

## Research Article

# Assessment of the State of Herbal Medicines Research and Development in Nigeria

Kanayo P Osemene<sup>1</sup>, Mathew O Ilori<sup>2</sup> and Anthony A Elujoba<sup>3</sup>

<sup>1</sup>Department of Clinical Pharmacy and Pharmacy Administration, <sup>2</sup>Technology Planning and Development Unit,

<sup>3</sup>Department of Pharmacognosy, Obafemi Awolowo University, Ile-Ife, Nigeria

## Abstract

**Purpose:** To examine the state of herbal medicines research and development (R&D) outputs in universities, research institutes and pharmaceutical manufacturing firms in Nigeria.

**Methods:** Questionnaires were administered to core researchers in the above-mentioned research organizations using purposive and convenient sampling technique. The questionnaire elicited vital information on researcher's area of specialization, academic qualifications, state of research facilities and approach to herbal medicines R&D by the organization. Data were analyzed using appropriate statistical tools.

**Results:** The study revealed that the researchers were highly qualified individuals who specialized in eight distinct areas. Research facilities were in varying degrees of deterioration. Major R&D activities were incremental or modification of products/process (58 %), continuous improvement of R&D programs (23 %), radical process/product development (20 %), and creative (11 %) and duplicative (7 %) efforts. Strategies to enhance herbal medicine R&D were increased funding (36.3 %), training of researchers (28.1 %), improvement in R&D infrastructure (18.6 %) and fostering public-private partnership (17 %).

**Conclusion:** Herbal medicines R&D is not fully developed in Nigeria due to a myriad of fundamental challenges facing the key players.

**Keywords:** Research and development, Herbal medicine, Innovation, Pharmaceutical firms.

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\*Corresponding author: **Email:** [osemenekanayo@yahoo.com](mailto:osemenekanayo@yahoo.com); **Tel:** +234-803-716-1268

## INTRODUCTION

In Nigeria, the major actors in research and development (R&D) in herbal medicines are private and public-funded research institutes, universities and pharmaceutical manufacturing firms. Together, these organizations not only represent the bedrock of most R&D activities, but are also responsible for capacity building and training of manpower in the sector. However, failure to utilize such knowledge outputs may lead to stagnation of social and economic progress [1].

R&D activities could be enhanced through partnerships. Partnerships exist within the health R&D system and these include government-industry, research institute-industry, university-industry and any of these combination [2]. Contract research also exist between some pharmaceutical firms that produce herbal medicines and multinational corporations overseas. In any case, it has been reported, that industry partnership with research institutes is more common than with universities [3,4]. Besides, the nature of pharmaceutical R&D activities has been identified as duplicative, creative, incremental or modification of products/process, radical product /process – development, aggressive and defensive [2].

Furthermore, it has been established that plant preparations undergo value-addition or marked improvements in quality, through R&D [5]. Presently, most herbal preparations not only come in various forms, such as chewable and compressed tablets, but also in soft gelatin capsules and as creams, ointment in collapsible tubes or as flavored/coloured syrups [6]. Meanwhile, the mode of pharmaceutical R&D employed in the production of these new and improved herbal medicines from Far East Asian countries has been established. However, this is not the case with herbal medicine pharmaceutical R&D in Nigeria [7].

Current major issue in academic disclosure is the claim that most herbal medicinal products

developed in Nigeria are not supported with proven R&D. Consequently, there are many who have reservations about these medicinal products [8]. This study, therefore, seeks to provide answers to the following questions namely: What is the nature of the Nigerian herbal medicine R&D? What are the dominant herbal medicine R&D types? What strategies are required to enhance such R&D processes in Nigeria?

## EXPERIMENTAL

### Study area

Major actors within the national health innovation system environment (NHISE) where herbal medicine R&D activities take place in Nigeria were covered, namely, pharmacognosy departments/drug production units of universities, research institutes and herbal medicine producers/pharmaceutical manufacturing firms [9].

### Sample size

The sample population consisted of 13 universities involved in herbal medicine R&D, 3 research institutes and 50 herbal medicine manufacturing pharmaceutical firms/herbal medicine producers. Approx. 90 % of the pharmaceutical manufacturing firms in Nigeria are located in southwestern part of the country [10]. In all, the sample size was 325, made up of 100 respondents each from universities and research centres, and 125 from manufacturing firms.

### Sampling procedure

The 13 universities, which consists of 9 Federal government-owned, 2 state government-owned, and 2 privately-owned universities, were selected using a purposive and convenient sampling technique from the list of universities (sample frame) that offer courses in pharmacy [11]. The research institutes were drawn from two broad disciplines, namely, medical and natural sciences which reflect their mandates.

Random sampling technique was employed to select respondents in the research institutes and manufacturing pharmaceutical subsectors to minimize bias.

### Design and administration of questionnaire.

Three different sets of questionnaire were designed and administered. The questionnaire for universities and research institutes were administered to the Dean of the pharmacy school and/or Chairmen of research committee as well as to the, senior manager or officer of the institute responsible for the management of research activities, or any appropriate person identified by the Dean of pharmacy school or director of the research institutes. The questionnaire was also given to core researchers in herbal medicine R&D. The questionnaire for manufacturing pharmaceutical firms/herbal medicine producers was administered to senior R&D and production managers who also responded to questions in a follow-up personal interview session. Each questionnaire had two components: classification questions and questions on core issues. Classification questions assisted in classifying the targeted institution/organization by age, size or sector of operation for the purpose of analysis. The questions on core issues were derived from the statement of the problem and research questions hitherto formulated. The choice of any particular type of question was based on its appropriateness and power to elicit precise response to questions. All research instruments and interview schedules were pre-tested and subsequently used to make

necessary modifications and corrections on the questionnaire before they were administered to respondents. In all, a total of 240 questionnaires were returned, consisting of 74 from universities, 66 from research institutes and 100 from pharmaceutical manufacturing firms/herbal medicine producers.

### Data analysis

Data were collated, coded and variables given sequential numbers, and then analyzed using Statistical Package for Social Sciences (SPSS), version 12, software. The results are expressed in percentages. A  $p$ -value  $< 0.05$  was considered as statistically significant for the purpose of this study.

## RESULTS

Table 1 shows the educational qualification of the respondents. The proportion of PhD degree holders among herbal medicine researchers was greater in the universities (38.8 %) than in research institutes (30.3 %) and herbal medicine manufacturing firms (3.0 %). On the other hand, middle manpower (HND, BSc and MSc degree holders) were proportionally more in research institutes and herbal medicine manufacturing firms than in universities. The differences were statistically significant at  $p < 0.05$ .

### Specialties of herbal medicine R&D researchers

Close to half (45.8%) of herbal medicine researchers (were in the specialty of

**Table 1:** Qualifications of herbal medicine researchers

Organization	HND	BSc	MSc	PhD	Total
Universities	-	4 (5.4%)	8(10.8%)	62(38.8%)	74(100%)
Research institutes	4(6.1%)	14(21.2%)	28(42.4%)	20(30.3%)	66 (100%)
PMHP	11(11.0%)	31(31%)	55(55.0%)	3(3%)	100 (100%)
Total	15(6.3%)	49(20.42%)	91(37.9%)	85(35.4%)	240 (100%)

PPMHP = pharmaceutical manufacturing firms/herbal medicines producers HND = Higher National Diploma; MSc = Master of Science; BSc = Bachelor of Science; PhD = Doctor of Philosophy

pharmacology, while 19.6 % were in photochemistry. Microbiology accounted for 17 %, and formulation/compounding 6.7 %, Others were herbarium, conservation/cultivation and environmental studies recorded 3.8, 2.9 and 4.2 % of the researchers, respectively.

### State of research facilities in herbal medicine R&D organizations

The study revealed (Table 2) that research facilities in herbal medicine pharmaceutical manufacturing firms/herbal medicine producers were generally in better state than those in universities and research institutes. R&D facilities in herbal medicine pharmaceutical manufacturing firms were considered adequate by 88 % of the respondents; this was buttressed by 94 % of respondents who rated the degree of

equipment obsolescence in the sector to be < 40 %. The reverse, however, was the case for the state of facilities in universities and research institutes where 86 % and 91 % of the respondents in universities and research institutes, respectively, rated the facilities as poor; those who also categorized the facilities as being in varying degrees of deterioration was in the range of 60 – 80 %.

### Types of herbal medicine R&D activities

The dominant R&D activity types were identified amongst the various herbal medicine research organizations, namely, incremental and modification of products/process, and continuous improvement of R&D program. However, the degree to which these two R&D activities were practiced differed from one organization to the other (Table 3). Majority of the herbal

**Table 2:** Respondents assessment of the state of research facilities in herbal medicine R&D organizations

Facilities	Universities	Research institutes	Manufacturing firms
<b>Level of adequacy</b>			
Very inadequate	31(41.9%)	32(48.5%)	0(0.0%)
Inadequate	33(44.6%)	28(42.4%)	0(0.0%)
Fair	10(13.5%)	3(4.55%)	12(12.0%)
Adequate	0(0.0%)	3(4.55%)	35(35.0%)
Very adequate	0(0.0%)	0(0.0%)	53(53.1%)
<b>Degree of obsolescence (%)</b>			
0 – 20	0(0.0%)	0(0.0%)	53(53%)
21 – 40	0(0.0%)	10(15.2%)	41(41.0%)
41 – 60	25(33.8%)	11(25.0%)	6(6.0%)
61 – 80	41 (44.4%)	45(60.8%)	0(0.0%)
>80	8(10.8%)	0(0.0%)	0(0.0%)

**Table 3:** Type of herbal medicine R&D activities

Organization	Type of R&D activity	Respondents	
		N	%
<i>Universities</i>	Incremental or modification of product/process	45	60.8
	Continuous improvement of R&D program	11	14.9
	Radical process/product development	18	24.3
<i>Research institutes</i>	Incremental or modification of process/product	41	62.1
	Continuous improvement of R&D program	15	22.7
	Radical process/product development	10	15.2
<i>Manufacturing firms</i>	Incremental or modification of product/process	51	51.0
	Continuous improvement of R&D program	31	31.0
	Creative imitation	11	11.0
	Duplicative imitation	7	7.0

medicine researchers in universities (60.8 %), research institutions (62.1 %) and manufacturing firms (51.0 %) indicated that incremental or modification of product/process was their dominant R&D activity.

Another prominent R&D type was continuous improvement of R&D programs. This was more pronounced in manufacturing firms/herbal medicine producers (31 %), than in research institutes (22.7 %) and universities (14.9 %). Radical process/product development R&D activity was practiced only by R&D researchers in universities (24.3 %) and research institutes (15.2 %).

On oral interview, majority (36.3 %) of the herbal medicine R&D researchers in the various organizations averred that one major strategy for improving R&D process is to increase R&D funding. Other researchers believed that improved capacity building programs for R&D researchers (28.1 %), provision of modern research facilities (18.6 %) and public-private partnership (17.0 %) would also enhance herbal medicine R&D process in Nigeria.

## DISCUSSION

The preponderance of highly qualified herbal medicine researchers in the universities and research institutes indicate that these organizations are centers of knowledge generation. Basically, the main focus in terms of job content in these institutes is teaching and research. Therefore, concentration of highly qualified specialists and therefore those skillful in handling advanced research facilities would normally be expected to be higher in universities and research institutes than in manufacturing firms, and this is buttressed by the findings of this study. The pattern of the quality of researchers across the various organizations studied can be attributed to the nature of tasks in each of the organizations.

Furthermore, the proportion of researchers in areas such as herbarium conservation/cultivation and environmental studies were low. This could be one of the reasons why only a handful of active full-time trained ethnobotanists exist to catalog information on medicinal properties of plants [7]. In any case, researchers may be active in more than one area; though R&D researchers are usually specialists in their area of core competence.

Our findings on the state of research facilities in the organizations corroborate those of previous works [12] where it was also reported that research facilities in educational institutions and public research institutes were in a very poor state but those in the industries were better. This could be linked to the degree of funding in the various research organizations. It has been established elsewhere that the funding of research activities in the universities and public research institutes was poor when compared to what obtains in private research organizations/industries [10].

The present study indicates that R&D organizations in Nigeria mainly transform products or processes by either modifying or improving on existing production knowledge. This may be in response to certain unfolding activities in the competitive market environment such as changes in tastes, demand, and presence of other competing brands, among others. The ability to modify an existing product/process requires in-house R&D capability. Radical innovation is associated with scientific or engineering principles not previously in use. To undertake such research, there is a need for strong in-house R&D capabilities as well as creative and innovation-minded scientists. The present study shows that creative and duplicative research was mainly undertaken in manufacturing firms. This may be in response to competitive forces in the external environment where competition for larger market share in the industry is a major driving

force, especially as the outputs of these firms are product-oriented.

### Limitations of the study

This study was limited to R&D outputs in herbal medicine. The names of herbal medicines that were derived from such R&D processes were not mentioned. This, however, is unlikely to significantly affect the results obtained and their importance.

### CONCLUSION

Pharmaceutical R&D in herbal medicine is not fully developed in Nigeria due to the myriads of challenges highlighted in this study. However, the R&D process can be considerably improved if appropriate strategies, such as those highlighted by the respondents in this study are adopted and implemented.

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