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## STUDY OF STORAGE CONDITIONS ON THE NUTRACEUTICAL PRODUCTS AND ITS IMPLIMENTATION AT RETAIL AND WHOLESALE STORES OF QUETTA



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### Abstract

Nutraceuticals are important to provide health benefits including prevention and treatment against ailments. The target can be achieved with the obligation that the nutraceuticals retain their required effectiveness till the consumer's bucket. A cross sectional study was conducted to evaluate storage conditions of nutraceuticals at retail and wholesale stores. The data revealed that the principal storage conditions mentioned on the label have a great difference between advice and its implementation at storage sites. This might result in loss of potency during improper storage which not only impacts the efficiency and safety of nutraceutical products but also the health of the user. It becomes the moral responsibility of the custodian of nutraceuticals at retail and wholesale outlets to follow the required storage conditions mentioned on the label to ensure that the quality of nutraceutical product is not compromised.

**Keywords:** Light protection, Nutraceuticals, Storage conditions, Temperature maintenance

## INTRODUCTION

The term nutraceutical (nutrients and pharmaceuticals) was coined by Stephen DeFelice in 1979 with the understanding "a food or part of food that provides medical or health benefits, including the prevention and treatment of disease (1). Nutraceuticals might be natural functional/medical foods, bioactive phytochemicals or any non-toxic extract that has scientifically proven health promoting effects (2). The nutraceuticals are used in nutritional therapy based upon their chemical structures and biological functions (3). These may include vitamins, lipids, proteins, carbohydrates, minerals or combinations of nutrients like dietary supplements (4). The majority of the nutraceuticals do possess multiple therapeutic benefits as they act as immune boosters. They act as anti-obese, anti-diabetic and anti-cancer agents. Nutraceuticals have been reported to manage chronic inflammatory disorders, degenerative and cardiovascular diseases (5).

Nutraceutical products require controlled storage and transit conditions in order to ensure the quality. Storage at recommended temperatures is a very critical and important aspect of the total nutraceutical control system (6). Proper environmental control i.e., desired temperature, protection from sunlight, humidity, conditions of sanitation, ventilation, and segregation must be maintained wherever nutraceuticals are stored in the premises (7). The nutraceuticals stored at temperature higher than that of label advice may result in the loss of potency which ultimately influences the efficacy and safety of nutraceuticals (8).

Nutraceuticals having water soluble vitamins are available in the form of liquid, granules and powder supplements (9). Liquid supplements are more sensitive to light and heat compared to granular and

powder supplements. They need special means/ conditions for storage. Storage or transportation at a temperature higher than the manufacturer's advice results in deterioration of potency. Thus it is crucial to store nutraceutical products especially liquid water soluble vitamins in compliance with labeling. To accomplish the goal of proper storage of heat sensitive products responsibilities must be developed and implemented. Keeping in mind the importance of storage conditions which includes maintenance of temperature and exposure to direct sunlight in respect of injectable nutraceuticals, survey has been conducted at different retail and wholesale stores of Zarghoon Town Quetta, Balochistan, Pakistan, to update the existing storage conditions and compare them with the label advice of the manufacturer.

## METHODOLOGY

Descriptive cross-sectional survey was conducted among the nutraceutical sale outlets located at Zarghoon town Quetta from May 2019 to August 2019. During the course of study there were 750 retail and 126 wholesale outlets in the study area. The software Raosoft (10) was used for the random selection of sale points. A total of 256 retail and 96 wholesale outlets were visited. Sale outlets were visited during 12 pm to 3pm and temperature out and inside was recorded using calibrated mercury minimum and maximum thermometer (HTC). The maximum peak hours were assessed on the basis of previous five-year data downloaded from website "AccuWeather" (11). The data from sale outlets was collected using a pretested structured proforma, with parameters:

- Presence of qualified staff
- Awareness of counter staff about storage conditions of nutraceuticals
- Temperature control arrangement
- Direct sunlight protection measurement

## RESULTS

Data regarding presence of qualified staff presented in figure 1 revealed that, during the survey, 6 and 9 % qualified staff was present in the retail and wholesale outlets respectively. The results regarding characteristics; awareness of counter staff about storage conditions of nutraceuticals, protection of nutraceuticals from direct sunlight and presence of temperature control measurements are presented in Table I. The survey conducted amongst the retail and wholesale stores revealed that 31 and 45 % over the counter staff were aware about the various storage conditions advised by the nutraceutical product manufacturers. Direct sunlight protection arrangement and temperature control measurements were present in 37, 16% retail outlets and 51, 10% wholesale outlets respectively.

The data regarding out and inside temperature of the sale points showed a significant ( $P < 0.05$ ) difference. Inside temperature was recorded significantly ( $P < 0.05$ ) higher than the manufacturer label advises (Table II).

**Table I.** Presence (in %) of Characteristics in the nutraceutical sale outlets

| Characteristics                                 | Nutraceutical sale outlets |                   |            |
|-------------------------------------------------|----------------------------|-------------------|------------|
|                                                 | Retail outlets             | Wholesale outlets | Cumulative |
| Awareness Of OTC staff about storage conditions | 31                         | 45                | 76         |
| Direct Sunlight Protection                      | 37                         | 51                | 88         |
| Temp control measurement                        | 16                         | 10                | 26         |

**Table II.** Month wise temperature of the out and inside of nutraceuticals sale outlets.

| Sale outlets | Month   | Outside Temperature (°C) | Inside Temperature (°C) | Label advice Max (°C) |
|--------------|---------|--------------------------|-------------------------|-----------------------|
| Retail       | May     | 41.6±2.8 <sup>a</sup>    | 38.8±2.2 <sup>b</sup>   | 29.9 <sup>c</sup>     |
|              | June    | 43.5±2.5 <sup>a</sup>    | 40.7±2.8 <sup>b</sup>   | 29.9 <sup>c</sup>     |
|              | July    | 42.1±2.5 <sup>a</sup>    | 39.8±1.44 <sup>b</sup>  | 29.9 <sup>c</sup>     |
|              | overall | 42.4±2.5 <sup>a</sup>    | 39.8±2.3 <sup>b</sup>   | 29.9 <sup>c</sup>     |
| Wholesale    | May     | 42.2±2.8 <sup>a</sup>    | 37.6±3.3 <sup>b</sup>   | 29.9 <sup>c</sup>     |
|              | June    | 44.1±2.7 <sup>a</sup>    | 40.9±3.3 <sup>b</sup>   | 29.9 <sup>c</sup>     |
|              | July    | 42.2±1.7 <sup>a</sup>    | 39.1±1.5 <sup>b</sup>   | 29.9 <sup>c</sup>     |
|              | Overall | 42.9± <sup>a</sup>       | 39.2± <sup>b</sup>      | 29.9 <sup>c</sup>     |



## DISCUSSION

Stability of nutraceutical products is extremely essential to maintain their therapeutic efficacy (12). Exposure of nutraceuticals including water soluble vitamins to high temperature, either at storage or during transport could reduce their efficacy (13). The improper storage of nutraceuticals at undesirable temperature is among major factors which contribute to decrease efficacy of product (14). The journey of nutraceutical begins at the site of manufacturer and after passing through wholesale and retail sale outlets ends in the hands of consumer (15). The findings of present study revealed that majority of the sale outlets (wholesale and retail) were lacking qualified staff at counter. Similar situation was reported from Karachi with the observation of 4% qualified staff at nutraceutical sale outlets (16). The results of present survey revealed that, responsibility of the owner of pharmacy to keep qualified staff for dispensing of nutraceutical was overruled as it is very clear in Pakistan Pharmacy Act, “a pharmacy graduate is mandatory to run a pharmacy” (17).

The results of present study showed that, more than 80% of the nutraceutical sale outlets were devoid of temperature control measurements. Furthermore, 50% of the nutraceutical outlets were exposed directly to sun light. These results are consistent with the previous findings (15). Findings of present study also showed that the mean temperature of sale outlets during peak temperature hours was undesirable, and it was significantly higher than that of label advice. The scenario may affect the quality of nutraceutical and makes it questionable (18). In this regard a previous study suggested, exposure to high temperature caused loss of efficacy of nutraceutical products (19).

Current findings exposed a huge gap between knowledge of over-the-counter staff and their on-ground practices they were well aware that, the direct exposure of sun light and keeping the nutraceuticals at high environmental temperature can deteriorate the quality of the product whereas, temperature control at required level i.e., below 30° and protection from direct sun light were not maintained in the nutraceutical sale outlets of the study area. These findings are consistent with other studies (19, 20)

It is suggested that, to avoid direct sun light exposure to nutraceutical products in the sale outlets amber glass or UV protected glass should be used instead of plain glass and for inside temperature control there must be air conditioners or any other means by which the temperature of inside remain below the temperature of label advice. Active awareness campaign using print and online media along with seminars and distribution of pamphlets might be helpful to change the scenario. Pharmacovigilance centers can take up this as an added responsibility.

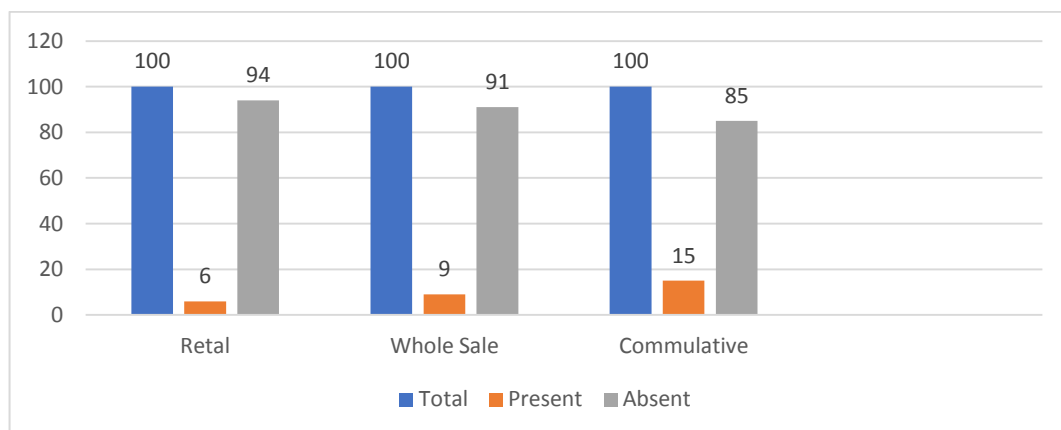


Fig. 1. Presence of qualified staff (in %) at nutraceutical sale outlets

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