to assess the conformance of the FNRI-PTL QMS to ISO/IEC 17043:2010 standard. In 2012, the FNRI-PTL applied for accreditation for the PTs on proximates and minerals in infant formula. The FNRI-PTL Quality Manual, the corresponding standard operating procedures and the report of the first PT (FNRI PT 11-01) were submitted for review and evaluation before the on-site assessment.

Since 2013, FNRI-PTL applied annually for the expansion of scope of accreditation, after the successful completion of a PT round for a new matrix/measurand. The DSS-BLA surveillance audit is scheduled every third to fourth quarter of the year.

Results and discussion

Proficiency testing provision

Results of the survey on the food matrix and analysis requirements, conducted in 2011 among the DOST laboratories and other commercial testing local laboratories, identified the priority of food matrix to be investigated: milk and dairy products, fish and marine products, wheat flour/rice flour and baked products, breakfast cereals and snack foods, fruit and fruit juices, and meat and meat products. The following analytes were often requested by the laboratories: proximates, minerals, total dietary fiber, titratable acidity, sugars and vitamins.

The first PT (FNRI PT 11-01) on proximates (moisture, fat, protein, ash) and minerals (iron, calcium, sodium) in infant formula was conducted in 2011. The second PT (FNRI PT 12-01) on proximates (moisture, fat, protein, ash) and minerals (iron, calcium, sodium, potassium, zinc) in milk powder was organized in 2012.

Since the ISO/IEC 17043:2010 accreditation, FNRI-PTL organizes several PT rounds per year using different food matrices (Table 1). The choice of matrices was based on the above-mentioned surveys conducted in 2011, 2013 and 2015 and on suggestions or recommendations provided by participants in the feedback forms at the end of each PT.

FNRI-PTL continued serving the needs of the local testing laboratories providing useful PTs and fulfilled most of the food matrices suggested by the local testing laboratories. The observed decrease in the total number of participants is due to the fact that several participants analyze only specific matrices, or the relevant analytical method is not yet implemented.

Homogeneity testing

The suitability of the proficiency test items for use in PT was determined by establishing its homogeneity. Results showed that all of the six food matrices were of "sufficient" homogeneity, except for iron in powdered concentrate. For the latter, inhomogeneity was accounted for including the between-samples standard deviation (s_{sam}) in the newly computed standard deviation for proficiency assessment (σ'_{pt}).

Table 1 PT schemes provided by FNRI-PTL

PT round FNRI-PTL	Matrix	Analytes[a]	Total no. of participants
FNRI PT 11-01	Infant formula	Proximates, iron, calcium, sodium	38
FNRI PT 12-01	Milk powder	Proximates, iron, calcium, sodium, potassium, zinc	33
FNRI PT 14-01	Wheat flour	Proximates, total dietary fiber, iron, calcium, zinc	37
FNRI PT 14-02	Corn-based snack food	Proximates, iron, calcium, sodium, potassium, zinc, TDF, saturated fatty acids	34
FNRI PT 15-01	Powdered concentrate-*water-based flavored drinks*	Total sugar, vitamin C, iron, calcium, sodium	24
FNRI PT 16-01	Infant formula	Proximates, iron, calcium, sodium, potassium, zinc	28

[a]Proximates refer to moisture, fat, protein and ash

$$\sigma'_{pt} = \sqrt{\sigma_{pt}^2 + s_{sam}^2} \quad (1)$$

Cochran's test results for within-sample variation indicated good analytical precision at 95 % confidence level (critical value is 0.602 for 10 samples, $n = 10$) for all measurands included in each PT round. Moreover, all analyses passed the method precision criteria [i.e., analytical variance $(s_{an})/\sigma_{pt} < 0.50$], indicating that the methods were precise enough to demonstrate homogeneity.

Based on experience on the homogeneity of infant formula in PT 11-01, only selected analytes (moisture, fat, potassium and zinc) were monitored for homogeneity in the second round, PT 16-01.

Stability testing

Statistical analysis of the stability study proved that the investigated proficiency test items were stable for most of the measurands. The "stable" proficiency test items fulfilled for each measurand the required criteria $|A - B| \leq 0.3\ \sigma_{pt}$, where A is the overall average of homogeneity test results at the beginning of the PT and B is the overall average of stability test result after 1.5, 2 or 3 months.

Surprisingly, iron, calcium and sodium in infant formula (PT 11-01) seemed not to fulfill the stability criteria. Similarly, fat in wheat flour (PT 14-01) and corn-based snack food (PT 14-02) seemed to be unstable after 1.5-month storage, but stable after 3-month storage. This apparent instability may be attributed to the lack of analytical reproducibility by the subcontractors.

Most of the measurands (4 out of 5) of the powdered concentrate-water-based flavored drink (PT 15-01) were found not to be stable after 2-month storage or the length of time equivalent from preparation to the conclusion of analysis by participants. Since the results were already submitted, the provider opted to issue performance score through z' scores to account for the instability. The issuance of z' scores, as shown in Eq. (2), accounted for the standard uncertainty of the assigned value ($u(x_{pt})$), which "can be assumed to include the effects of uncertainty due to inhomogeneity, transport, and instability." [5]

$$z'\text{score} = \frac{x - x_{pt}}{\sqrt{u^2(x_{pt}) + \sigma_{pt}^2}} \quad (2)$$

Moisture analysis of the samples for transport stability was performed on all the test items. Stability study provided that samples are stable during transport.

Assigned values

The assigned values (x_{pt}), the respective standard uncertainties ($u(x_{pt})$) and the standard deviation for proficiency assessment (σ_{pt}) were derived for the results of participants of the corresponding PT rounds. The consensus value was used as the assigned value (x_{pt}) when the standard uncertainty ($u(x_{pt})$) of the consensus value met the requirements of ISO 13528 standard ($u(x_{pt}) \leq 0.3\sigma_{pt}$) [5] and the criteria outlined in the IUPAC Technical Report ($0.3\sigma_{pt} < u(x_{pt}) \leq 0.6\sigma_{pt}$) [7].

Table 2 summarizes the outcome of the homogeneity and stability studies and lists the assigned values, the respective standard uncertainties and the standard deviations for performance assessment. The percentages of satisfactory results for the various measurands are also presented.

The consensus value for FNRI PT rounds 11-01, 12-01, 14-01 and 14-02 was derived from the robust average (x^*) of PT participants' results computed using Algorithm A of ISO 13528 standard. Measurement results for fat and ash in PT 11-01; proximates and potassium in PT 12-01; and fat, protein, ash, iron and sodium in PT 14-02, with assigned values having negligible uncertainties ($u(x_{pt}) \leq 0.3\sigma_{pt}$), were assessed using the z scores. The assigned values for measurands having a wide range of reported results (i.e., moisture and protein in PT 11-01; iron, calcium, sodium and zinc for PT 12-01; proximates and zinc in PT 14-01; and moisture, TDF, calcium, potassium and zinc in PT 14-02) had

Table 2 Summary statistics and properties of proficiency test item, per PT round

FNRI PT round matrix	Measurand	Homogeneity	s_{an}/σ_{pt}	Stability	N	Unit	x_{pt}	$u(x_{pt})$	σ_{pt} (%)	Ref	Satisfactory performance (%)
11-01 Infant formula	Moisture	Passed	0.25	Passed	33	g	2.32	0.11	12 %	[8]	79 %
	Fat	Passed	0.38	Passed	30	g	22.09	0.16	5 %	[8]	80 %
	Protein	Passed	0.41	Passed	31	g	***9.70***	0.07	2 %	[8]	71 %
	Ash	Passed	0.40	Passed	34	g	2.51	0.01	2 %	[8]	88 %
	Iron	Passed	0.48	Failed	25	mg	(6.01)	–	–	–	No score
	Calcium	Passed	0.48	Failed	24	mg	(373)	–	–	–	No score
	Sodium	Passed	0.41	Failed	25	mg	(145)	–	–	–	No score
12-01 Milk powder	Moisture	Passed	0.16	Passed	30	g	2.93	0.07	13 %	[8]	97 %
	Fat	Passed	0.23	Passed	25	g	27.31	0.20	3 %	[8]	92 %
	Protein	Passed	0.12	Passed	30	g	22.97	0.17	3 %	[2]	77 %
	Ash	Passed	0.36	Passed	31	g	5.66	0.02	2 %	[8]	97 %
	Iron	Passed	0.13	Passed	28	mg	***7.94***	0.41	9 %	[2]	61 %
	Calcium	Passed	0.09	Passed	27	mg	***812***	34	7 %	[2]	63 %
	Sodium	Passed	0.17	Passed	27	mg	***292***	11	6 %	[8]	67 %
	Potassium	Passed	0.10	Passed	26	mg	1225	28	9 %	CS	92 %
	Zinc	Passed	0.14	Passed	23	mg	***2.60***	0.17	11 %	CS	65 %
14-01 Wheat flour	Moisture	Passed	0.29	Passed	29	g	***11.62***	0.24	5 %	[2]	76%
	Fat	Passed	0.08	Passed	24	g	***1.24***	0.12	17 %	[2]	67 %
	Protein	Passed	0.14	–	27	g	***10.86***	0.09	2 %	[2]	67 %
	Ash	Passed	0.42	–	28	g	***0.38***	0.01	5 %	[2]	71 %
	Iron	Passed	0.40	Passed	17	mg	(3.66)	–	–	–	No score
	Calcium	Passed	0.47	–	18	mg	(17)	–	–	–	No score
	Zinc	Passed	0.26	–	14	mg	***0.51***	0.03	10 %	MVS	71 %
	TDF	Passed	0.43	–	10	g	(2.41)	–	–	–	No score
14-02 Corn-based snack food	Moisture	Passed	0.08	Passed	28	g	***3.19***	0.13	12 %	QC MDS	93 %
	Fat	Passed	0.12	Passed	25	g	14.71	0.21	5 %	Alg A	88 %
	Protein	Passed	0.30	Passed	24	g	9.12	0.05	2 %	Alg A	88 %
	Ash	Passed	0.19	Passed	26	g	1.68	0.02	4 %	Alg A	85 %
	Iron	Passed	0.22	Passed	25	mg	2.56	0.08	10 %	MVS	88 %
	Calcium	Passed	0.12	Passed	24	mg	***187***	7	10 %	MVS	75 %
	Sodium	Passed	0.15	Passed	22	mg	189	5	10 %	MVS	91 %
	Potassium	Passed	0.18	Passed	19	mg	***141***	5	10 %	MVS	84 %
	Zinc	Passed	0.19	Passed	22	mg	***2.64***	0.08	10 %	MVS	91 %
	TDF	Passed	0.11	Passed	10	g	***3.54***	0.16	11 %	Alg A	60 %
	SFA	Passed	0.07	Passed	5	g	(9.47)	–	–	–	No score
15-01 Powdered concentrate-water-based flavored drinks	Iron	Failed	0.09	Failed	13	mg	22.06	1.62	11 %	MVS	85 %
	Calcium	Passed	0.16	Failed	14	mg	381	38	10 %	MVS	71 %
	Sodium	Passed	0.26	Failed	13	mg	587	33	10 %	MVS	62 %
	Total sugar	Passed	0.13	Passed	12	g	82.02	2.12	5 %	expert	75 %
	Vitamin C	Passed	0.06	Failed	14	mg	579	41	10 %	MVS	50 %
16-01 Infant formula	Moisture	Passed	0.47	Passed	24	g	2.42	0.12	12 %	PT 11-01	83 %
	Fat	Passed	0.25	Passed	22	g	23.73	0.51	5 %	PT 11-01	82 %

Table 2 (continued)

FNRI PT round matrix	Measurand	Homogeneity	s_{an}/σ_{pt}	Stability	*N*	Unit	x_{pt}	$u(x_{pt})$	σ_{pt} (%)	Ref	Satisfactory performance (%)
	Protein	–	–	–	21	g	10.14	0.09	3 %	Alg A	71 %
	Ash	–	–	–	24	g	2.66	0.02	2 %	PT 11-01	83 %
	Iron	–	–	–	20	mg	6.17	0.42	15 %	expert	70 %
	Calcium	–	–	–	19	mg	377	19	10 %	expert	79 %
	Sodium	–	–	–	21	mg	155	6	12 %	Alg A	67 %
	Potassium	Passed	0.24	Passed	19	mg	573	19	10 %	expert	89 %
	Zinc	Passed	0.36	Passed	17	mg	4.17	0.22	15 %	Alg A	82 %

(−) not analyzed/computed

N is the total number of data submitted by the participant laboratories

Figures in bold italics are shown for information only (i.e., assigned values and *z* scores are given for information only)

Figures enclosed in parentheses indicate that consensus value is not fit for use as assigned value (i.e., no *z* scores issued)

TDF total dietary fiber, *SFA* saturated fatty acids, *Ref* reference, *CS* Collaborative Study on Whole Milk Powder in China (Wang G, Li X, 1990), *MVS* RSD_r from method validation study of FNRI, *QC MDS* Quality Control Material Data Sheet from FAPAS (T25119QC: corn/maize-based snack food), *Alg A* ISO 13528:2015 Algorithm A, *expert* perception of the Advisory Committee on how PT participants should perform

significantly higher uncertainties ($0.3\sigma_{pt} < u(x_{pt}) \leq 0.6\sigma_{pt}$) that could affect participants' *z* scores. Thus, "*provisional*" *z* scores were given to these parameters indicating that the scores provided are for information only and not for evaluative purposes [2, 7].

No *z* scores were given for minerals (iron, calcium and sodium) in PT 11-01 as the infant formula test item did not fulfill the required criteria of stability for the evaluation of *z* scores. Moreover, the uncertainties of the consensus values for measurands, such as calcium and sodium in PT 11-01, TDF, iron and calcium in PT 14-01, and saturated fatty acids in PT 14-02, were significantly high ($u(x_{pt}) > 0.6\sigma_{pt}$); thus, the consensus values were considered as unsuitable [7].

For FNRI PT rounds 15-01 and 16-01, new procedure regarding computation of assigned values was employed based on the revised ISO 13528:2015 standard [5]. The consensus values for all the measurands included in FNRI PT 15-01 and zinc in FNRI PT 16-01 were derived as the median (*med*(x)) of PT participants' results due to limited number of data included in robust statistics, while for proximates, iron, calcium, sodium and potassium in FNRI PT 16-01, where $n \geq 15$, consensus values were derived as the robust average (x^*) of PT participants' results computed using Algorithm A.

The suitability of the consensus value to be used as assigned value was based solely on the ISO 13528:2015 criteria [5]. *z* scores were provided for protein, ash and sodium in FNRI PT 16-01, which had negligible uncertainties ($u(x_{pt}) \leq 0.3\sigma_{pt}$), while *z*' scores were provided for measurands included in FNRI PT 15-01 and some measurands (moisture, fat, iron, calcium, potassium and zinc) in FNRI PT 16-01, for which $u(x_{pt}) > 0.3\sigma_{pt}$.

Laboratory performance

Except for vitamin C in FNRI PT 15-01, the majority of participants in each PT round obtained "satisfactory" performance (Table 2). Laboratories having reported unsatisfactory results ($|z\text{score}| > 2.0$) were encouraged to review their results and take corrective actions to prevent recurrence of the problem.

No *z* scores were calculated for several measurands in FNRI PT 11-01, 14-01 and 14-02 due to: (a) very high uncertainty of the consensus value or (b) proficiency test items that did not fulfill the required criteria for stability. Since 2015—as suggested in the revised ISO 13528:2015 [5]—the *z*' score was used when $u(x_{pt}) \geq 0.3\sigma_{pt}$.

Conclusion and recommendation

FNRI-PTL successfully provided the analytical testing laboratories of the Philippines with PT schemes on different food matrices for nutrition labeling parameters. These PT schemes assisted the local laboratories in generating quality, reliable and globally acceptable test results. Moreover, the remaining proficiency test items produced from these PT schemes can be used as quality control test materials in the frame of corrective and preventive actions to improve their laboratory performance.

It is highly recommended that FNRI-PTL continuously provides affordable and quality food PT rounds to improve the measurement capabilities of Philippine testing laboratories for food. The PT provider recognizes the need to expand its scope of accreditation into other food matrices and measurands.

Acknowledgement The authors greatly acknowledge the support from Department of Science and Technology—Philippine Council for Industry and Emerging Technology Research and Development (DOST-PCIEERD) as the funding agency of the projects; the members of its Advisory Committee; and the staff of Food Quality and Safety Section of DOST-FNRI.

References

1. ISO, IEC 17025:2005 (2005) General requirement for the competence of testing and calibration laboratories. International Organization for Standardization (ISO), Geneva
2. Portugal TR, Udarbe MA, Ardeña JG, Castillo LN, Mendez ST (2011) Provision of proficiency test (PT) scheme on proximate and mineral analyses: Philippine experience. J Food Compos Anal 24:656–662
3. Portugal TR, Parcon MRV, Udarbe MA (2013) Proficiency test on total dietary fiber in wheat flour. Int J Chem Eng Appl 4(2):82–87
4. ISO, IEC 17043:2010 (2010) Conformity assessment—general requirements for proficiency testing. International Organization for Standardization (ISO), Geneva
5. ISO 13528:2015 (2015) Statistical methods for use in proficiency testing by interlaboratory comparisons. International Organization for Standardization (ISO), Geneva
6. Fearn T, Thompson M (2001) A new test for "sufficient" homogeneity. The Analyst 126(8):1414–1417
7. Thompson M, Ellison SLR, Wood R (2006) The International harmonized protocol for the proficiency testing of analytical chemistry laboratories (IUPAC Technical Report). Pure Appl Chem 78(1):145–196
8. Puwastien P, Pinprapai N, Judprasong K, Sungpuag P (2003) Laboratory performance study 7: analysis of mandatory nutrients for nutrition labelling. Institute of Nutrition, Mahidol University, Nakhon Pathom, Thailand