WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 6.805
Volume 5, Issue 6, 119-140. Research Article ISSN 2277– 7105

# EXTEMPORANEOUS COMPOUNDING: ATTITUDES OF COMMUNITY PHARMACISTS AT KHARTOUM CITY

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Article Received on
28 March 2016,

Revised on 19 April 2016,
Accepted on 10 May 2016

DOI: 10.20959/wjpr20166-6287

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## ABSTRACT

**Objectives:** To determine the type and extent of extemporaneous dispensing undertaken by community pharmacists and to assess their attitudes towards related issues. **Methods:** Self-administered questionnaire was handled to every third community pharmacy. **Results:** Fifty-four questionnaires were completed (78.6%), 61.1% males and 38.9% females; 33.3% of respondents dispensed 1-5 prescription weekly; For 70.4% of respondents extemporaneous prescriptions made up >1%-5% of total prescriptions; Products prescribed were mainly dermatological preparations; The main reasons for prescribing were product not commercially available and physician's preference; 92.6% stated that prescriber were very often dermatologist; 22.2% and 20.0% rated standard of the equipments and quality of the ingredients as high, respectively; 33.3% cited that lack of ingredients often limit extemporaneous dispensing; 44.5% and 40.8% had high confidence and satisfaction in extemporaneous compounding, respectively; 59.5% and 53.7% felt that undergraduate training was adequate and their skills increased since graduation, respectively; 81.4% and felt that refreshing courses would be useful; 77.8% agreed for periodical assessment of pharmacists; 40.8% and 40.7% believed that extemporaneous dispensing had greatly decreased in the few past years and will decrease in the future, respectively; 66.7% and 5% agreed that extemporaneous compounding should be undertaken by all pharmacists and decline for all, respectively; 48.2% supported specialist pharmacies. **Conclusion:** Extemporaneous compounding comprises minor part of pharmacy income. Pharmacists

supported keeping extemporaneous compounding within the profession. Several constraints were highlighted. These may be overcome through appropriate stocking of ingredients, equipments maintenance, regular inspection, ongoing continuous education and periodical assessment. Development of guidelines, dermatologic drug formulary and conduct stability testing should also be encouraged.

**KEYWORDS:** Extemporaneous, compounding, community, pharmacists, attitudes, constraints ,dispensing, confidence.

## INTRODUCTION

Standard of practice stated that, when feasible, pharmacists should prepare drug formulations, strengths, and dosage forms, as well as packages that are not commercially available, but that are needed for optimum patients care (American Society of Hospital Pharmacists 1985; Kalman and Schlegel 1979).

For centuries extemporaneous compounding was an elementary task of the pharmacist, and since early 1950s this situation has gradually changed. As more manufactured preparations became available the demand for extemporaneous dispensing by pharmacists has steadily declined and the profession shifted towards a more patient oriented role in the optimal choice and use of medicines. In several Western countries compounding by individual pharmacies even ceased to exist or was dramatically minimized. Nowadays the incidence of extemporaneous prescriptions is estimated in vicinity of 1% in Australia (Pappas 1999) or slightly higher in some western countries (Kettis et al 1991; Buurma et al 2003). According to the Dutch National Health Insurance the share of pharmacy compounded products declined from 5.5% in 1994 to 3.7% in 2000. Whereas, a conflicting data from Foundation for Pharmaceutical Statistics confirm that there is a decline during these years, but not as strong: from 6.6% in 1995 to 5.5% in 2000. In spite of this fact, however, most pharmacists strongly believed that extemporaneous dispensing should be remained within the profession as a whole.

Several studies have been published in the literature assessing opinions and attitudes of community pharmacists towards extemporaneous dispensing. Findings from these studies revealed that there has been periodical concern expressed by authorities in declining of practitioner competence prescribing extemporaneous products (Pappas 1999). The standard of equipments and raw materials used has also been questioned and pharmacist themselves

have undependably express concerns. Variation in product quality and pharmacist level of skills has also been reported[3]. Inadequate experience with calculations, lack of quality assurance, time for undertaking the task and the deficiency in the stability and clinical efficacy information about extemporaneous products has been questioned as well (Fisher et al 1991; Davis 1997; Trissel 1994; Stewart and Tucker 1982; Purkiss and Kayes 1981). Other study (Treadway et al 2007) revealed variability in overall compounding practices and training and in practices specifically related to certain compounded preparations. Likewise, similar studies have been conducted to test the relative bioavailability, pharmacokinetics and stability of extemporaneously prepared formulations from commercially available, tablets, capsules and solutions (Nahata 1999; Thompson et al 2003; Alexander and Kaushik 2004; Jann et al 1998; Freed et al 2005).

Due to the lack of such study in Sudan, it was thought timely to consult the community pharmacists about standard, value and directions of this service. The objectives of this study was to identify the type and extent of extemporaneous dispensing and reasons for prescribing, to assess the quality, condition and standard of ingredients, equipments and scales used, to determine the perceived constraints that limit immediate dispensing of extemporaneous products; to assess personal level of confidence and professional satisfactions towards the service as well as level of skills in compounding, to determine factors that influenced pharmacists' attitudes towards extemporaneous dispensing and to view the perceived present and future of this service and to suggest feasible improvements where appropriate.

## Methods

### Survey instrument

A self-administered questionnaire was developed on the basis of other related studies (Pappas 1999; Stewart and Tucker 1982; Purkiss and Kayes 1981). A draft of the questionnaire was piloted on a convenience of 10 community pharmacists. The survey consisted of a brief introduction to the study and contained 37 questions and options to provide comments and suggestions. The study was designed to address the followings:

1. The characteristics of the study population: comprise 10 questions aimed to compile demographic information about age, gender, marital status, type and location of premises, work experience, qualifications, University, staff position, business hours per week.
2. Type and extent of dispensing extemporaneous preparations: encompass 7 questions used to collect data on prescription volume received and type of extemporaneous dispensing

undertook; who prepare the extemporaneous prescriptions; average period in minute that take the pharmacist to prepare extemporaneous product; the estimated percentage of overall extemporaneous prescriptions to overall prescriptions dispensed; who request extemporaneous compounding and reasons for prescribing extemporaneous products.

3. Preparation for dispensing: contains 7 questions deal with: the adequacy of compounding area; quality, standard, and condition of ingredients, equipments and scales used; control of expiry dates; standard for storage of ingredients; constraints for immediate extemporaneous compounding.
4. Attitudinal questions towards extemporaneous dispensing: contains 13 attitudinal questions and statements dealing with demand for services in the past and future; confidence; satisfaction and level of skills maintenance; factors influencing general attitudes; and views in the present and future of extemporaneous service.

The terms "extemporaneous dispensing" and "extemporaneous compounding" were used in exchangeable manner throughout the survey. Most questions were measured by five-point Likert scale (Likert 1932). Certain questions also permitted a written response or selection doesn't know or don't have.

**Subject selection and distribution**

Due to logistical difficulties, the 240 surveyed pharmacies were randomly selected from a list of registered pharmacies included in the comprehensive medical directory, 2007 in Khartoum city. From this list then every third pharmacy was selected. Accordingly, the final list comprises 80 pharmacies.

After piloting, the final questionnaire with minor modification was handled by face-to-face encountered to the pharmacy director of these premises. Of the pharmacists approached, 70 agreed to participate in the study and 10 declined for various reasons including concerns about confidentiality, commercial sensitivity and concerns about the time involved in taking part. The questionnaire was followed-up in person for collection on later date that range from one to ten weeks, and pharmacy staff had the opportunity to ask questions about the study and data collection process. Non-respondents were telephoned or visited to return their questionnaire. All returned usable questionnaires were completed anonymously. Data collection was performed in three months from March to May 2015.

**Statistical analysis**

All usable questionnaires returned were coded and entered into the Statistical Package for Social Sciences (SPSS) database version 16.0 (SPSS Inc., Chicago, IL) prior to analysis. Percentage and frequency distribution then was calculated for each of the variables. The statistical differences in the attitudes towards extemporaneous dispensing by demographic attributes were identified using $X^2$ test with significant difference indicated by 5% level of significance. The effect of demographic characteristics on selected variables was tested using one-way analysis of variance (ANOVA). Demographic characteristics tested were for: gender; age; marital status; qualifications; work experience; type and location the premises; staff position in premises; business hours. Only those showed significant difference was mentioned.

**RESULTS**

While 70 pharmacists agreed to participate, 10 never recorded any data and further 6 not recorded full data. Only 54 pharmacists had recorded a full data set, representing a response rate of 78.6%.

**Demographic characteristics of respondents**

The socio demographic characteristics of the respondents are shown in Table 1. 61.1% of respondents were from male and 38.9% from female, with respondents distributed across 4 ages groupings (<30 y 61.1%; 30-39 y 14.8%; 40-49 y 7.4%; ≥ 50 y 16.7%). No significant differences between male and female ($P$<0.102) and marital statues ($P$<0.276) were identified. Significant higher proportions of the sample were from pharmacies having extended work hours from 99-128 hours ($P$<0.002). Nearly 24.2% of independent pharmacies had 13 part-time pharmacists, compared with 12 in 22.2% of chain pharmacies. Approximately 21 (40%) and 12 (22.2 %) of the independents and chain pharmacies employed at least one pharmacy assistant technician, respectively. The majority (55.6%) of respondents completed their pharmacy education at Khartoum University, with remainder at other Sudanese universities (31.5%) or in foreign universities (12.9%).

**Number of prescriptions received**

The estimated weekly number of prescriptions received for extemporaneous dispensing was: Zero prescriptions for 7.4% of the respondents; 1-5 prescriptions for 33.3%; 6-10 prescriptions for 27.4%; 11-15 prescriptions for 18.5%; 16 -20 prescriptions for 9.3% and >20 prescriptions for 3.7% of respondents. About 33.0% of the respondents stated that they

were often prepared the prescriptions which they received. Of these 85.2% of the pharmacists personally undertook the task of compounding, whereas, only 14.8% delegated it to assistant technicians. The average time for preparation was estimated as 6-10 minutes by 44.4% of pharmacists, 11-15 minutes by 22.2% of the pharmacists, 10-20 minutes by 16.7% of the pharmacists and more than 20 minutes by only 7.4% of the pharmacists. No time was recorded by 9.4% of the pharmacists surveyed.

**Frequency (%) of dosage forms requested**

The data related to the types of dosage forms frequently received for compounding are presented in figure-1. There was a large share of dermatological dosage forms. About 81.5%, 79.6% and 40.7%, of the respondents stated that ointments, creams and lotions were the most popular prescriptions they received for compounding, respectively. This followed by 35.1% for ENT (ear, nose, throat) prescriptions. 27.8% for oral emulsion, 22.2% for oral solution, and 20.4% for suspension. Only 11.2% and 5.4% of respondents reported that powder and rectal, respectively, were among prescriptions requested for compounding. When the pharmacists were asked about the proportions of prescribed extemporaneous products they would describe as therapeutically effective or safe or inadequate. About 55.5% of the pharmacists considered them as high or very high therapeutically effective, 20.4% moderate, 14.9% low or very low, and only 9.3% they don't know. With regard to safety 35.2% of respondents thought that it was low or very low, 13.0% reported high, 31.5% moderate and only 20.4% did not know. Whereas, in respect to inadequacy, 61.1% of respondents believed that they are low or very low, 11.1% stating moderate, and only 3.8% viewed them as high or very high. Whilst only 24.0% stated that they did not know.

**Percentage of extemporaneous dispensing share**

The estimated percentage of the share of pharmacy extemporaneous compounded products to overall dispensed prescriptions was estimated at <1 by 20.4% of pharmacists, 1%-2% by 22.2% of pharmacists, 3-5% by 27.8% of pharmacists, 6-8% by 3.7% of the pharmacists, 9-11% by 11.0% of the pharmacists,>12% by 9.3% of the pharmacists.

**Who request extemporaneous products?**

The most common prescribers of extemporaneous prescriptions were illustrated in Figure -2. Approximately, 92.6% of pharmacists stated that often or very often they received prescriptions from dermatologists, whilst 25.9% 20.4% and 16.0% stated the same frequency for ENT specialists, pediatricians and general practitioners, respectively. Only 9.30%, 11.1%

and 7.4% of respondents reported that often or very often they received prescriptions from surgeons, dentists and veterinarians, respectively.

**Reasons for prescribing extemporaneous products**

Respondents were asked for their views regarding reasons for requesting extemporaneous products. Reasonable proportions stated that often or very often a product (57.4%) or strength (26.0%) was not commercially available or preference by the physician (55.6%) or product equivalent to commercial product but of low cost (33.3%). Between 9.3% and 24.1 % also estimated that often or very often the dosage form was either not commercially available or that needed for patients care, Table-2.

**Adequacy of space and availability and standard of equipments**

When pharmacists were asked how adequate the dispensary space in their pharmacies? About 57.4% felt that their dispensary space was adequate or very adequate, 35.2% considered it as inadequate or very inadequate and only 7.4% stating neutral. Also, when they were asked to what extent their dispensary space equipped with the necessary equipments for suitable compounding, 33.3% of the pharmacists considered it as low or very law, with 44.4% stating neutral and only 22.3% viewed it as high or very high. However, concerning the standard, conditions and availability of equipments (Table 3), about 4-23% of the pharmacists felt that the condition of their equipments such as mortars (glass & porcelain), dispensing weights, liquids measures, mixing containers, steering rods and heating equipment as very low or low, whereas, half and more than two third of the pharmacists rated their prescription balance and large pan balance as very low or low, respectively. 68.6% of the pharmacists indicating the lack of electronic balances. Most of the pharmacists (27.8%-51.8%) reported the condition of their scales as moderate, 22.2-38.9% as high or very high, and 16.7-37.1% as low or very low with regard to level with bench, cleanliness, sensitivity and accuracy. 0nly 13% equally indicated that they don't know if their scales were sensitive or accurate. Also, with respect to certification of scales, 77.8% of respondents never certified their scales, 13% undertook certification every 1-3 months and only 9.2% every 4-12 months.

**Quality, control and level of confidence in the ingredients**

Respondents were asked to what extent the ranges of ingredients they stock cope with the demand of variety of extemporaneous products received. About 20.4% and 48.1% rated them as high or very high and moderate, respectively, whilst 31.5% stating low or very low. On the other hand, in respect to their level of confidence in the ingredients they stock in terms of

quality, stability and level of contaminations, 38.9% of the respondents indicated that it is very high or high, while 37% of pharmacists consider it as moderate and only 24.1% consider it as low or very low. Likewise, the proportion of ingredients with expiry dates were rated by 53.7% of the respondents as low or very low, by 27.7% as high or very high and moderate by only 13%, whilst only 5.6% did not know.

Moreover, concerning stock control of the ingredients for expiry date, 37.1% of the respondents indicated that they checked them rarely, whereas 25.9% checked them immediately prior to use, 20.4% every 1-3 months and 9.3% every 4-12 months. Only 1.9% and 5.6% of the respondents checked them every 2-3 years or more, respectively. However, considering the standard of storage of the ingredients, approximately, 29.7%, 38.9% and 31.5% of the respondents rated the storage of their ingredients as low or very low, moderate and high, respectively.

More respondents reported low or very low standard storage for ingredients were males ($P$<0.05) more than females, while pharmacists working in pharmacies in shopping centers (<0.024) reported high or very high standard storage for ingredients than their counterparts.

**Constraints influenced immediate extemporaneous dispensing**

The respondents were asked how frequently a list of situations had occurred which led them to refrain immediate response to extemporaneous dispensing. A lack of ingredients was the most common factors that limit immediate dispensing of extemporaneous product (Table 4).

Assessment of the influence of socio-demographic characteristics on constraints that limit immediate extemporaneous dispensing showed that pharmacists less than 30 years of age ($P$<0.05) and staff employees ($P$<0.05) had a significant effect on the factors: lack of expertise and lack of references, respectively, and were more likely to ask the patients to return the next day or referred them to another pharmacy than their counterparts.

**Confidence, professional satisfaction and level of skills**

Pharmacists were asked about their confidence, professional satisfaction and level of skills in extemporaneous dispensing ability. 44.5% and 42.6% of the respondents stated that their confidence in extemporaneous dispensing was high/very high or moderate, respectively, whilst only 12.9% felt that it was low or very low. Approximately, 40.8% and 42.6% reported their professional satisfaction in this field as high or very high and moderate, respectively,

and merely 16.6% considered it as low or very low. With regard to skill levels 53.7% of the respondents felt that their level of skills in extemporaneous dispensing practice had increased or greatly increased since they were graduated as pharmacists, 24.1% believed that it remained the same, and only 22.2% felt that it had decreased or greatly decreased.

Assessment of the influence of socio-demographic characteristics of the respondents on their level of confidence and level of skills showed that they exhibited significant differences. Age and years in practice of respondents was found to have a significant effect ($P<0.005$) and ($P<0.008$), respectively on general confidence in extemporaneous dispensing ability. Those age 40-49 and those in practice for more than 20 years showed high confidence in extemporaneous dispensing ability than others. Similarly, age, marital status, year in practice were found to have a statistical significant effect on level of skills in extemporaneous dispensing ($P<0.002$, $P<0.016$, and $P<0.006$, respectively). More respondents aged 40-49 years showed high increase in their skill levels than the others, while, married participants reported high increase in level of skills than single ones. Those in practice for 10-20 years felt that their skills had increased or greatly increased compared with their counterparts.

**Skills and interest in refreshing courses and periodical assessment**

Almost 59.2% of the pharmacists surveyed felt that their undergraduate training was adequately or very adequately equipped them with the necessary skills to prepare extemporaneous products, whilst 33.4% felt inadequately or very inadequately prepared and only 7.4% indicated that they don't know. Respondents were asked if training in undergraduate should be given more emphasis, 44.5% of respondents agreed strongly agreed and 35.2% stating neutral, whereas 20.3% disagreed or strongly disagreed. Also, large proportions of respondents (81.4%) felt that a refreshing course in extemporaneous dispensing would be useful or very useful at the moment; with only 7.4% stating useless and 11.2% neutral. Moreover, 77.7% of the respondents agree or strongly agree that all pharmacists should be periodically assessed to determine their competence in extemporaneous dispensing, whilst 16.7% were neutral and only 5.6% disagreed.

Business hours per week of pharmacy were found to have a statistically significant ($P=<0.039$) effect on giving more emphasizes in undergraduate training. Pharmacists in pharmacies with extended working hours (>140 hours) felt that undergraduate training should be emphasized or overemphasized compared with their counterparts in pharmacies with normal working hours.

**Factors influencing respondents' attitudes**

When pharmacists were asked to indicate factors that influenced their attitude towards extemporaneous dispensing, appreciable number of pharmacists (18.5-22.2%) indicated the following were of high or very high concern: lack of practice in extemporaneous dispensing, inadequate payment for extemporaneous products, lack of stability or incompatibility information, unknown bioavailability, unknown safety inadequate availability of dispensing equipments. However, fewer respondents (5.6%-13%) stated that questionable quality of ingredients and time taken to prepare a product was highly or very highly influenced their attitudes towards extemporaneous compounding (Table-5).

Assessment of influence of socio-demographic characteristics of the respondents on factors that influence their attitudes about extemporaneous dispensing showed numerous statistically significant findings. Age of respondents was associated with 2 out of 8 factors. Respondents more than 50 years of age felt that factors: lack of practice in preparations (*P*=<0.021), time taken in producing a product (*P*=<0.026) had low or very low influencing in their attitudes compared with others. Years in practice were significantly associated with 3 of the 8 factors. Those with more than 20 years indicated that the lack of practice in field of compounding (*P*=<0.007), time taken in producing a product (*P*=<0.004) had low or very low influence on their attitudes than their counterparts. Marital status was significantly associated with one factor: lack of stability information, where married respondents showed lower influence on their attitudes than the single ones (*P*=<0.026). Pharmacists working in chain pharmacies were highly influenced with the factor: inadequate availability of equipments, than their counterparts in independent pharmacies (*P*=<0.041).

**Past and future trends in extemporaneous compounding**

When pharmacist were asked how would they describe the trend in extemporaneous prescribing in the past few years as well as how they see the future trend in extemporaneous prescribing, 40.8% of the respondents believed that demand for extemporaneous compounding had decreased or greatly decrease over the few past years, with 25.9% equally felt that it remained the same or decreased. Whereas only 7.4% stated that they didn't know. However, concerning future trend in extemporaneous compounding, 40.7% of respondents thought that it would be decrease or greatly decreased, 38.9% anticipated increase or great increase, whilst 13% of respondents expected that it will remain the same. Only 7.4% reported that they didn't know.

**Present views and prospects for future**

The pharmacists were also assigned three attitudinal statements to agree or disagree on: (i) extemporaneous dispensing should be undertaken by all pharmacists (ii) the profession as whole should decline its role in extemporaneous compounding; (iii) overall the task handled by pharmacists who were specialized in the area of compounding. Those who disagree with the statements also were requested to give reasons for that.

For the first statement: 66.7% agreed or strongly agreed, 24.0% were neutral and only 9.3% disagreed or strongly disagreed. While, for the second statement: 5.0% of respondents agreed or strongly agreed, 12% were neutral and 83% disagreed or strongly disagreed. Their disagreement centered on: extemporaneous dispensing has been a traditional task that pharmacist performed since the beginning of the profession and still; the pharmacists are only the healthcare professionals that possess knowledge and skill required for compounding and preparing products; demand for patient with unique condition; extemporaneous dispensing is fundamental and unique to pharmacy profession; skill that differentiate pharmacists from physicians and other healthcare professionals; opportunity for best training; the need to be undertaken by all pharmacists; the practice of compounding keeps a professional features for the pharmacists.

However, for the last statement: 48.2% agreed or strongly agreed, 33.3% were neutral and 18.5% disagreed or strongly disagreed for specialized compounding pharmacies. The reasons cited for disapproval put emphasis on: extemporaneous dispensing should be a task undertaken by all pharmacists without limiting to specialist pharmacies; a need to maintain broad knowledge and skills by the whole pharmacists.

Marital status was found to have a statistically significant ($P$=<0.05) effect on keeping the present situation of the pharmacies i.e. all pharmacists undertaken the task, with married respondents tended to have higher agreement with the statement than the single ones.

**Comments from respondents**

Several comments of the respondents were shown in Table-6.

**Table 1. Demographic characteristics of the respondents**

| Demographic characteristics | n (%) | $x^2$ *P<.05* |
|---|---|---|
| **Age (yr)** | | .000 |
| <30 | 33 (61.1) | |
| 30-39 | 08 (14.8) | |
| 40-49 | 04 (07.4) | |
| >50 | 09 (16.7) | |
| **Gender** | | .102 |
| Male | 33 (61.1) | |
| Female | 21 (38.9) | |
| **Marital status** | | .276 |
| Married | 23 (42.6) | |
| Single | 31 (57.4) | |
| **Location** | | .000 |
| Main street | 19 (35.2) | |
| Near hospital | 19 (35.2) | |
| Polyclinic | 09 (16.7) | |
| Shopping center | 05 (09.3) | |
| Industrial area | 02 (03.7) | |
| **Position in the pharmacy** | | .000 |
| Pharmacist in charge | 34 (63.0) | |
| Working owner | 18 (33.3) | |
| Partner-proprietor | 02 (03.7) | |
| **Qualification** | | .000 |
| B pharm | 49 (90.7) | |
| M clin pharm | 03 (05.6) | |
| Higher diploma | 02 (03.7) | |
| **Experience in practice (yrs)** | | .000 |
| ≤5 | 29 (53.7) | |
| 6-10 | 12 (22.2) | |
| 10-20 | 01 (01.9) | |
| >20 | 12 (22.2) | |
| **Type of pharmacies** | | .000 |
| Independent | 34 (63.0) | |
| Chain pharmacy | 20 (37.0) | |
| **weekly business hours of the pharmacy** | | .002 |
| 56-66 | 07 (13.0) | |
| 77-88 | 18 (33.3) | |
| 99-128 | 22 (40.7) | |
| 140-168 | 07 (13.0) | |

**Table 2. Reasons cited for extemporaneous prescribing**

| Reason (s) | Never/rarely n (%) | Often/Very often n (%) |
|---|---|---|
| Product not commercially available | 23(42.6) | 31(57.4) |
| Preparation with patients' specific reasons: | | |
| Demand of prescriber | 24(44.5) | 11(55.6) |
| Special strength needed | 40(74.1) | 14(26.0) |
| Demand of patient | 41(75.9) | 13(24.1) |
| Demand for product from commercial tablets, capsules and solutions or injections | 41(75.9) | 13(24.1) |
| Demand for official products | 42(77.8) | 12(22.3) |
| Demand for patients with unique condition | 44(81.5) | 10(18.5) |
| Intolerance to commercial product (e.g. hypersensitivity) | 46(85.2) | 08(14.9) |
| Inconvenience taste of commercial product | 49(90.8) | 05(09.3) |
| Equivalent to commercially product but of low cost | 36(66.7) | 18(33.3) |

**Table 3. Standard, condition and availability of equipments and dispensing scales**

| Issues examined | Very low/low n (%) | Moderate n (%) | Very high/high n (%) | I don't have n (%) |
|---|---|---|---|---|
| **Equipments:** | | | | |
| Prescription balance | 27(50.0) | 13(24.1) | 14(25.9) | 0 |
| Large pan balance | 33(61.1) | 06(11.1) | 08(14.8) | 07(13.0) |
| Electronic balance | 0 | 06(11.1) | 11(20.4) | 37(68.6) |
| Dispensing weights | 21(38.9) | 15(27.8) | 09(16.7) | 09(16.7) |
| Liquid measures | 13(24.1) | 13(24.1) | 21(38.9) | 07(13.0) |
| Mixing containers | 19(35.2) | 14(25.9) | 15(27.8) | 06(11.1) |
| Stirring rods | 19(35.2) | 16(29.6) | 10(18.5) | 09(16.7) |
| Spatulas | 23(42.6) | 10(18.5) | 13(24.1) | 08(14.8) |
| Mortar & pestles | 04(07.4) | 11(20.4) | 32(59.2) | 07(13.0) |
| Heating equipments | 28(51.8) | 08(14.8) | 11(20.4) | 07(13.0) |
| Sterilization equipments | 0 | 03(05.6) | 03(05.6) | 48(88.9) |
| **Dispensing scales:** | | | | |
| Issues examined | Very low/ low n (%) | Moderate n (%) | Very high/high n (%) | I don't know n (%) |
| Level with bench | 14(25.9) | 28(51.8) | 12(22.3) | -------- |
| Cleanliness | 09(16.7) | 24(44.4) | 21(38.9) | -------- |
| Sensitivity | 20(37.0) | 15(27.8) | 12(22.3) | 07(13.0) |
| Accuracy | 15(27.8) | 16(29.6) | 16(29.6) | 07(13.0) |

**Table 4. Constrains that led pharmacists to refrain immediate dispensing of extemporaneous prescriptions**

| | Never /Rarely n(%) | Sometimes n(%) | Often/Very often n(%) |
|---|---|---|---|
| Lack of ingredients | 21(38.0) | 18(33.3) | 10(28.7) |
| Inadequate equipments | 45(83.3) | 03(05.6) | 06(11.1) |
| Lack of references | 45(83.3) | 04((07.4) | 05(09.3) |
| Inadequate mixing containers | 46(85.2) | 03(05.6) | 05(09.3) |
| Inadequate dispensing weights | 47(87.1) | 03(05.6) | 04(07.4) |
| Lack of time | 47(87.1) | 03(05.6) | 04(07.4) |
| Lack of expertise | 45(83.3) | 08(14.8) | 01(01.9) |

**Table 5. Factors influenced pharmacist's attitudes towards extemporaneous compounding**

| Factors | Very low/ low n (%) | Moderate n (%) | Very high/ high n (%) |
|---|---|---|---|
| Lack of practice in preparation | 24(44.5) | 18(33.3) | 12(22.2) |
| Inadequate payment for the product | 27(50.0) | 16(29.6) | 11(20.4) |
| Lack of stability information about the product | 31(57.4) | 12(22.2) | 11(20.4) |
| Unknown bioavailability and clinical efficacy of the product | 27(50.0) | 16(29.6) | 11(20.4) |
| Unknown safety of the product | 31(57.4) | 12(22.2) | 11(20.4) |
| Inadequate availability of dispensing equipments | 26(48.2) | 18(33.3) | 10(18.5) |
| Questionable quality of ingredients used | 32(59.3) | 15(27.8) | 07(13.0) |
| Time taken to prepare a product | 32(59.3) | 19(35.2) | 03(05.6) |

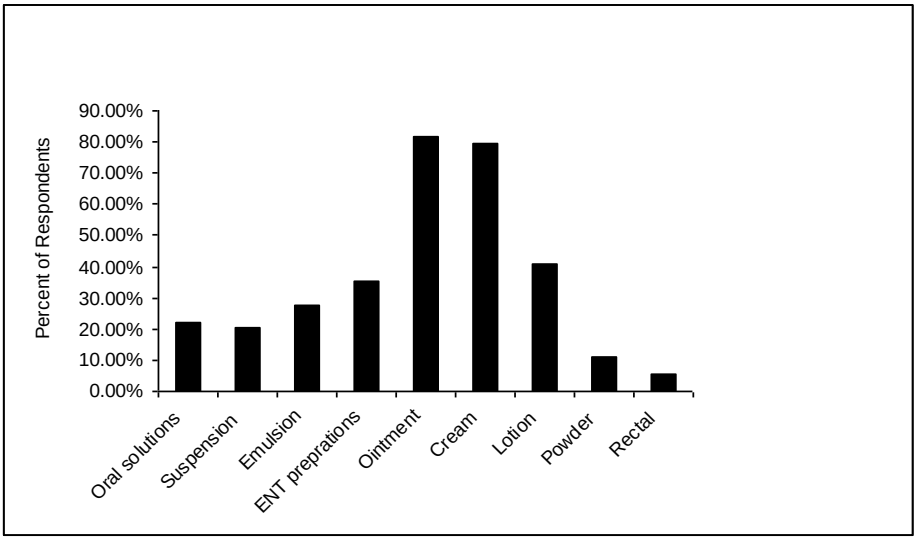


**Figure 1. Commonly prescribed extemporaneous dosage forms**

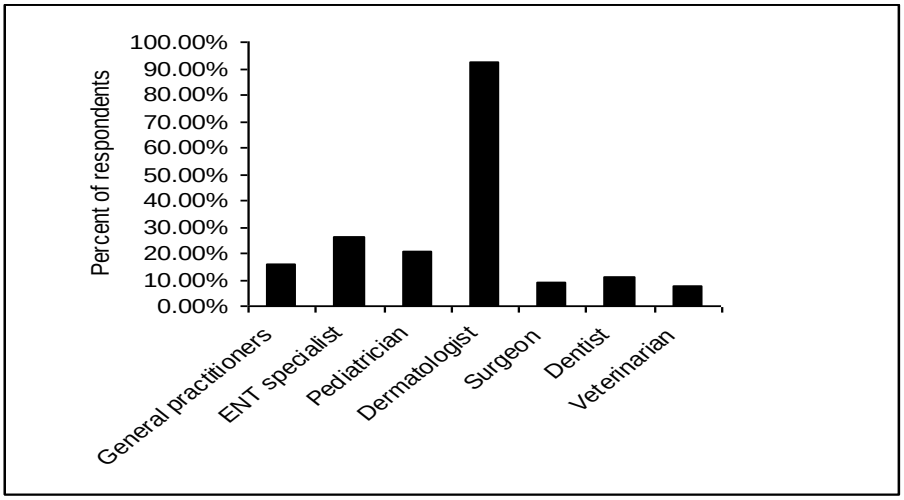


**Figure 2. Common Prescribers of extemporaneous prescriptions**

**Table 6. Representative comments of the respondents**

| |
|---|
| "Nowadays the knowledge of using medicines and drugs is becoming very high, and most prescriptions we received in our pharmacy are not in favor of extemporaneous dispensing". |
| "There must be some source of evaluation for the extemporaneous products which are prepared in community pharmacies before using them by the patients, taking in mind that these products are out of the restrictions of the quality control and quality assurance, so they may be of low quality and poor bioavailability or stability and even may lead to patients suffering" |
| "Undergraduate training and continuous education in extemporaneous dispensing is very essential. Pharmacy educators can also play an important role in this regard by keeping follow up the trainee and providing graduates with encouragement and training to gain more knowledge and skills in this field" |
| "Knowledge of physicians about extemporaneous products is very scarce and hence, our responsibility as community pharmacists is to promote this service to medical professionals and public to prove its importance and encourage practitioners' competence in this field". |
| "In our country as part of African area there is extraordinary use of dermatological preparations for cosmetic purposes. So I recommend that these preparations should be a prepared in pharmacies as part the pharmacist job, in order to protect our young girls from using heavily containing steroid preparations prepared at boutiques and beauty shops". |
| "Extemporaneous dispensing should not be ignored as it would ensure that a reasonable level of experience and skill as well as aid in improving our professional image as formulators of unique products". |
| "Compounding should be a part of college of pharmacy practice courses especially in last year of graduation". |

## DISCUSSION

The study was the first survey of attitudes of the community pharmacists towards issues related to extemporaneous compounding in Khartoum city, Sudan.

Our study showed that the estimated percentage of the share of pharmacy extemporaneous compounding to overall dispensed prescriptions was generally low. This trend is similar to that reported in other studies, which indicated that the incidence of extemporaneous prescriptions received in community pharmacies was in the vicinity of 1% (Pappas 1999; Kettis et al 1991) and 3.4% (Buurma et al 2003).

The current study also revealed that over one third of respondents predicted that extemporaneous compounding would continue to decline in the future, this finding was consistent with the results of other studies (Pappas 1999)**,** which showed that most of the respondents surveyed believed that the demand for the services would decrease or greatly decrease in the future. Further studies (Bouwman-Boer and Van de Vaart 1999;

Schoenmakker 1997)**,** indicated that compounding for outpatients will continue to decline due to growing availability of specialized compounding firms, changes in payment system and a growing pressure in evident-based era to rationalize dispensing and compounding. Other aspects like shortage of personnel and effort of the pharmacist to co-operate with prescribers especially dermatologist to rationalize compounding will contribute to a further decline (Foundation for pharmaceutical statistics 2001). Despite this fact, however, it was not surprising to find that reasonable proportion of pharmacists, in our study, strongly supported keeping compounding within the general profession's role. Most undertook the task personally rather than delegated it to assistant technicians. However minority (14.8%) handed it over to assistant technician. In this regard one pharmacist commented that there is an extraordinary use of dermatological preparations for cosmetic purposes in our country. So I recommend that these preparations should be prepared in the pharmacies as part of the pharmacist's job, rather than handled by other persons in boutiques and beauty shops.

Overall, respondents in this study had high confidence in their extemporaneous compounding ability and reported high level of professional satisfaction. In spite of this fact, however, a set of constraints that limit immediate dispensing of extemporaneous prescriptions were identified. These include lack of ingredients, lack of adequate equipments, and lack of information as well as lack of expertise. These results reinforced findings of similar studies (Pappas 1999; Crawford and Dombrowiski 1991)**,** which identified lack of ingredients, time constraints and lack of supporting information as major factors that limit pharmacist from immediate dispensing of extemporaneous compounding. Apart from these constraints mentioned above, we presumably suggest a number of other factors which would adversely affect the community pharmacist to provide this service but not investigated in our study. These may include limited interest and negative attitudes towards this service.

The lack of ingredients, which greatly affected immediate compounded prescriptions in our study, could be a sign of low and unpredictable demand for such prescriptions. In such situation it apparently difficult for all pharmacists to stock wide range of ingredients or invest in row materials packaged in large sizes with limited expiry date. Even though, it seems that the patients might not be greatly affected by a short delay in compounding, knowing that most of the pharmacies had extended business hours as well as some pharmacists claimed that they kept adequate stock of ingredients that cope with variety of extemporaneous prescriptions in their pharmacies.

The results of the study also highlighted a number of other issues of concern that may greatly influence the pharmacists' role in providing extemporaneous compounding. For instance, approximately overwhelming number of respondents never certified their scales; 13% equally indicated that they don't know if their scales were sensitive or accurate; 13% and 68.6% lacked large pan balances or electric balances; 13% and 16% lacked liquid measures and dispensing weights, respectively; 13% and 16.7% lacked heating equipments and stirring rods, respectively; 88.9% lacked sterilization equipments; 37% rarely check their ingredients for expiry date and 32.5% considered their dispensary space were inadequate or very inadequate. Certainly, if a number of these factors coexisting together could lead to potentially hazardous outcomes. It is noteworthy that although certification of scales is highly demanded to ensure the accuracy of dispensing, it is not obligatory task to be done by community pharmacies according to pharmacy law.

Additionally, a number of other factors that influence the attitudes of the pharmacists towards extemporaneous dispensing were also acknowledged. Factors that concern and need to be addressed include physical and chemical stability, unknown bioavailability and safety of the extemporaneously prepared products. These findings are similar to other concerns identified by pharmacists elsewhere (American Society of Hospital Pharmacists 1985; Kalman and Schlegel 1979; Stewart and Tucker 1982; Purkiss and Kayes 1981), which indicated that the lack of information on compatibility, stability and bioavailability poses problems for pharmacists when suitable dosage forms, concentrations, or preparations are not commercially available and must be prepared for individual patients with unique conditions according to prescription orders.

Moreover, to reduce these constraints and perceived risk errors, pharmacists must become more incentive to overcome all these obstacles. Logically this can be done by encouraging suppliers to have ingredients available in small sizes, maintenance of necessary equipments, and issue a conservative shelf life as well as appropriate documentation for all extemporaneously prepared products (Hayes et al 1992). There is also a need to evaluate currently used formulation with the aim of determining their chemical, physical and bioavailability acceptability and assigning a meaningful storage conditions. In this regard one pharmacist commented that "there must be some source of evaluation for the extemporaneous products which are prepared in community pharmacies before using them by the patients, taking in mind that these products are out of the restrictions of the quality control and quality

assurance, so they may be of low quality and poor bioavailability or stability and even may lead to patients suffering".

Furthermore, our study also revealed that pharmacy compounding consists for a large part of dermatological dosage forms. Correspondingly, the dermatologist is strongly represented within the group of compounded preparations compared with ENT specialist, pediatrician, general practitioners, and surgeons. Although not exactly similar, these data confirm results from others studies (Foundation for pharmaceutical statistics 2001; Altmeyer et al 1997). Similarly, majority of the pharmacists showed positive attitudes with regard to therapeutic efficacy of these dosage forms. In contrast some pharmacists showed negative attitudes towards the safety of compounded dosage forms. Certainly informed compounding allows the dermatologist to offer therapies to his or her patients that might not be otherwise available. These products provide for efficacy and ease of use that likely result in higher rates of compliance.

The study also, showed several reasons for prescribing extemporaneous products. Reasonable proportions of pharmacists indicated patient's specific reasons. These findings were consistent with results of other studies (Pappas 1999; Buurma et al 2003), which highlighted on some reasons such as strength not commercially available, preference of the clinician and patients with unique medical conditions. Specific pharmaceutical care issues like intolerance, inconvenience, special strength and product for unique patient care were only mentioned by 68.7%% of pharmacists. Similarly, it cannot be ruled out that in other reasons mentioned like "demand by prescriber "or "demand by patients or "demand for official products", pharmaceutical care issues may have been present Likewise, cost reason represent a considerable share (33.3%) of patients' specific reasons indicating that the price of compounded is lower in some instance (Kettis et al 1991). So it remains arguable whether avoidance of cost for the patient is pharmaceutical care issue, given that almost some products with higher cost may be advantages to individual patient in some situations. Meanwhile we have to highlight that the attitude of prescribers towards patients' specific reasons was not investigated in our study. Nevertheless, one may assume that while prescribing extemporaneous preparations, they almost certainly have a positive attitude about their pharmaceutical value for the individual patient.

The study also showed that almost more than half of the respondents felt that their skills in extemporaneous dispensing were increased or greatly increased since they were qualified as

pharmacists, while 24.1% reported that it remained the same and 22.2% thought that their skills were greatly decreased or decreased. Those reported that their skills decrease or greatly decrease were most likely those who did not practice extemporaneous dispensing in their pharmacies. Since over third of the pharmacists indicated quite strongly they supported specialized pharmacies, still others disagree with this support and felt that the responsibility remains for the profession as a whole to set standards that ensures reasonable level of skills in this field for all pharmacists as well as promoting this service to other medical practitioners and patients. In this respect one pharmacist noted that our responsibility as community pharmacists is to promote this service to medical professionals to prove its importance and encourage their competence in this field.

Overwhelming number of the pharmacists felt that refreshing courses in extemporaneous compounding is very useful at this moment in order to increase their skills and knowledge base in extemporaneous compounding as well as enable them to undertake revision or more advanced training in this field. Others supported periodical assessment for all pharmacists to determine their capabilities and skills in extemporaneous compounding. This would ensure that a reasonable experience and skills could be maintained in this field as well as emerge the professional image of the community pharmacists as formulators and for unique products. In this esteem one pharmacist commented that "undergraduate training and continuous education in extemporaneous dispensing is very essential. Pharmacy educators can also play an important role in this regard by keeping follow up and providing graduates with encouragement and training to gain more knowledge and skills in this field

We believe that there is an opportunity for the community pharmacists to be a pioneer in taking a traditional role together with the concept of modern technology and pharmaceutical care to meet the needs of today's patients. However, with little effort and appropriate planning these challenges can be successfully applied.

**Study limitations**

There were some limitations regarding our study. Data presented here are small sample size and self-report of the pharmacists' attitudes and dependent on the trustfulness of respondents. It was also possible that some respondents were those with high attitudes towards extemporaneous compounding. Appreciable proportions of the participants not responded to the questionnaire and non-response bias was not assessed, which could compromise the external validity of the survey instrument. The survey was also limited to a particular group

of pharmacists registered in Khartoum city. Another limitation of our study was that it occurred in a short time period. Because of these limitations, no attempt will be made to generalize the results beyond the sample. Nevertheless, the results may offer insight into some information needs for all pharmacists pertaining to extemporaneous compounding.

## CONCLUSION

Our findings indicated that the incidence of extemporaneous compounding was generally low and comprised minor part of pharmacy income. Most responded strongly supported keeping extemporaneous compounding within the profession, but several constraints were highlighted. These shortcomings may be overcome through appropriate keeping reasonable stock of ingredients, adequate equipments maintenance and regular inspection by health authorities. In addition, implementation of ongoing continuous education and quality assurance programs as well as periodical assessment of all pharmacists for competence in extemporaneous compounding will ensure a reasonable level of experience and skills. The feasibility of investigating current extemporaneous products and conduct stability testing should be encouraged. Development of guidelines for extemporaneous compounding particularly for pediatric patients as well as establishing dermatologic drug formulary will also be very helpful. Some socio-demographic characteristics as age gender, marital status, qualifications, locations, staff position and business hours had impact on some selected variables.

## ACKNOWLEDGMENTS

We would like to thank all pharmacists who participated in this study.

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