Consumer Awareness of Health Risks of Arsenic, Cadmium, Chromium, and Lead Present in Cosmetic and Personal Care Products in Dubai

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Abstract

Objectives: This study aimed to (i) identify the categories of cosmetic and personal care products (PCPs) and the relevant tests for each category, (ii) identify arsenic, cadmium, chromium, and lead in these products, and (iii) measure the level of awareness among the employees’ of Dubai Municipality (DM) about the associated risks in these products.

Methods: Primary data were collected through administering a questionnaire to 1500 DM employees at 10 health related departments of DM. Secondary data to identify the categories of cosmetic and PCPs and associated risks were collected from the product databases available at consumer products safety section at DM. The data were analyzed using SPSS version 16.

Results: The cosmetic and PCPs containing (i) cadmium and chromium posed the highest public health risk, and (ii) arsenic posed the lowest health risk. The cosmetic and PCPs originating from (i) Taiwan and Egypt posed the highest health risk, and (ii) Tunisia and France posed the lowest risk.

Conclusions: The understanding level of the consumers on certain physical aspects of consumer products was acceptable.

Keywords: Cosmetics; Dubai; Environmental health; Heavy metals; Personal care products; Risk management

Introduction

The subject of health risks associated with consumer products is internationally recognized [1-5]. To ensure safety of the consumer product, the quality of the product is assessed for the presence of the harmful ingredients or traces through the manufacturing process [6]. This is achieved through identifying the harmful ingredients at all stages from importation, distribution, storage and consumption through enforcing policies and procedures to maintain and test the safety of consumer products [7,8]. Dubai Municipality (DM) is a pioneer authority in United Arab Emirate (UAE) that assesses the safety of consumer products based on standardized universal chemical and physical tests [9].

Trace quantities of naturally occurring heavy metals such as chromium, arsenic, cadmium, and lead end up in the raw materials used for production of cosmetic and personal care products (PCPs) [10,11]. The absorption of these heavy metals via skin and/or oral route depends upon physical-chemical properties of these products [11]. Cadmium is classified as a human carcinogen [12]. The presence of cadmium in the products and its absorption by the body can lead to kidney damage, lower bone mineral density, bronchitis, pulmonary edema, chemical pneumonitis, including peripheral neuropathy with symptoms of tingling, numbness, and muscle weakness [11,12-14]. The extensive exposure to consumer products that contain lead can elevate the level of lead concentration in the blood that may reach to 10µg/dL. Exposure to lead from cosmetics and dermal absorption can result in adverse effects on the central nervous system, kidneys, and the hematopoietic system [10,15-17].

Arsenic is one of highly toxic metals and it can be absorbed via ingestion and inhalation [18]. Arsenic accumulates in skin, hair, and nails. Chronic exposure to arsenic can result in dermatitis, hyper pigmentation, keratosis, leukemia, kidney cancer, and bladder cancer, damage to nervous system, anorexia, liver enlargement, and death [18]. Chromium exposure via ingesting contaminated food or drinking water or breathing contaminated air may result in anemia, damage to the stomach or intestines, and cancer [4]. The contact of several chromium containing products with skin can cause severe redness and swelling of the skin as well as skin ulcers [19-21].

The main goal of the present study was to identify the main chemical risks associated with the use of cosmetic and PCPs, and to identify those products with higher risk on the public health of the Emirate of Dubai [22]. The specific objectives of the study were to (i) identify the categories of cosmetic and PCPs used by the people in Dubai [23], and relevant chemical and physical tests for each category, (ii) identify the cosmetic and PCPs with highest and lowest risk in terms of both potential risks and country of origin, and (iii) measure the level of DM employees awareness about the risks associated with these products.

Methods

Study sample and sampling

Data collection: Data about the categories of the cosmetic and PCPs and their relevant tests, scope of the safety of the products, services that had been provided, and the chemical test results were, obtained from several databases available at Consumer Products Safety Section (CPSS) of DM. The primary data was obtained by the “Consumer

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Products Risk Questionnaire” distributed at the 10 departments of two health related sectors at DM: environment, health and safety control sector and environmental and health services sector. The questionnaire was distributed to 1500 DM employees via their email and the completed questionnaires were returned to the authors. We received 368 questionnaires in which 10 questionnaires were not fully completed and the rest 358 questionnaires were appropriate for use yielding a 24% response rate. The scale measure used in SPSS software was used to measure the responses of the employees in many variations like strongly agree, agree, not applicable or not decided, disagree and strongly disagree where each carried a symbol number like 5, 4, 3, 2, and 1 respectively [24].

Sample size

For the DM populations above 10,000 people and around 1500 employees in the 2 health related sectors of DM at time this study was conducted, the following equation was used for determining the sample size:

\[ n_0 = \frac{z^2 \cdot p \cdot (1-p)}{\epsilon^2} \]

Where: \( n_0 \) = required sample size; \( z = \) confidence level at 95% (standard value of 1.96), \( p = p \) is the estimated proportion of an attribute that is present in the population. A 50% of respondent is expected that yields a value of 0.50 as proportion, \( \epsilon = \) is the desired level of precision or the margin of error at 5% (standard value of 0.05).

Sample size required for the employees = \( n_0 = 1.96 \times 1.96 \times 0.50 \times (0.05 \times 0.05) = 384 \). Correction for finite population is as per the following formula [25].

\[ n = n' \]
\[ n' = \frac{n}{1 + (n-1/p)} \]

Therefore, the new sample size (n’) for the employees who participated in the questionnaire was as follows: New sample size (employees) = \( 384 / (1+383/1500) = 384 / 1.255 = 305 \) employees. The same equation was used for determining the sample size for the products as follows: New sample size (products) = \( 384 / (1+383/2000) = 384 / 1.915 = 322 \) products.

A sample size of 241 provided enough sample size and fit the normal distribution. As for list of the test on the chemical, it was tested at an alpha risk at 5% using one population test on means with a test normal distribution. As for list of the test on the chemical, it was tested at an alpha risk at 5% using one population test on means with a test normal distribution. As for list of the test on the chemical, it was tested at an alpha risk at 5% using one population test on means with a test normal distribution. As for list of the test on the chemical, it was tested at an alpha risk at 5% using one population test on means with a test normal distribution. As for list of the test on the chemical, it was tested at an alpha risk at 5% using one population test on means with a test normal distribution.

Results

Table 3 shows the one-sample statistics and test performed for cadmium chemical test and it shows that the sample size for cosmetic and PCPs that were tested for cadmium was 241 with the spread of 0.5 for the standard deviation (SD) and a mean of 0.103. The t value which is referred as \( Z_{\epsilon_{sd}} \) was 1.637 and the significance (p-value) was 0.103. As the null hypothesis for cadmium stated that the concentration level was greater than 0.05 ppm, the p-value in this case was greater than alpha at 10%, 5% and 1%. So, it failed to reject the null hypothesis for the cadmium test thereby suggesting that the cadmium levels in cosmetic and PCPs are greater than 0.05 ppm and that can pose human risk upon use [1,14]. For the presence of chromium in cosmetics and PCPs the data as shown in table 3 indicates a sample size of 241 with the spread of 3.475 for SD and a mean of 1.21. The t value was 3.285 whereas the p-value was 0.001. Since the null hypothesis for chromium stated that the concentration level was greater than 0.05 ppm in the cosmetic and personal care products, the p-value in this case was less than alpha at 10%, and 5%. Therefore, the null hypothesis was rejected.

| Category         | Examples                                      |
|------------------|-----------------------------------------------|
| Face care        | Face masks (with the exception of peeling products) |
| Tinted bases     | Liquids, pastes and powders                   |
| Powders          | Make-up, after-bath and hygiene powders       |
| Soaps            | Toiletry and deodorant soaps                  |
| Perfumery        | Perfumes, toilet waters and eau de Cologne    |
| Bath care        | Salts, foams, oils and gels                   |
| Depliators       | Hair remover                                  |
| Body care        | Deodorant, anti-perspirant and Sunbathing products |
| Shaving          | Creams, foams, lotions                        |
| Lip care         | Make-up and make up remover                   |
| Mouth care       | Teeth and mouth products                      |
| Nail care        | Nail polish                                   |
| Skin care        | Anti-wrinkle products, skin-whitening products, creams, emulsions, lotions, gels and oils |
| Hair care        | Hair tints and bleaches, product for waving, straightening and fixing and setting products |
| Cleansing        | Lotions, powders and shampoos                 |
| Conditioning     | Lotions, creams and oils                      |
| Hairdressing     | Lotions, lacquers and brilliantine            |

Table 1: List of cosmetic and personal care products (CPSS, 2010).

| Type of consumer product | Chemical test |
|--------------------------|---------------|
| All cosmetic & personal care products | - Cadmium  |
|                           | - Chromium    |
|                           | - Zinc        |
|                           | - Chloroform  |
|                           | - Lead        |
|                           | - Arsenic     |
| Hair care products        | - Formaldehyde|
|                           | - 1,4-Dioxane |
| Whitening creams          | - Mercury     |
|                           | - Hydroquinone|
| All Cosmetic & personal care products containing preservatives | - Alkyl-hydroxy- benzoate |
| Mouth wash products       | - Fluoride    |
| Hair dyes                 | - Hydrogen Peroxide |
| Cosmetic products for application on hair, scalp, skin or nails which remain in traces after rinsing or use | - Staphylococcus aureus  |
|                           | - Molds & Yeasts |
| Tooth pastes              | - Di-ethylene Glycol |

Table 2: List of chemical tests for cosmetic products.
for the chromium test, suggesting that the chromium levels in cosmetic and personal care products were less than 0.05 ppm and hence did not pose risk upon use [15,19].

The one-sample statistics for presence of lead as shown in table 3 indicates that with a sample size of 241, the spread of SD was 7.95 with a mean of 1.276. In addition, the t value was 2.395 and p-value of 0.017. The null hypothesis used for the presence of lead stated that the concentration level would be greater than 0.05 ppm in the cosmetic and PCPs. The data as shown in table 3 rejected this null hypothesis thereby suggesting that the lead levels in cosmetic and personal care products were less than 0.05 ppm and posed no human risk upon use (FDA 2011; [28]). Table 3 also shows the one-sample statistics for presence of arsenic in cosmetics and PCPs that with a sample size of 241, the spread of SD was 0.327 and a mean of 0.107. The t value was 2.708 and the p-value was 0.007. As the null hypothesis for arsenic stated that the concentration level would be greater than 0.05 ppm, the null hypothesis was rejected for the arsenic test, hence suggesting that the arsenic levels in cosmetic and PCPs were less than 0.05 ppm so posed no human risk upon use [11].

Descriptive analysis for relationship between the country of origin of the cosmetic and PCPs

Cadmium

Products from Algeria, Argentina, Brazil, France, Germany, Iran, Ireland, Italy, Jordan, Korea, Malaysia, Netherland, Pakistan, Poland, South Africa, Spain, Taiwan, SAR (Syria), Tunisia, Turkey, UK, and USA did not show any risk of cadmium presence in their products (Table 4). On the other hand, there were certain products and brands sourced from different regions that showed risk of presence of cadmium (detection level more than 0.05 ppm) as follows: 50% of the products from Egypt, 25% of the products from KSA (Kingdom of Saudi Arabia), 20% of the products from Thailand, 14.3% of the products from UAE, 10.5% of the products that carry no label of country of origin, 7.7% of the products from India, and 5.6% of the products from China showed risk of cadmium presence.

Chromium

Products from Algeria, Brazil, and Iran did not pose any risk of chromium presence (detection level of 0.05 ppm) in their products (Table 4). However, there were certain products and brands sourced from different regions that posed risk of presence of chromium (detection level of more than 0.05 ppm) as shown in table 4.

### Table 3: One-sample statistics and test for cadmium, chromium, lead, and arsenic.

|            | N   | Mean | Std. Deviation | Std. Error Mean |
|------------|-----|------|----------------|-----------------|
| **Cadmium**|     |      |                |                 |
|            | 241 | 0.1027 | 0.5000         | 0.0322          |
| Test Value | 0.05|      |                |                 |
| t          | 1.637| df= 240 | =0.103        |   0.0527         |
| Sig.       | 0.103| (2-tailed) | | 95% Confidence Interval of the Difference |
| **Chromium**|   | 1.2110 | 5.4750         | 0.3534          |
| Test Value | 0.05|      |                |                 |
| t          | 3.285| df =239 | =0.001        |   1.1609         |
| Sig.       | 0.001| (2-tailed) | | 95% Confidence Interval of the Difference |
| **Lead**   |     | 1.2764 | 7.9481         | 0.5119          |
| Test Value | 0.05|      |                |                 |
| t          | 2.395| df = 240 | =0.017        |   1.2264         |
| Sig.       | 0.017| (2-tailed) | | 95% Confidence Interval of the Difference |
| **Arsenic**|     | 0.1070 | 0.3273         | 0.0210          |
| Test Value | 0.05|      |                |                 |
| t          | 2.708| df = 240 | =0.007        |   0.0570         |
| Sig.       | 0.007| (2-tailed) | | 95% Confidence Interval of the Difference |

### Lead

The relation between the country of origin of the cosmetics and PCPs, and lead as shown in table 4 suggests that products from Algeria, Brazil, France, Ireland, Iran, Jordan, Korea, Malaysia, Netherland, South Africa, Syria, Tunisia, and Turkey did not show any risk of lead presence (detection level of 0.05 ppm). On the other hand, there were certain products and brands sourced from different regions that posed risk of presence of lead (detection level of more than 0.05 ppm).

### Arsenic

Products from Algeria, Argentina, Brazil, France, Iran, Ireland, Italy, Jordan, Korea, Malaysia, Netherland, South Africa, Syria, Spain, Thailand, Tunisia, Turkey, and UK did not pose any risk of arsenic presence (detection level of 0.05 ppm). However, several products and brands originating from various other countries posed risk of presence of arsenic (detection level of more than 0.05 ppm).

Descriptive analysis for the risks associated with the cosmetics and PCPs

The descriptive analysis of DM employees’ awareness about the risks associated with the cosmetics and PCPs is shown in table 5. As per the questionnaire, we asked the participants regarding their understanding of the organizational unit that was responsible for the approval of the consumer products in Dubai. The result of this question showed that approximately 44.6% of the participants understood which organizational unit or section at DM that was responsible for the consumer products safety and control program. The other 31.1% of the participants strongly agreed on this matter yielding 75.7% understanding of the entity responsible for approving the consumer products at DM. However, 35 participants out of the 305 in total could not decide on the organizational unit’s name though they might have understood that there was one section or more doing this task. The rest around 12.8% disagreed and stated that they did not understand the organizational unit that dealt with consumer products approval. The average score on this question was 3.9 out of 5 measurement scales as shown in table 5.

The second objective question (Table 5) stated that "I think that the compliance of the products been sold in Dubai represents services and responsibilities of the concerned Dubai authorities". The result showed that around 50.5% of the participants understood that the presence of products that complied with rules and regulations of the Dubai authority and were sold in Dubai represented the several...
services and responsibilities of the concerned Dubai authority. The other 21.3% of the participants strongly agreed on this matter. 46 participants out of the 305 in total could not decide whether it carried all the related safety information. The majority of the participants around 59.6% agreed with this. Around 16.7% could not decide and the rest 23.6% expressed their disagreement. The average score on this question was 3.5 out of a 5 measurement scale.

The question number six highlighted the consumer products’ safety scope through the understanding of the label of the product that had been purchased, as shown by the ingredients of the product. Around 61.3% expressed their agreement on this whereas around 11.1% could not decide and the rest 27.5% expressed their disagreement. The average score on this question was 3.4 out of a 5 measurement scale.

The seventh question studied the production date of the products that could be identified by the consumer. The majority of the participants around 88.8% expressed their agreement. Around 9.8% could not decide and the rest 1.3% expressed their disagreement. The average score on this question was 4.2 out of a 5 measurement scale.

The consumer products safety as manifested by the expiry date that could be identified by the consumers was analyzed through question 8. Around 86.6% of the participants expressed their agreement. However, approximately 10.2% could not decide and the rest 3.3% expressed their disagreement. The average score on this question was 4.1 out of a 5 measurement scale.

The proper understanding of the label of the product with health warnings was tested via question number 10. While 63.9% of the participants expressed their agreement, whereas 17.7% could not decide and the rest 18.4% expressed their total disagreement. The average score on this question was 3.6 out of a 5 measurement scale.

The understanding of storage condition that could be identified by the consumers was tested in the next question. A 64.9% of the participants expressed their agreement, 17.4% were not sure about this, and the rest 17.7% expressed their total disagreement. This yielded a score of 3.6 out of 5.

The association of brand name with the perception of safety of consumer products was also tested (see question 12). The majority of the participants around 78.1% agreed with this. Around 14.1% could not decide on the matter and the rest 7.7% expressed the total disagreement. The average score on this question was 3.8 out of 5.

The technical statement thirteen within the questionnaire focused on the objective with a simple question in which it tested the consumer perception of safety of a product based on its country of origin. The results showed that while more than half of the participants expressed their agreement whereas approximately 23.6% were not confident and the rest 22.3% expressed their total disagreement. The average score on this question was 3.8 out of 5.

The understanding of the written label on each product that had been purchased. The results showed that 41.6% of the participants agreed that they understood the language of the label in addition to another 27.9% of participants that strongly agreed they understood the matter. Around 17% of the participants were not able to decide and 25 participants disagreed on the matter stating that they did not understand the language of the written label. The average score on this question was 3.8 out of 5 measurement scales.

The next question (question 5) focused on the objective that highlighted on the consumer products’ safety scope through understanding of the label of the product that was purchased and whether it carried all the related safety information. The majority of the participants around 59.6% agreed with this. Around 16.7% could not decide and the rest 23.6% expressed their disagreement. The average score on this question was 3.5 out of a 5 measurement scale.

| Country      | Cadmium % | Lead % | Chromium % | Arsenic % |
|--------------|-----------|--------|------------|-----------|
| China        | 5.6       | 27.8   | 83.3       | 11.1      |
| Egypt        | 50        | 50     | 100        | 50        |
| India        | 50        | 50     | 100        | 30.8      |
| KSA          | 25        | 48.3   | 83.3       | 16.7      |
| Thailand     | 20        | 20     | 100        | 0         |
| UAE          | 14.3      | 35.7   | 85.7       | 21.4      |
| No country label | 10.5   | 42.1  | 94.7       | 15.8      |
| Argentina    | 0         | 100    | 100        | 0         |
| Germany      | 0         | 11.1   | 83.3       | 5.6       |
| Italy        | 0         | 15.4   | 100        | 0         |
| Pakistan     | 0         | 50     | 50         | 50        |
| Poland       | 0         | 33.3   | 89.9       | 11.1      |
| Spain        | 0         | 50     | 50         | 0         |
| Taiwan       | 0         | 100    | 100        | 100       |
| UK           | 0         | 13.6   | 59.1       | 0         |
| USA          | 0         | 37.9   | 89.7       | 0.4       |
| France       | 0         | 66.7   | 0          | 0         |
| Ireland      | 0         | 75     | 0          | 0         |
| Jordan       | 0         | 100    | 0          | 0         |
| Korea        | 0         | 50     | 0          | 0         |
| Malaysia     | 0         | 100    | 0          | 0         |
| Netherlands  | 0         | 100    | 0          | 0         |
| SAR          | 0         | 100    | 0          | 0         |
| S. Africa    | 0         | 100    | 0          | 0         |
| Tunisia      | 0         | 33.3   | 0          | 0         |
| Turkey       | 0         | 75     | 0          | 0         |
| Iran         | 0         | 0      | 0          | 0         |

Table 4: The risk associated products, tests in percentage and country of origin.

The fourth question tested the understanding of the participants towards the language of the written label on each product that had been purchased. The results showed that 41.6% of the participants agreed that they understood the language of the label in addition to another 27.9% of participants that strongly agreed they understood the matter. Around 17% of the participants were not able to decide and 25 participants disagreed on the matter stating that they did not understand the language of the written label. The average score on this question was 3.8 out of 5 measurement scales.
The consumer perception on their awareness of the safety program and the time limit it was initiated in the Emirate of Dubai was also analyzed. The data showed that the majority of the participants agreed as shown in question 15. However, 5.9% could not decide on the matter and the rest 4% expressed total disagreement in which 3.3% disagreed and 0.7% strongly disagreed and stated that they had no idea of the time the consumer products safety program that was initiated in the Emirate of Dubai. The average score on this question was 4.3 out of 5.

The consumer perception on their capability of access to the services provided by the organizational unit on providing information with reference to the product category that was controlled was also tested. While the minority of the participants around 37.7% expressed their agreement, whereas 33.4% of the respondents did not know and the rest 28.9% of the respondents expressed the total disagreement. The average score on this question was 3.1 out of 5.

Finally, the 17th question tested the consumer perception on their capability of access to the services provided by the organizational unit on providing information with reference to the product category that was controlled. The results showed that 39.7% of the participants expressed their agreement. Around 24.3% could not decide and the rest 36% expressed total disagreement. The average score on this question was 3.1 out of a 5 measurement scale.

**Discussion**

Most of the product categories within the international firms included cosmetic and personal care products along with the healthy supplement products. These two categories were under question both from the questionnaire perspective as well as the chemical tests. The Safe Cosmetics Action Network in 2007 revealed that 66% of the lip care products contained lead comparing to this research that showed around 25.2% of the products contained detectable lead content. This variance between the two findings was due to the un-recognized product within the market where the sources were not defined.

As the null hypothesis for cadmium stated that the concentration level was greater than 0.05 ppm within the cosmetic and personal care products, the p-value in this case was 0.103. So, it is failed to reject the null hypothesis for the cadmium test, what it means is that the cadmium level in cosmetic and personal care products is greater than 0.05 that induces risk upon consumption.

Similarly, the null hypothesis for chromium stated that the concentration level was greater than 0.05 ppm within the cosmetic and personal care products, the p-value in this case was 0.001 which is less than alpha at 10%, and 5%. Hence, the null hypothesis is rejected for the chromium test, what it means that the chromium level in cosmetic and personal care products is less than 0.05 that does not induce risk upon consumption.

The null hypothesis for lead stating that the concentration level is greater than 0.05 ppm within the cosmetic and personal care products, the p-value in this case was 0.017. We therefore rejected this null hypothesis for the lead test, so the lead level in cosmetic and personal care products is less than 0.05 that does not induce risk upon consumption.

The most risk associated products as per the type of products and their origins as shown in table 4 were:

- Products that are from Taiwan had the highest risks associated 60%
- Products that are from Egypt had the second most risks associated 50%
- Products that are from India had the third most risks associated 44%
- Cosmetic and personal care containing Chromium 80.6%

**Table 5:** Dubai municipality employees’ awareness measurement score.

| # | Questionnaire Technical Statement                                                                 | Awareness Measurement Score | Awareness Measurement Percentage |
|---|----------------------------------------------------------------------------------------------------|------------------------------|---------------------------------|
| 1 | I understand the organizational unit responsible for the approval of the consumer products in Dubai | 3.9/5                        | 75.7%                          |
| 2 | I think that the compliance of the products been sold in Dubai represents services and responsibilities | 3.7/5                        | 71.8%                          |
| 3 | I am sure that the consumer products I use are safe                                                | 3.4/5                        | 58.3%                          |
| 4 | I understand the language of the label on each product I purchase                                  | 3.8/5                        | 69.5%                          |
| 5 | The label of the product I usually purchase carry all the related information as it is defined as | 3.5/5                        | 59.6%                          |
|    | part of consumer products safety scope                                                             |                              |                                 |
| 6 | I can identify the ingredients contained in the consumer products I use                            | 3.4/5                        | 61.3%                          |
| 7 | I can identify the production date on the label of the consumer products I use                     | 4.2/5                        | 88.8%                          |
| 8 | I can identify the expiry date on the label of the consumer products I use                         | 4.2/5                        | 86.6%                          |
| 9 | I can identify the country of origin on the label of the consumer products I use                   | 4.1/5                        | 89.2%                          |
| 10| I understand the health warnings added to the labels of the consumer products I use                | 3.6/5                        | 64.9%                          |
| 11| I understand the storage condition for each consumer products I use                                 | 3.6/5                        | 64.9%                          |
| 12| I buy the consumer product based on its brand name                                                  | 3.8/5                        | 78.1%                          |
| 13| The product safety depends on the country of origin of the product                                 | 3.5/5                        | 54.1%                          |
| 14| I am familiar with the risks associated with consumer products                                     | 3.7/5                        | 68.2%                          |
| 15| I understand when the safety program has been initiated                                              | 4.3/5                        | 90.2%                          |
| 16| The service information with reference to each consumer products category is accessible by the consumer | 3.1/5                        | 37.7%                          |
| 17| The service information with reference to each consumer product related risks is easily accessible | 3.1/5                        | 39.7%                          |
|    | by the consumer                                                                                     |                              |                                 |
| Total Score |                                                                                                          | 3.7/5                        | 74%                            |
Least Risk Associated Products: The least risk associated products as per the type of products and their origins as shown in table 4 were:

- Products that are from Tunisia and France have the least risks associated (7%).
- Products that are from Korea have the third least risks associated (10%).

Basically, the questionnaire examined the consumer’s awareness on the identification of the product categories and the relevant tests. It is also revealed that the physical tests been performed through the questionnaire questions identified that the country of origin of the product was of much importance as it showed the origin of the product.

Moreover, the questionnaire results showed that compared to healthy supplement daily dealing which scored less than half of the participants, cosmetic category scored 100% and this grabs the attention that more cosmetic products were used than the healthy supplements where its users were less. The total awareness score for the technical statements within the questionnaire was 3.7 out of 5 yielding 74%. This means that the understanding level of the consumers on certain physical aspects of consumer products was acceptable and ranged within the good level of understanding.

Conclusions

Summarizing the abovementioned results, we conclude that the most risk associated products as per the type of products and their origins (Table 4) were:

- Products that were from Taiwan had the highest risks associated (60%).
- Products that were from Egypt had the second most risks associated (50%).
- Products that were from India had the third most risks associated (44%).
- Products that were from South Africa, Malaysia, Argentina and Pakistan had the fourth most risks associated (40%).
- Products that carried no label for the country of origin had the fifth most risks associated (36%).

The most risk associated products as per the type of test (Table 3) were:

- Cosmetic and PCPs containing cadmium.

The least risk associated products as per the type of products and their origins (Table 4) were:

- Products that were from Tunisia and France had the least risks associated (7%).
- Products that were from Korea had the third least risks associated (10%).
- Products from UK had the fourth least risks associated (14.5%).
- Products from Ireland and Turkey had the fifth least risks associated (15%).

The least risk associated products as per the type of test (Table 3) were:

- Cosmetic and PCPs containing arsenic.

The understanding level of the consumers on certain physical aspects of consumer products was acceptable and ranged within the good level of understanding.

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