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https://dx.doi.org/ 10.4314/nvj.v41i3.2 **ORIGINAL ARTICLE**

Knowledge Of Validation Status Of Point-Of-Care Glucometers Among Veterinarians And Veterinary Technologists In Nigeria

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SUMMARY

Point-of-care glucometers (PCGs) have of recent almost replaced the conventional laboratory methods of blood glucose determination in animals. This study evaluated the level of awareness and knowledge about the use of handheld PCGs among veterinarians and veterinary technologists. Respondents to a structured questionnaire included academic staff and laboratory technologists from veterinary schools and public and private veterinarians across Nigeria. Design of the questions progressed from whether one had ever used a PCG before or not, how they knew about the PCG, the brands used, for what purposes and on which animals. Results showed that out of 209 respondents, 75 (36%) had used PCGs. Of this number, 37 (49.33%) used PCGs for research purposes, while 36 and 6.67% had used the PCGs for diagnosis of glucose disorders in animals and for both research and diagnostic purposes, respectively. The distribution of respondents that knew about the validation status of the PCGs used was 2.67%. As values generated by each PCG vary significantly in different species, there may be chances of reporting erroneous research conclusions as well as misdiagnosis of glucose disorders with consequent erroneous therapies in such species.

Keywords Point-of-care Glucometers, Validation status, Veterinarians.

INTRODUCTION

A vital aspect of diabetes management is use of hand-held point-of-care glucometers (PCGs) in monitoring of blood glucose levels, in order to detect and treat glycemic disorders as well as to guide therapy and

dietary management in man and animals (Brazg *et al*, 2013; Suvarnavibhaja *et al*., 2014; Higbie *et al*., 2015). Studies showed improved glycemic control in people with both type 1 and II diabetes mellitus due to self-monitoring of blood glucose (ADA, 1994; Kempf *et al*., 2010; Polonsky *et al*., 2011). Also, PCGs are important in research settings, especially in small animals such as some wild birds and in biomedical research related to obesity and glucose abnormalities in monkeys (Tardif *et al*., 2009; Higbie *et al*., 2015; Mohsenzadeh *et al*., 2015) as they are found to be not only useful in glucose determination with little quantity of blood, but they are also cheap, easy to operate and could generate results in shortest possible time (Lieske *et al.*, 2002). In addition, there is minimal stress induced in animals because of its less-invasive nature, thereby making it possible to regularly monitor blood glucose level at home and therefore reflect more accurately blood glucose levels (Johnson *et al*., 2009).

Although these devices have been successfully applied in some animals, there have been concerns about generation of erroneous results in certain species (Cohn *et al*., 2000; Lieske *et al*., 2002; Freckmann *et al*., 2012; Tauk *et al*., 2015; Clemmons *et al*., 2016; Okorie-Kanu *et al*., 2018a b). The variations in the values generated by use of PCGs have made it imperative to validate device for blood glucose measurements in diverse species of animals to guarantee accuracy of results (Burdick *et al*., 2012).

Validation process helps to minimize erroneous test results, for proper interpretation, case management and consumer safety. It involves determination of intra- and inter-run variability, linearity under dilution and upper and lower reportable limit experiments following American Society of Veterinary Clinical Pathologists (ASVCP) guidelines (Flatland *et al*., 2010), as well as comparison studies between the new method and an already established method or gold standard (Jensen and Kjelgaard-Hansen, 2006).

There are concerns that many people may not be aware of the importance of knowledge of validation status of these PCGs before use. This work therefore was designed to assess the knowledge of veterinarians and veterinary technologists on the importance of validation status of PCGs for blood glucose determination in animals.

MATERIALS AND METHODS

A close-ended questionnaire was distributed to academic and technical staff serving in relevant departments and laboratories of colleges/faculties and Veterinary Teaching Hospitals of 10 Nigerian universities accredited by the Veterinary Council of Nigeria, which included Ahmadu Bello University Zaria, Kaduna State, Michael Okpara University of Agriculture, Umudike, Abia State, University of Abuja, University of Agriculture Abeokuta, Ogun State, University of Agriculture Makurdi, Benue State, University of Ibadan, Oyo State, University of Ilorin, Kwara State, University of Maiduguri, Borno State, University of Nigeria, Nsukka, Enugu State and Usman Danfodio University Sokoto, Sokoto State. Also, the questionnaires were administered to veterinarians, serving in States and Federal Ministries of Agriculture and private practitioners. There was no form of selection of respondents, therefore academic staff, laboratory technologists, public and private veterinarians who were willing to provide the needed information constituted the respondents.

The structure of the questionnaire progressed from knowing the respondent's

designation, whether University academic staff or veterinarian serving in State or Federal Ministry or laboratory technologist in veterinary schools. Respondents were also asked in the questionnaire whether they had used a PCG before or not. If yes, how did the respondent know about the PCG, the brands used and for what purposes, whether for research, diagnosis, both research and diagnosis and other uses, and lastly which animals the PCGs were used on?

The data obtained were subjected to descriptive statistics using SPSS statistical package (version 16.0; SPSS Inc., Chicago, USA). The values were expressed in absolute and relative terms and presented in tables and graphs.

RESULTS

A total of 209 respondents returned the completed questionnaires (Table I), including 61 academic staff representing 29.19%, 66 (31.58 %) of the veterinarians serving in State and Federal Ministries, 75 (35.58 %) private practitioners, while 7 (3.35 %) were laboratory technologists (Figure 1). Out of the 209 respondents, 75 (36 %) had used PCGs, while 134 (64 %) had not (Figure 2). Among the respondents that had used PCGs, 31 respondents representing 41.35% were academic staff, 18 representing 24.00% were veterinarians in States and Federal Ministries, 19 representing 25.33% were private practitioners and 7 representing 9.33% were laboratory technologists (Figure 3).

Also, among the respondents that had used PCGs, 6 respondents representing 8.00% knew about the use of PCGs for determination of blood glucose level via recommendations, 15 (20.00 %) respondents knew about it through colleagues, 12 (16.00 %) respondents through marketers, 4 (5.33 %) respondents knew about it through their supervisors, 6 (8.00 %) respondents knew it from journal papers, 4 (5.33 %) respondents saw them in the veterinary clinics, 1 respondent (1.33 %) each knew because of popularity and through workshop participation, 8 (10.67 %) knew because it was the only available method, 2 (2.67 %) knew about it from laboratory technologists, 9 (12 %) respondents knew through human use and 7 (9.33 %) respondents had no idea how the device was introduced to them (Figure 4).

With regard to the brands of PCG used, at least 4 brands were identified. Among those that had used PCGs, 37 respondents representing 49.33 % used Accu-check Active®, 5 (6.67 %) respondents used Accu-chek Advantage®, 1 (1.33%) respondent used Easycheck® and OneTouch® while 31 respondents representing 41.33% didn't know the brands they used (Figure 5). On the reason for the use of the PCGs, 37 respondents representing 49.33% used them for research purposes, 27 (36.00 %) respondents used them for diagnosis, 5 (6.67 %) respondents used them for both research and diagnosis, 4 respondents representing 5.33% used them for human blood glucose monitoring, while 2 (2.67 %) respondents did not specify what they used them for (Figure 6).

On the animal species for which PCGs were used, 26 respondents representing 34.67% used them on dogs, 1 (1.33 %) respondent each used them on cats and sheep, 18 (24.00 %) respondents used them on rats, 1 (1.33 %) respondent used it on monkey, 6 (8.00 %) respondents used them on two different animal species, 7 (9.33 %) respondents used them on three or more animal species, 10 (13.33 %) respondents used them on human blood glucose monitoring while 5 (6.67 %) respondents did not indicate the animals they used the PCGs on (Figure 7).

On the knowledge about validation status of the glucometers used, 2 respondents representing 2.67% of those that had used glucometers knew and got the information from journal articles (Figure 8).

TABLE I Distribution of PCG use among respondents in States and Abuja (FCT), Nigeria.

States & FCT	Yes	No	Total
Abia	13	4	17
Abuja (FCT)	1	6	7
Adamawa	1	2	3
Bauchi	0	1	1
Benue	5	3	8
Borno	4	8	12
Delta	1	2	3
Edo	0	1	1
Ekiti	1	0	1
Enugu	12	9	21
Gombe	1	2	3
Kaduna	19	22	41
Kano	1	12	13
Kogi	1	0	1
Katsina	0	3	3
Kebbi	0	4	4
Kwara	0	3	3
Lagos	1	0	1
Nasarawa	0	4	4
Niger	0	1	1
Ogun	1	5	6
Oyo	0	3	3
Plateau	10	27	37
Rivers	1	2	2
Sokoto	1	4	5
Taraba	0	2	2
Yobe	1	2	3
Zamfara	0	2	2
Total	75	104	209

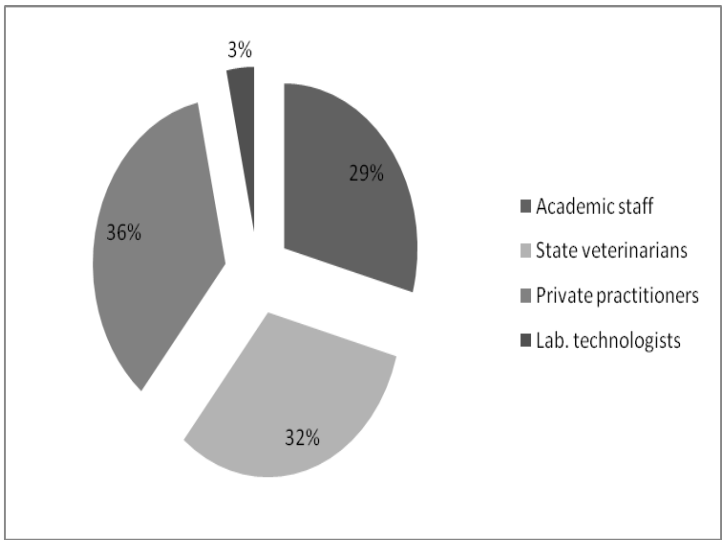

Figure 1 Distribution (%) of respondents based on job designations.

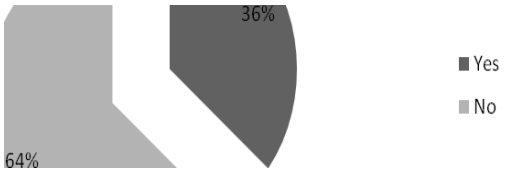

Figure 2 Distribution (%) of PCG use among respondents.

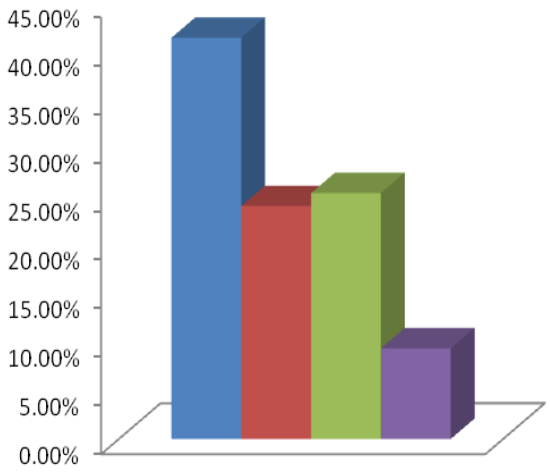

Figure 3 Distribution (%) of the respondents that had used PCGs based on job designations.

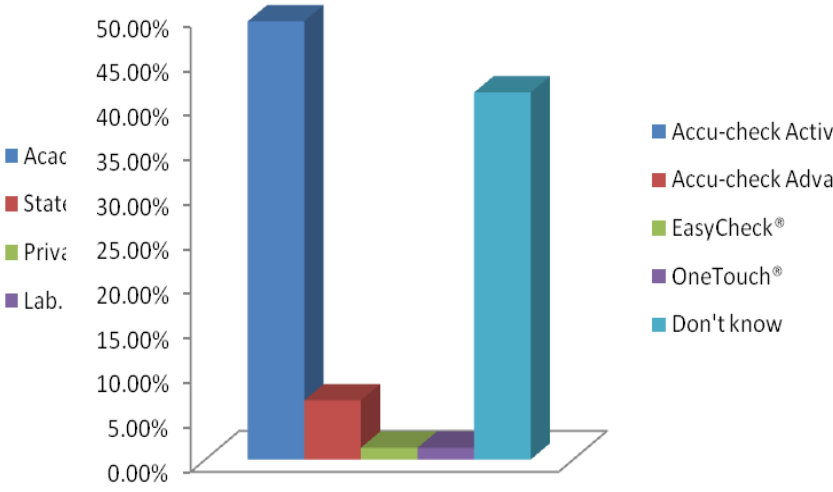

Figure 5 Distribution (%) of brands of PCGs used by the respondents.

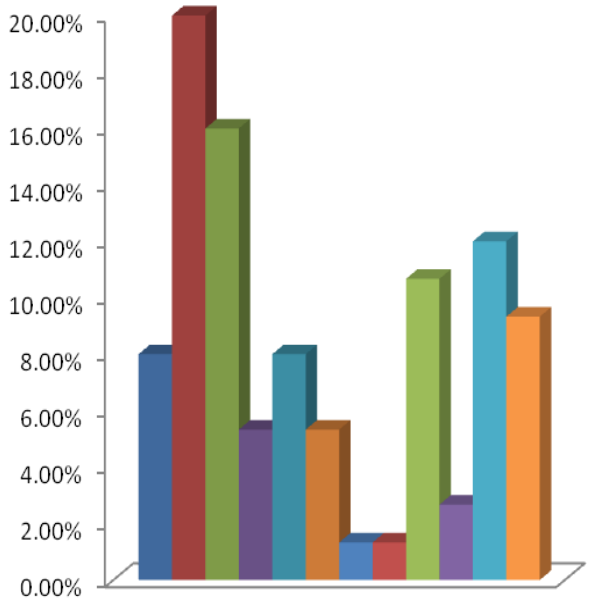

Figure 4 Distribution (%) of means through which respondents that had used PCGs knew about them.

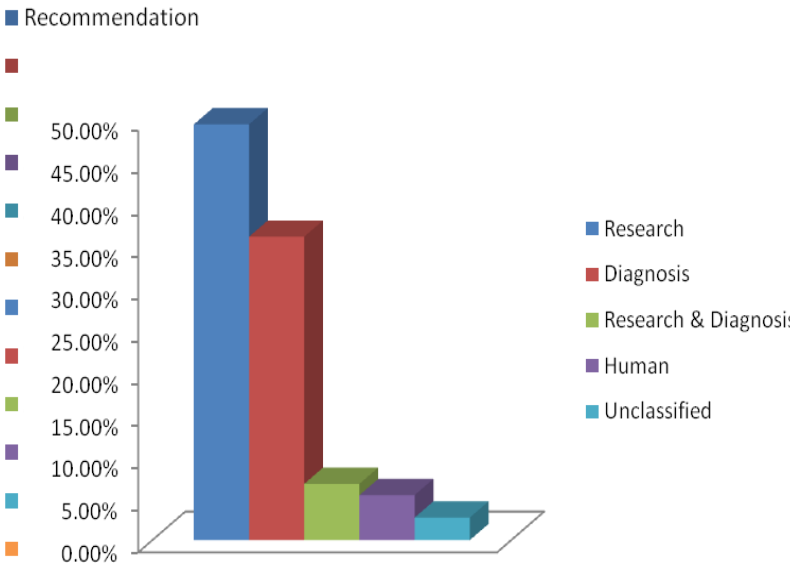

Figure 6 Distribution (%) of purposes for which PCGs were used by the respondents.

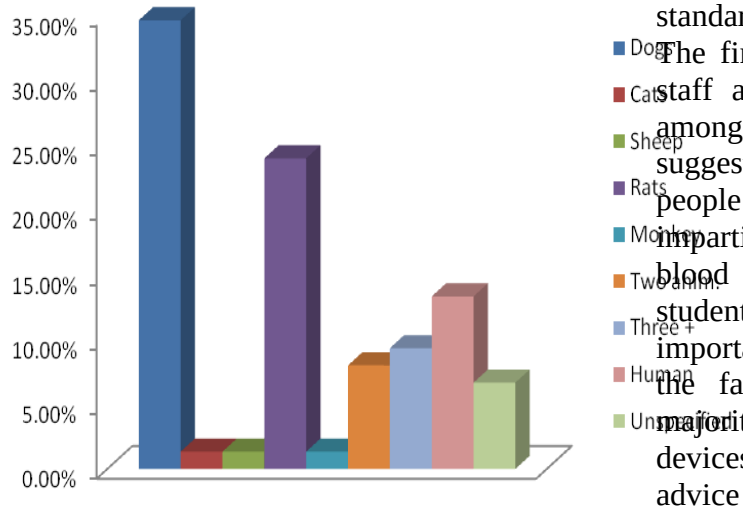

Figure 7 Distribution (%) of animals on which PCGs were used.

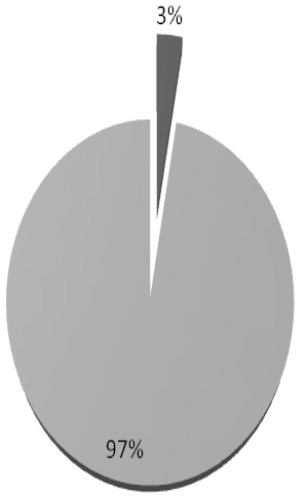

Figure 8 Distribution (%) of knowledge about PCGs validation status among respondents.

DISCUSSION

The findings from this study indicate that the proportion of respondents that had used PCGs was lower compared to those that had not. Nevertheless, the fact that a greater percentage of users had little knowledge about the workings of the devices and the standard operative procedures is worrisome. The finding from this study that academic staff accounted for 41.33 % and highest among the respondents that had used PCGs suggests that a greater percentage of the people charged with responsibility of imparting knowledge of this rapid technique blood glucose evaluation to veterinary students are themselves ignorant of these important procedures. More worrisome is the fact that the means through which majority of the respondents knew about the devices practically left no room for expert's advice on the choice of the PCGs.

Although many brands of PCGs originally designed for use in humans were being used by veterinarians and technologists as observed in this study, only Accu-chek Active®, which accounted for 49.33 % of the PCGs used was validated for use in some species of animals (Johnson and Baker, 1998; Wess and Reusch 2000; Okorie-Kanu *et al*., 2018a b) while others were not validated for use on animal species. This improper use of the devices may partly account for the erroneous results from measurements conducted in certain species of animals (Cohn *et al*., 2000; Lieske *et al*., 2002; Freckmann *et al*., 2012; Tauk *et al*., 2015; Clemmons *et al*., 2016; Okorie-Kanu *et al*., 2018a b). In our previous reports on comparison studies of two handheld PCGs on some animals, one consistently and significantly over-estimated the glucose levels in layers, cows, goats and fish (Okorie-Kanu *et al*., 2018a b).

Among the respondents that had used the PCGs, 49.33 % used them for research purposes and considering the significant variation in the values generated by each PCG in different species of animals; there may be chances of reporting erroneous

research conclusions in some journals. Also, about 36.00 % of those that had used PCGs were for diagnosis of glucose disorders especially in dogs. There is every tendency that the actual glycemic concentration may be missed with the attendant misdiagnosis and erroneous therapeutic interventions. The distribution of respondents that knew about the validation status of the PCGs used was a paltry 2.67% of the respondents. This is very worrisome because although the waste of time and extra cost of diagnosis and treatment arising from this lapse can be quantified; pain, death and other inconveniences are immeasurable.

CONCLUSION

Majority of veterinarians and laboratory technologists are ignorant of validation status of PCGs they use for blood glucose monitoring, diagnosis and research which may lead to erroneous research reports, misdiagnosis of glucose disorders and wrong therapeutic interventions.

RECOMMENDATIONS

1. The importance of knowledge of validation status of PCGs should be emphasized to students by lecturers and laboratory technologists.
2. Choice of PCGs on the basis of cost rather than efficiency should be discouraged.

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