Knowledge, Attitudes and Practices on exposure to Camphor & Eucalyptus Essential Oils and risk of Seizure disorder in children: A cross sectional study

ABSTRACT

Background: Camphor and eucalyptus essential oils contain camphor and eucalyptol respectively which serve as active ingredients in over-the-counter drugs to manage upper respiratory tract infections and pain in children. However, because of their pro-convulsant properties, seizures constitute a documented complication of their toxicity after ingestion, inhalation, and dermal exposure.

Objectives: This study aimed to assess the knowledge, attitudes and practices of parents and health personnel on the risk of onset of seizures in children exposed to pharmaceutical products containing camphor and/or eucalyptus essential oils.

Methods: This was a hospital-based cross-sectional study conducted in the Mother and Child Centre of Chantal Biya Foundation, a reference hospital. The survey was conducted using questionnaires directed to health personnel and parents of hospitalized children under 8 years old.

Results: A total of 350 parents out of the 360 encountered were included in the study and 57 health personnel out of the 100 encountered. Parents 337 (96.3%) and health personnel 18 (31.6%) had poor knowledge on the issue. Parents 338 (96.6%) and health personnel 54 (94.75%) had very satisfactory attitude scores. Both parents 319 (91.1%) and health personnel 31 (54.4%) had harmful practices scores.

Conclusion: This study showed that both parents and health personnel had poor knowledge, very satisfactory attitudes and harmful practices towards the risk of onset of seizures in children exposed to pharmaceutical products containing camphor and/or eucalyptus essential oils.

Keywords: Camphor, eucalyptus, paediatrics, seizures, toxicity, health personnel, parents, pharmacovigilance

INTRODUCTION

Camphor essential oil is extracted from *Cinnamomum camphora* L. (Sieb.) of the Lauraceae family. Camphor is a pure natural product used in pharmaceutical products for its secretolytic and decongestant effects [1]. EO is obtained from *Eucalyptus sp.* of the Myrtaceae family and is rich in 1,8-cineole (eucalyptol) [2]. It is an expectorant used in pharmaceutical products against cough, common cold and bronchitis [1,3]. Camphorated oil and Eucalyptus essential oil (EO) can cause poisonings [3–5]. Camphorated oil is a CNS stimulant, causing mild excitation, grand mal seizures or status epilepticus in toddlers as young as 4 months [6] and even up to children aged 4-5 years [4]. It causes an onset of seizures 20 to 30 min after ingestion whereas ingestion of 3 to 5 mL of pure EO can cause seizures [4,7,8]. Products containing EO or eucalyptol are readily available worldwide over the counter. However, EO when orally ingested can result in seizures and even death [7,9]. Seizures in children are therefore a known complication of toxicity due to camphor and EO and have been reported after ingestion, inhalation, and dermal exposure [4,7–13]. The proconvulsant essential oils of eucalyptus and camphor can cause both generalized and focal status epilepticus [14] . Pharmaceutical products containing these active ingredients can be purchased at community pharmacies for the management of cold, flu and cough in Cameroon without any written prescription. Self-medication by parents being rampant in Cameroon [15,16] and lack of knowledge of parents on associated risks of seizures may imply that exposure in infants and young children to these pharmaceutical products may represent an under-recognized cause of seizures. Additionally, these products are at times prescribed to children by health personnel who either overlook contra-indications or are not sufficiently informed. Furthermore, throughout out our internship at the neuro-paediatrics unit of the Mother and Child Centre of Chantal Biya Foundation in 2017, we noticed that parents exposed their children to camphor-containing balms not knowing that it was a proconvulsant. Also, some children already under anti-epileptic drugs still had seizures, and after inquiring from their parents, we realized that they frequently exposed them to such balms. We also noticed that some nurses sold such balms to parents of hospitalized children, advising them to apply it to children for the management of cold, flu and cough, and some nurses claimed that it could prevent seizures. Consequently, we chose to carry out a study to evaluate the knowledge, attitudes and practices of parents and health personnel (paediatrician, general practitioners, interns, residents and nurses) on the risk of onset of seizures following exposure to pharmaceutical products containing camphor and/or

eucalyptus essential oils in children and to determine the factors associated with harmful practices among parents and health personnel.

METHODS

Study design

A cross-sectional study was carried out using pre-tested questionnaires. The questionnaires were designed to assess the knowledge, attitudes and practices of both parents and health personnel on risk of seizures in children exposed to camphor and eucalyptus essential oils contained in pharmaceutical products.

Site of study

The study was carried out at the Mother and Child Center (MCC) of Chantal Biya Foundation of Yaounde in Cameroon. This site was chosen because of the abundance of children, among which children being admitted for seizures and also for the abundance of health personnel dealing with children.

Duration/period of study

The study was carried out during 4 months, 6 days (18 weeks and 2 days) from the 2nd of March 2020 to the 08th of July 2020.

Study population

We had two target populations; the paediatric health personnel and parents of children hospitalized in paediatrics. We had two source populations for this study. The first one included the parents of all the infants and children from 0-7 years old both male and females hospitalized in the Mother and Child Center of the Chantal Biya Foundation. The second one included paediatric health personnel (paediatricians, general practitioners, residents, interns, nurses, pharmacists, principal technicians in pharmaceutical sciences) in the Mother and Child Center of the Chantal Biya Foundation who provided informed consent.

Inclusion criteria

Inclusion criteria for parents involved having a child under eight years old hospitalized at the Mother and Child Center of the Chantal Biya Foundation as well as ability and willingness of parents to provide informed consent for their hospitalized children. Inclusion criteria for paediatrics health personnel involved working as health personnel (paediatrician, general

practitioners, residents, interns, nurses, pharmacist, principal technician in pharmaceutical sciences) at the Mother and Child Center of the Chantal Biya Foundation as well as ability and willingness to provide informed consent.

Exclusion criteria

The main exclusion criterion was refusal or inability to provide informed consent. Children whose ages could not be determined were also excluded.

Sampling

Sampling was consecutive, that is sampling it involved convenience sampling with inclusion criteria and a sample size. Concerning our sample size calculation, our primary outcome was the rate of exposure to pharmaceutical products containing camphor and/or eucalyptus essential oils susceptible of causing seizures in children under 8 years old. Given scarcity of relevant literature, we decided to consider the null hypothesis, stipulating that out of every two children under 8 years old, one was exposed to pharmaceutical products containing camphor and/or eucalyptus essential oils.

H_0: P= 50%

We determined the sample size required to detect a difference in 5% considering threshold of significance of 5% and power of 80%. We used the Cochran's formula below [17]:

$$Sample\ size = \frac{Z_{1-\alpha/2}{}^2 p(1-p)}{d^2}$$

$$Sample\ size = \frac{1.96^2 0.5(1-0.5)}{0.05^2}$$

$$Sample\ size = 384.2$$

Where d= 5%, p=50% and $Z_{1-\alpha/2} = 1.96$

In order to make up for potential withdrawal, we considered 400 as sample size.

Data collection Procedure

In order to evaluate the knowledge of parents and paediatric health personnel on the risks of seizures associated with exposure to camphor and/or eucalyptus oils in children, we asked questions to parents and health personnel of the hospitalized children following a written pre-

designed KAP (knowledge, attitudes and practices) questionnaire on the use of pharmaceutical products containing camphor and/or eucalyptus essential oils and associated risks of seizures in children. The questionnaires were pre-tested and validated in order to ensure that participants understood the questions correctly so as to answer accurately and to estimate how long it took to fill the questionnaires. Questions were asked to the participants and the answers were written down immediately. An information sheet made up of images and names of the pharmaceutical products concerned was shown to the participants in order to help them in answering questions accurately. The questionnaires and information sheets were provided in both French and English so as to avoid language bias in the parents or health personnel.

List of key variables

Socio-demographic characteristics of health personnel sample included age, gender, specialty, educational sector, number of years in practice, religion, nationality, pharmaceutical products prescribed, mode of administration, dose, frequency and duration of administration of the concerned pharmaceutical products. Socio-demographic characteristics of parents' sample included age of the child, weight, gender, demographics (ethnicity, religion, nationality, region of origin, number of children, age of parents, educational level of parents, profession of parents, monthly income), child history of seizures or epilepsy, family history of seizure or epilepsy, pharmaceutical products involved, mode of administration, dose, frequency and duration of administration of the pharmaceutical products concerned.

Statistical data analysis and scoring

Data analysis was performed using the software Statistical Package for Social Sciences (SPSS) version 22. Qualitative data was summarized with counts and proportions which were presented as frequency tables. We used bar charts and pie charts to illustrate the distribution of some characteristics in the sub-groups. Quantitative data was summarized with averages, or means depending on data distribution. Some quantitative data was converted to groups of sizes which were defined by the data. These groups were represented with histograms when needed. The knowledge of parents and health personnel was assessed using questions on drugs containing camphor or camphor essential oil, drugs containing eucalyptol or Eucalyptus essential oil and drugs containing both camphor and eucalyptus essential oils or both camphor and eucalyptol. For each correct answer, 1 point was given, and was given for each incorrect answer. The attitudes of parents and health personnel were assessed using

Likert-item questions on drugs containing camphor and on age restrictions on drug information leaflets with responses “strongly agree”, “agree”, “uncertain”, “disagree” and “strongly disagree”. Participants received 1 point for each correct answer and 0 points for each incorrect answer. Practices of parents and health personnel were assessed using questions on drugs containing camphor/camphor essential oils, drugs containing eucalyptol/eucalyptus essential oil, drugs containing both camphor and eucalyptus essential oil and drug administration practices according to drug information leaflets. Participants received 1 point for each correct answer and 0 points for each incorrect answer. The participants’ overall knowledge, attitudes and practices scores were categorized using the model suggested by Essi *et al.* in 2013 [18] as shown in table 1. Fisher’s exact test was performed and Odds Ratios were calculated to determine the factors associated with harmful practices. The significance threshold of each statistical test was considered for a P value < 0.05 and each estimation was made by considering confidence interval to be 95%.

Scoring Model for knowledge attitudes and practices

The model adopted from Essi and collaborators [18] was used as indicated in table 1.

Table 1: Scoring model for knowledge, attitudes and practices *[18]*

	Score	**Percentage of correct answers**
Knowledge	Poor	0-24%
	Insufficient	25-49%
	Average	50-69%
	Good	>70%
Attitudes	Harmful	0-24%
	Wrong	25-49%
	Approximate	50-69%
	Correct/very satisfactory	>70%
Practices	Harmful	<50%
	Inadequate	50-65%
	Adequate	>65%

RESULTS

Participants recruitment flowchart

A total of 100 health personnel as well as 360 parents were encountered for this study. 21 health personnel did not consent to participate in the study, as such they were not included. Among the 79 health personnel who were enrolled, 22 were excluded; 19 because of unavailability, and 3 because the questionnaire was returned incomplete. The response rate for health personnel was 57%. Among the 360 parents which were encountered, 10 did not consent to participate in the study. As such, 350 parents were enrolled, none of which were excluded. The response rate for parents was 97.2%. Thus, a total of 407 participants were enrolled in this study, among which 57 health personnel and 350 parents. The participants recruitment flow chart is represented in figure 1

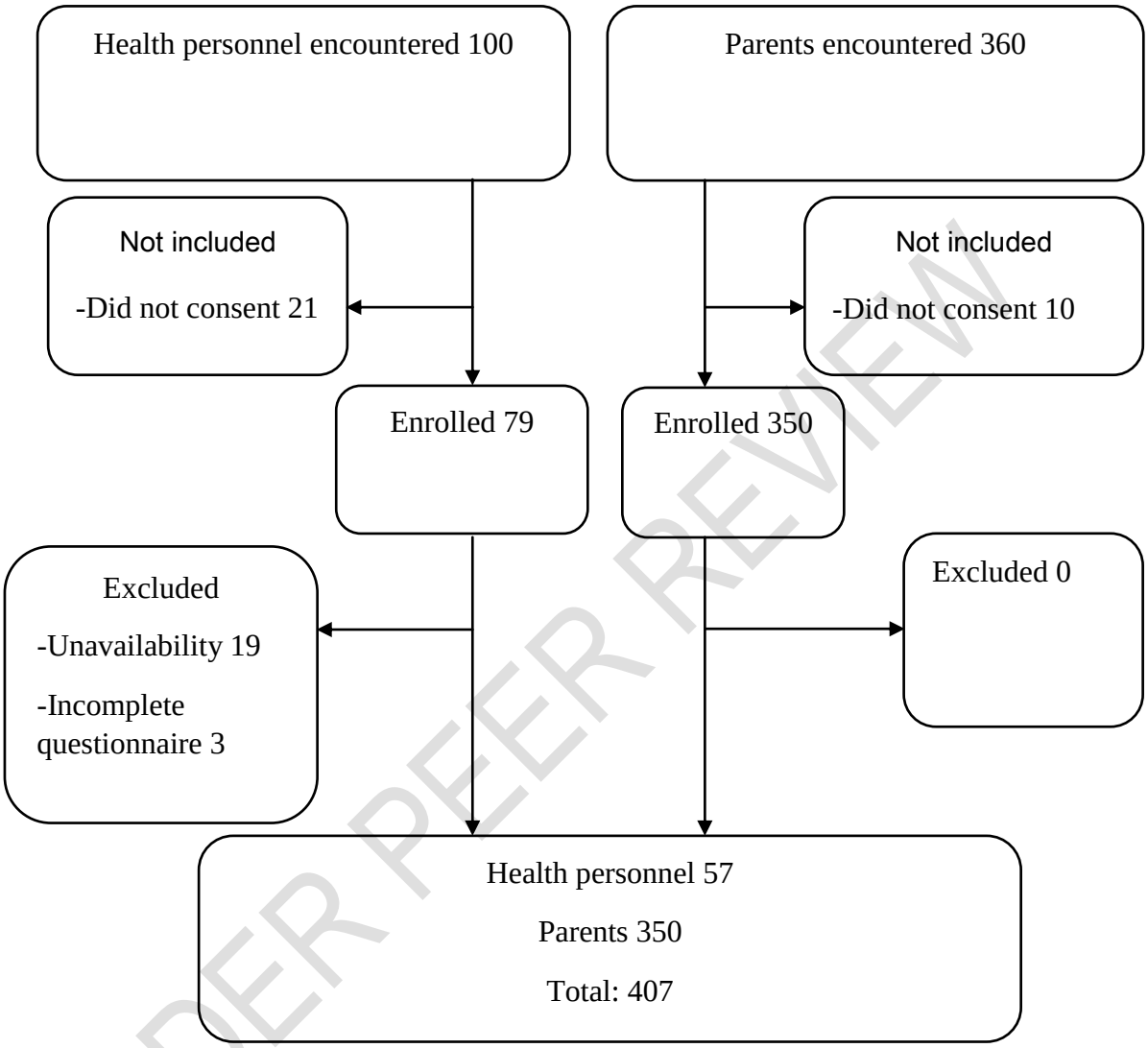

Figure 1: Participants recruitment flow chart

SOCIO-DEMOGRAPHIC PROFILE

Socio-demographic profile of parents

Among the 350 participants which were interviewed, 163 (47.5%) participants were from the Centre region of Cameroon, and 326 (93.1%) identified as Christians. Also, 136 (38.9%) were married and 243 (69.4%) had 0-3 children. 234 (67.2%) of the mothers were between 21-35 years while 151 (46.7%) fathers were between 21-35 years. Moreover, 111 (32.1%) mothers had a secondary school educational level while 123 (39.5%) fathers had a university educational level. Of the 350 households, 127 (38.8%) households had a monthly income of <50000 CFA Francs per month (Table 2). The socio-demographic profile of parents is shown in table 2.

Children's socio-demographic profile and seizure history

Of the 350 children, 191 (54.6%) were males while 159 (45.4%) were females. 241 (68.9%) children aged between 0-30 months old. 123 (35.1%) children had a history of seizures while 227 (64.9%) had never had seizures (table 2).

The age ranges were divided according to the specific ages before which the drugs were strictly contraindicated. Ointments, suppositories and syrups containing eucalyptol or eucalyptus essential oil are strictly contraindicated under 30 months, balms containing camphor are strictly contraindicated for children under 4 years old. Balms containing both camphor and eucalyptus essential oil and medicated lozenges containing eucalyptus essential oil are strictly contraindicated for children under 7 years old and camphorated oil is strictly contraindicated for children under 8 years old. The socio-demographic profile and seizure history of the children involved in the study is shown in table 2.

Socio-demographic profile of health personnel

Among the 57 health personnel interviewed, 42 (75.0%) were females while 14 (25%) were males. 28 (54.9%) health personnel interviewed were between 21-35 years old and 21 (36.8%) had between 5-10 years of practice as shown in table 2.

Table 2 : Socio-demographic profile of parents (N=350), children (N=350) and health personnel (N=57)

Study population	Variable	Class	Total (Proportion %)
Parents (N=350)	Religion	Christian	326 (93.1)
		Muslim	21 (6.0)
		Animist	0 (0)
		Atheist	0 (0)
		Traditionalist	2 (0.6)
		Other	1 (0.3)
	Nationality	Cameroonian	343 (98)
		Foreigner	7 (2)
	Region of origin	Adamawa	11 (3.2)
		Centre	163 (47.5)
		East	8 (2.3)
		Far North	8 (2.3)
		Littoral	12 (3.5)
		North	13 (3.8)
		North West	12 (3.5)
		West	97 (28.3)
		South	16 (4.7)
		South West	3 (0.9)
	Civil status	Celibate	98 (28)
		Married	136 (38.9)
		Divorced	1 (0.3)
		Widowed	6 (1.7)
		Separated	0 (0)
		Cohabitation	109 (31.1)

Study population	Variable	Class	Total (Proportion %)
	Number of children	0-3	243 (69.4)
		4-7	101 (28.9)
		≥8	6 (1.7)
	Mother's age	<21 years	46 (13.2)
		21-35 years	234 (67.2)
		35-50 years	65 (18.7)
		>50 years	3 (0.9)
	Min=13 Max=78 Mean=28.0 SD=7.3		
	Father's age	<21 years	4 (1.2)
		21-35 years	151 (46.7)
		35-50 years	147 (45.5)
		>50 years	21 (6.5)
	Min=8 Max=82 Mean=35.5 SD=8.8		
	Mother's educational level	Nursery school	0 (0)
		Primary school	47 (13.6)
		Secondary school	111 (32.1)
		High-school	92 (26.6)
		University	80 (23.1)
		Post-graduate studies	0 (0)
		Unschooled	6 (4.6)
	Total household monthly income	<50000	127 (38.8)
		50001-150000	120 (36.7)
		150001-250000	57 (17.4)
		250001-350000	15 (4.6)
		350001-450000	3 (0.9)
		>450 000	5 (1.5)

Study population	Variable	Class	Total (Proportion %)
	Father's educational level	Nursery school	0 (0)
		Primary school	34 (10.9)
		Secondary school	55 (17.7)
		High-school	88 (28.3)
		University	123 (39.5)
		Post-graduate studies	2 (0.6)
		Unschooled	9 (2.9)
	Father's profession	University student	16 (4.8)
		Unemployed	2 (0.6)
		Public sector health personnel	4 (1.2)
		Private sector health personnel	5 (1.5)
		Entrepreneur	122 (36.7)
		Private sector employee	109 (32.8)
		Public sector employee	67 (20.2)
		Retired	2 (0.6)
		Househusband	0 (0)
		High school student	2 (0.6)
		Clergy	3 (0.9)
	Mother's profession	University student	32 (9.2)
		Unemployed	50 (14.4)
		Public sector health personnel	7 (2.0)
		Private sector health personnel	6 (1.7)
		Entrepreneur	84 (24.2)
		Private sector employee	64 (18.4)
		Public sector employee	27 (7.8)
		Retired	1 (0.3)
		Housewife	64 (18.4)
		High school student	12 (3.5)
		Clergy	0 (0)

Study population	Variable	Class	Total (Proportion %)
Child (N=350)	Child's gender	Male	191 (54.6)
		Female	159 (45.4)
	Child's age	0-30 months	241 (68.9)
		30 months-4 years	43 (12.3)
		4 years-7 years	51 (14.6)
		7-8 years	15 (4.3)
	Min=14 days Max=7 years 11 months Median= 1.3 SD=2.1		
	Child's weight	<14kg	264 (75.6)
		14-18kg	48 (13.8)
		18-26kg	34 (9.7)
		≥26	3 (0.9)
	Child's history of seizures	Yes	123 (35.1)
		No	227 (64.9)
	Family history of seizures	Yes	132 (37.8)
		No	217 (62.2)
	Child diagnosed with epilepsy	Yes	2 (0.6)
		No	348 (99.4)
	Family history of epilepsy	Yes	18 (5.2)
		No	331 (94.8)

Study population	Variable	Class	Total (Proportion %)
Health personnel (N=57)	Gender	Male	14 (25.0)
		Female	42 (75.0)
	Age	<21 years	1 (2.0)
		21-35 years	28 (54.9)
		35-50 years	17 (33.3)
		>50 years	5 (9.8)
	Min=20 Max=65 Median=34.0 SD=10.5		
	Profession/degree	Paediatrician	5 (8.8)
		Resident	4 (7.0)
		General practitioner	12 (21.1)
		Intern	2 (3.5)
		Nurse	33 (57.9)
		Principal technician in pharmaceutical sciences	1 (1.8)
	Educational sector of training	Private school	19 (33.3)
		Public school	38 (66.7)
	Country of studies	Cameroon	51 (89.5)
		Abroad	4 (7.0)
		Both	2 (3.5)
	Number of years of studies	<4 years	25 (44.6)
		4-8 years	23 (41.1)
		8-12 years	4 (7.1)
		>12 years	4 (7.1)
	Number of years in practice	<5 years	19 (33.3)
		5-10 years	21 (36.8)
		10-20 years	11 (19.3)

		20-30 years	5 (8.8)
		>30 years	1 (1.8)

Study population	**Variable**	**Class**	**Total (Proportion %)**
	Religion	Christian	50 (87.7)
		Muslim	5 (8.8)
		Animist	0 (0)
		Atheist	0 (0)
		Traditionalist	0 (0)
		Other	0 (0)
	Nationality	Cameroonian	57 (0)
		Foreigner	0 (0)
	Number of children	0-3	38 (70.4)
		4-6	14 (25.9)
		≥7	2 (3.7)

Evaluation of knowledge, attitudes and practices of parents and health personnel

The global evaluation of the knowledge, attitudes and practices of parents and health personnel are shown in Table 3.

Knowledge

Of the 350 parents interviewed, 337 (96.3%) had a poor global knowledge level while 1 (0.3%) had a good global knowledge level. Of the 57 health personnel who responded to the questionnaire, 18 (31.6%) had poor knowledge levels while 5 (8.8%) had good knowledge levels as shown in table 3.

Attitudes

A Likert scale was used to assess the participants' attitudes. Globally, 338(96.6%) parents had correct attitudes scores. 59 (16.9%) parents strongly and wrongly believed that balms containing camphor could prevent or cure seizures in children under 8 years old, while 38(10.9%) of parents believed that age restrictions on drug information leaflets didn't apply to "black" African children, considering them more resistant to drug side effects than "white" Caucasian children as seen in figure 2. Additionally, among the 57 health personnel who responded to the questionnaire, 54 (94,7%) had good global attitudes scores as shown in table 3. 33 (57.9%) of which strongly disagreed on the use of balms containing camphor to treat or prevent seizures in children under 8 years old

Table 3: Global evaluation of knowledge, attitudes and practices of parents (N=350) and health personnel (N=57)

	Score	Parents n (%)	Health personnel n (%)
Knowledge	**Good**	1 (0.3)	5 (8.8)
	Average	0 (0)	17 (29.8)
	Insufficient	12 (3.4)	17 (29.8)
	Poor	337 (96.3)	18 (31.6)
Attitudes	**Correct/very satisfactory**	338 (96.6)	54 (94.7)
	Approximate	6 (1.7)	2 (3.5)
	Wrong	4 (1.2)	0 (0)
	Harmful	2 (0.6)	1 (1.8)
Practices	**Adequate**	0 (0)	4 (7.0)
	Inadequate	31 (8.9)	22 (38.6)
	Harmful	319 (91.1)	31 (54.4)

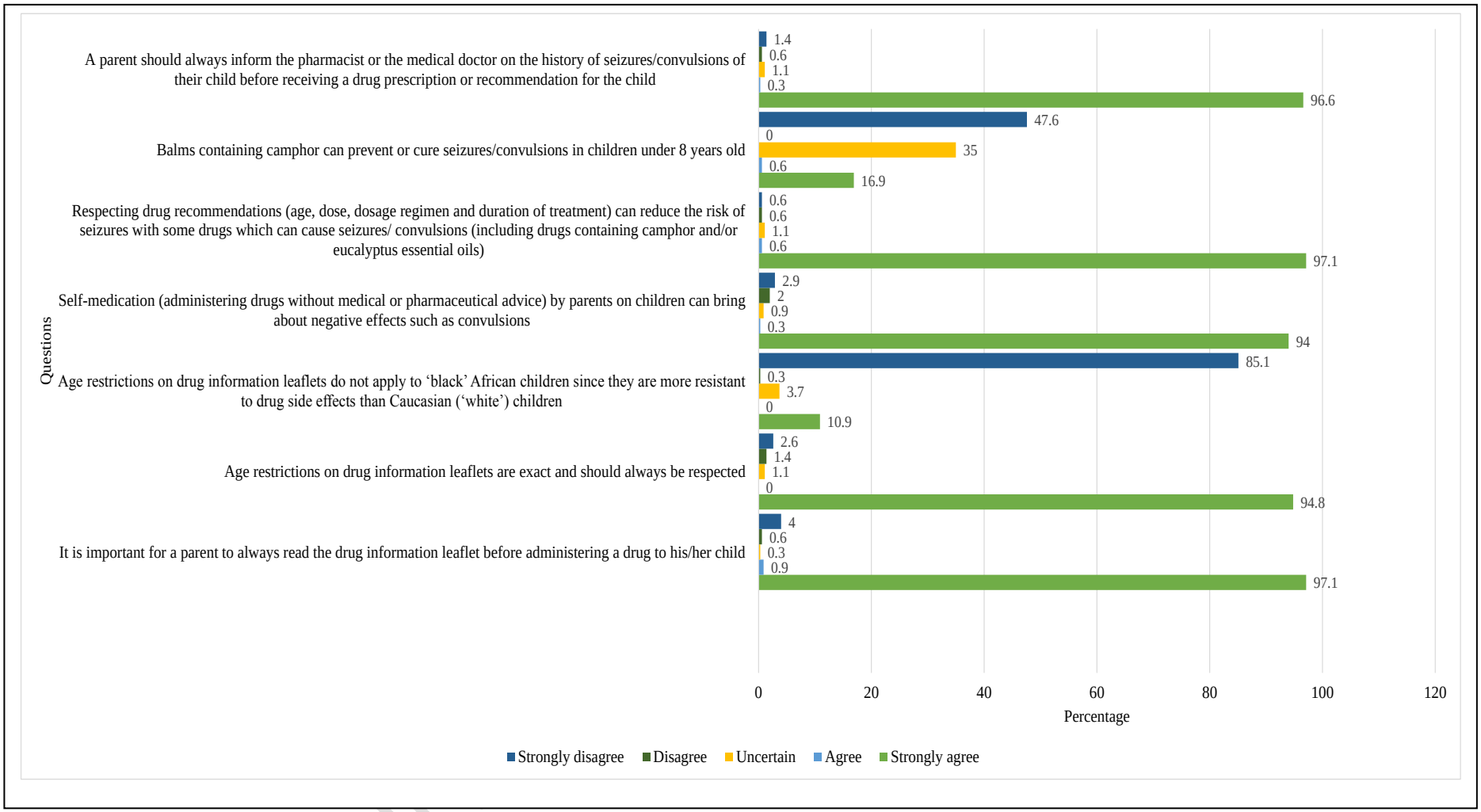

Figure 2: Evaluation of parents' attitudes (N=350)

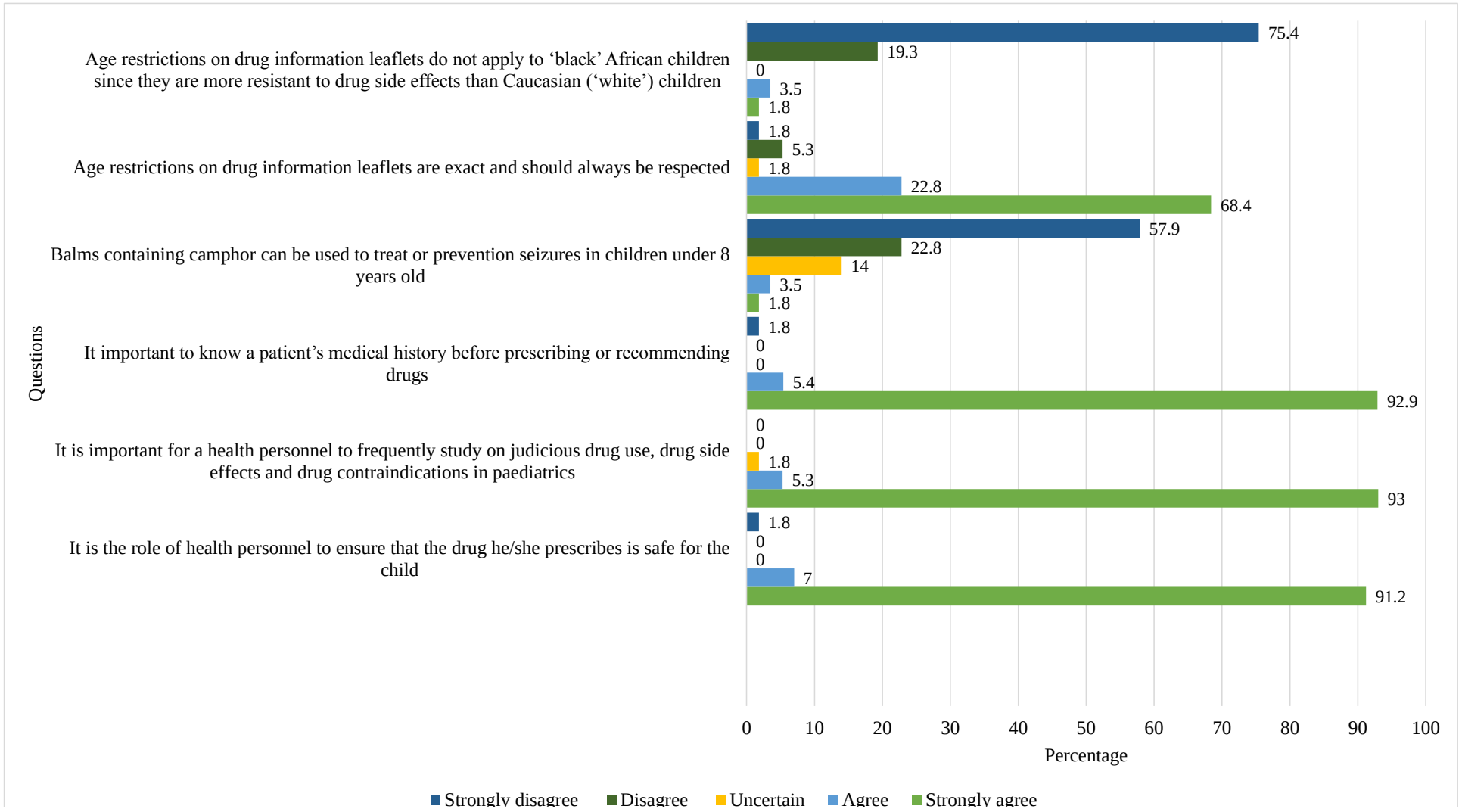

Figure 3: Evaluation of health personnel's attitudes (N=57)

Practices

Parents' practices were evaluated using questions on several drugs divided in three categories: drugs containing camphor only (balms), drugs containing only eucalyptus essential oil or eucalyptol (lozenges, syrups, suppositories, inhaler), other drugs containing both camphor and eucalyptus essential oils (balms). For each of these categories of drugs they were asked questions to assess whether they had already administered any of those drugs to their child, whether it was recommended or prescribed by a health personnel, mode of administration, dose, frequency of administration, duration of treatment, whether or not they read the drug information leaflet before administering the drug and whether or not they respected the age restrictions on the drug information leaflets for each drug as well as advice from health professionals on how to administer the drugs.

Among the 350 parents interviewed, 319 (91.1%) had harmful global practices score. Of the 57 health personnel which were interviewed, 31 (54.4%) had harmful global practices scores while 4 (7.0%) had adequate global practices scores as shown in table 3. More specifically, 337 (96.3%) parents had harmful practices scores pertaining to drugs containing camphor or camphor essential oil, 323 (92.3%) had harmful practices scores with drugs containing eucalyptol or eucalyptus essential oil, and 348 (99.4%) had harmful practices scores with drugs containing both camphor and eucalyptus essential oils or both camphor and eucalyptol. Nevertheless, 245 (75%) participants had adequate drug administration practices scores as shown in table 5.

Practices of health personnel were evaluated using questions on several drugs divided in three categories: drugs containing camphor only (balms), drugs containing only eucalyptus essential oil or eucalyptol (lozenges, syrups, suppositories, inhaler), other drugs containing both camphor and eucalyptus essential oils (balms). For each of these categories of drugs they were asked questions to assess whether they had already prescribed these drugs to toddlers and children, whether they took into account age restrictions on drug information leaflets before prescribing the drugs, whether they took into account children's history of seizures before prescribing the drugs, as well as whether they prescribed the correct mode of administration, dose, frequency of administration and duration of treatment.

Overall, 8 (14%) health personnel had adequate practices scores on drugs containing camphor or camphor essential oil, while 3 (5.3%) had adequate practices scores on drugs containing eucalyptol or eucalyptus essential oil, and 9 (15.8%) had adequate practices scores on drugs containing both camphor and eucalyptus essential oils or both camphor and eucalyptol. Also, 51 (89.5%) health personnel had adequate practices scores on drug prescription practice as seen in table 4.

Table 4: Evaluation of practices of parents (N=350) and health personnel (N=57)

Study population	Variable	Harmful (%)	Inadequate (%)	Adequate (%)
Parents (N=350)	Drugs containing camphor or camphor essential oil	337 (96.3)	10 (2.9)	3 (0.9)
	Drugs containing eucalyptol or eucalyptus essential oil	323 (92.3)	25 (7.1)	2 (0.6)
	Drugs containing both camphor and eucalyptus essential oils or both camphor and eucalyptol	348 (99.4)	0 (0)	2 (0.6)
	Drug administration practices according to drug information leaflet and medical/pharmaceutical advice	63 (18)	42 (12.0)	245 (70)
Health personnel (N=57)	Drugs containing camphor or camphor essential oil	41 (71.9)	8 (14)	8 (14)
	Drugs containing eucalyptol or eucalyptus essential oil	45 (78.9)	9 (15.8)	3 (5.3)
	Drugs containing both camphor and eucalyptus essential oils or both camphor and eucalyptol	5 (8.8)	43 (75.4)	9 (15.8)
	Drug prescription practice	6 (10.5)	0 (0)	51 (89.5)

Factors associated with harmful practices scores among parents and health personnel

Factors associated with harmful practices scores among parents

Fisher's exact statistical tests with significance level $\alpha=0.05$ were performed, and odds ratios were calculated with 95% confidence interval to ascertain the effects of specific variables on global harmful practices scores among parents (table 5). There was a significant association ($p<0.001$) between harmful practices scores and being married ($p=0.006$). Married individuals were 3 times more likely to have harmful practices scores (OR>1). There was a significant association ($p<0.05$, $p=0.016$) between practices scores and high-school educational level among mothers. Odds ratios revealed that mothers who had gone to high-school were less likely to have harmful practices scores (OR<1, OR=0.375). There was a significant association between harmful practices scores and being an unemployed father ($p<0.05$, $p=0.008$). There was a significant association between practices scores and being a mother working as a public sector health personnel ($p<0.05$, $p=0.015$). Mothers who worked as public sector health personnel were less likely to have harmful practices (OR<1, OR=0.110). There was a significant association between harmful practices scores and being a child under 30 months ($p<0.001$). Children less than 30 months were 4 times more likely to suffer from harmful practices (OR>1, OR=4.029). There was a significant association between practices scores and being a child aging between 4-7 years old ($p<0.001$). Children aging between 4-7 years old were less likely to suffer from harmful practices (OR<1, OR= 0.159). Additionally, there was a significant association between harmful practices scores and the child weighing less than 14kg ($p<0.01$, $p=0.001$). Children weighing less than 14kg were 3 times more likely to suffer from harmful practices (OR>1, OR=3.849). There was a significant association between practices scores and weighing between 18-26kg ($p<0.0001$). Children weighing between 18-26kg were less likely to suffer from harmful practices (OR<1, OR=0.171). There was a significant association between child history of seizures and harmful practices scores ($p<0.05$, $p=0.009$). Children with history of seizures were less likely to suffer from harmful practices scores (OR<1, OR=0.354), while children with no history of seizures were 2.8 times more likely to suffer from harmful practices (OR>1, OR=2.822). There was a significant association between harmful practices

scores and poor global knowledge levels ($p<0.0001$) on the topic as well as insufficient global knowledge ($p<0.0001$) levels on the topic. Parents with poor global knowledge levels were 15 times more likely to have harmful practices ($OR>1$, $OR=15.215$) while parents who had insufficient knowledge levels were less likely to have harmful practices scores ($OR<1$, $OR=0.080$) as seen on table 5.

Factors associated with harmful practices scores among health personnel

Fisher's exact statistical tests with significance $\alpha=0.05$ were performed, and odds ratios were calculated with 95% confidence interval to ascertain the effects of specific variables on global harmful practices scores among health personnel. There was no significant association ($p>0.05$) between harmful practices scores and health personnel gender, age, profession/degree, educational sector of training, country of studies, number of years of studies, number of years in practice, religion, number of children, global attitudes levels, and global knowledge levels.

Table 5: Factors associated with harmful practices scores among parents (N=350)

Study population	Variable	Class	Practices (%)		OR for harmful practices (95%CI)	P-value
			Harmful	Not harmful		
Parents	**Civil status**	Married	131 (96.3)	5 (3.7)	3.623 (1.356-9.681)	0.006
	Mother's educational level	High-school	78 (84.0)	14 (8.0)	0.375 (0.175-0.02)	0.016
	Father's profession	Unemployed	0 (0)	2 (100)	0 (0-NaN)	0.008
	Mother's profession	Public sector health personnel	4 (57.1)	3 (42.9)	0.110 (0.023-0.520)	0.015
	Child's age	0-30 months	229 (95.0)	12 (5.0)	4.029 (1.879-8.638)	0.00036
		4 years-7 years	37 (72.5)	14 (27.5)	0.159 (0.073-0.350)	0.000014
	Child's weight	<14kg	249 (94.3)	15 (5.7)	3.849 (1.812-8.175)	0.001
		18-26kg	24 (70.6)	10 (29.4)	0.171 (0.073-0.405)	0.000215
	Child's history of seizures	Yes	105 (85.4)	18 (14.6)	0.354 (0.167-0.751)	0.009
		No	214 (94.3)	13 (5.7)	2.822 (1.332-5.978)	0.009
	Global knowledge levels	Poor	313 (92.9)	24 (7.1)	15.215 (4.738-48.866)	0.000026
		Insufficient	6 (50.0)	6 (50.0)	0.080 (0.024-0.266)	0.000189

NaN-Not a Number

DISCUSSION

96.3% parents had poor knowledge which may be accounted for by the fact that only 3.71% mothers and 2.57% fathers worked as health personnel. The higher good knowledge in health personnel 8.8% compared to parents 0.3% can be accounted for by the number of years of studies and years in practice of health personnel. This goes in line with two studies conducted in India and published in 2021 by Chandar Dudipala *et al.* which revealed that despite the previous case reports in the literature quoting the seizurogenic potential of EO, this awareness was lacking in both clinicians and parents and that the knowledge about EO induced-seizures was essential to be disseminated among health care professionals and the general population [3,10].

94.0% parents strongly agreed on the fact that self-medication by parents on children could bring about negative effects like convulsions. This goes in line with a study conducted in France in 2010 by Escourrou *et al.* on self-medication in children by parents which revealed that 39% of parents believed they were taking a risk for their child by practicing self-medication [15].

The attitudes among parents were good 96.6% compared to their poor knowledge 96.3%. The attitudes among health personnel were mainly good 94.7% as compared with a majority of poor 31.6% and insufficient 29.8% knowledge among them. This paradox in both patients and health personnel could be explained by the ease in answering these general attitudes questions using common sense.

Despite the correct attitudes of health personnel 94.7%, only 7.0% health personnel showed adequate practices. Despite the 96.6% parents with correct attitudes, 91.1% parents had harmful practices. This could be accounted for by the low knowledge. This difference between attitudes and practices shows the discrepancy between beliefs (attitudes) and practices.

70% of parents showed adequate practices concerning reading drug information leaflets and administering drugs according to the information provided by the drug information leaflet or by a medical doctor or pharmacist. This suggests a high compliance and could be explained by the fact that the majority of parents 95.4% mothers and 97.1% fathers were schooled. This may explain their readiness to read drug information leaflets and to administer drugs according to instructions provided.

This goes in line with a study on patients' views on electronic patient information leaflets performed in 2016 in Granada, Spain by Hammar *et al.* which revealed that a majority; 52% of users occasionally read the patient information leaflet while 37% always read it. In this study, some said that they almost always read the patient information leaflet to find out more about their treatment and gain a better understanding of it as well as information on adverse effects dosage and user instructions[19].

89.5% health personnel generally had adequate drug prescription practice (prescribing in line with drug leaflets, considering contraindications, explaining to the parents the risks associated with not respecting doses and duration of treatment and informing on possible side effects). This is higher than what was reported in 2018 by Racuz *et al.* where 38.5% primary care providers (medical doctors) working in the primary care in Croatia, made sure in their drug prescription practice to inform patients on possible side effects of drugs as they prescribed them[11, 14].

Mothers who had gone to high-school were less likely to have harmful practices (OR=0.375, p=0.016). This could be explained by the fact that being more educated they were more likely to not practice self-medication and more likely to read drug information leaflets and follow instructions provided by these leaflets and health personnel. This goes in line with a study conducted in Brazil from 2013-2014 by Pons et al. which revealed that mothers with a higher level of education (12 years of education or more) were less likely to practice self-medication on their children[21].

Mothers working as a public sector health personnel were less likely to have harmful practices (OR=0.110, p=0.015). This could be explained by the fact that throughout their years in practice, they would have been more likely to manage cases of children who suffered from seizures following exposure to proconvulsant active ingredients thereby making them more careful with their own children. Additionally, working in the public health sector could imply they would have been exposed to more cases than those in the private sector thus having more background information to have good practices and protect their own children. Children under 30 months were 4 times more likely to suffer from harmful practices (OR=4.029, p<0.001). Children weighing less than 14kg were 3 times more likely to suffer from harmful practices (OR=3.849, p=0.001). This could be explained by the fact that when children are younger and

weighing less, parents are more over-caring and unable to bear to see them suffering from cold and flu, they would desire quick relief by using the same products which relieve them as adults, such as balms containing camphor. The parents may also resort to pharmaceutical products because they may consider their infants to be too young for home remedies against cold and flu (honey, lemon juice) [22–24]. Children aging between 4-7 years old were less likely to suffer from harmful practices (OR= 0.159, $p<0.001$). Children weighing between 18-26kg were less likely to suffer from harmful practices (OR=0.171, $p<0.001$). This could be explained by the fact that, as children grow older, and weigh more, their parents would be less over-protective, and consider it easier and more cost effective to administer natural home remedies to them against cold and flu, and thus would use less of the products containing camphor and/or eucalyptol. Children with history of seizures were less likely to suffer from harmful practices (OR=0.354, $p=0.009$), while children with no history of seizures were 2.8 times more likely to suffer from harmful practices (OR=2.822, $p=0.009$). This could be explained by the fact that parents whose children had seizures would be more careful when giving drugs to their children, and more likely to learn about different epileptogenic substances so as to protect their children from exposure, while parents whose children never had seizures would be less likely to do so. Parents with poor knowledge were 15 times more likely to have harmful practices (OR=15.215, $p<0.0001$) confirming the fact that the extent of knowledge will influence the quality of the practices.

Since this study was a questionnaire study, it had some limitations. It was applicable only to those respondents who had a considerable amount of education. It was difficult to administer the questionnaire to illiterate or semi-literate individuals. Other limitations for a questionnaire study could have been illegibility of the handwritings of the respondents and respondents skipping most of the questions but we avoided that by answering each question directly to the participants, ensuring that they gave an answer and filling the forms with a legible handwriting.

Another limitation was the difficulty in identifying previous studies which assessed the knowledge, attitudes and practices of parents and health personnel towards the risk of seizures in children exposed to camphor and eucalyptus essential oils contained in pharmaceutical products.

Some parents considered such studies to be a nuisance and waste of time since there was no financial compensation and several health personnel were unavailable to answer the questionnaire thereby limiting the number of participants [16].

The differences in age restrictions on drug information leaflets in English-speaking countries compared to French-speaking countries for drugs of the same brand and same composition in camphor and/or eucalyptus essential oils constituted a difficulty in harmonizing the questionnaire [25–28] .

CONCLUSION

From the results obtained, this study revealed the following; the state of knowledge among parents and health personnel was poor and the attitudes scores among both parents and health personnel were very satisfactory. Practices scores among the majority of parents and health personnel revealed harmful practices. Parents with poor knowledge scores were more likely to have harmful practices scores. There was no significant association between harmful practices scores and health personnel gender, age, profession/degree, educational sector of training, country of studies, number of years of studies, number of years in practice, religion, number of children, global attitudes levels, and global knowledge levels.

Ethical Approval and Consent

Administrative authorization for our study were obtained from the Director of the Mother and Child Centre of the Chantal Biya Foundation and the study was approved by the ethical committee of the Faculty of Medicine and Biomedical Sciences of University of Yaounde I. We also provided an informed consent form both for parents and health personnel with relevant information on the study. This was a detailed summary containing information about the aim of the study and the eventual risks. Signed informed consent was obtained from the parents and health personnel before administering the questionnaire.

COMPETING INTERESTS:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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