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Evaluating the palatability of an oral nutritional supplement (Livity®): A consumer-based, cross-sectional study.

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Abstract

Background: There is a substantial global market for dietary supplements that are frequently used. These products are meant to supplement diets while also enhancing health and wellness. Fewer studies have been conducted on sensory and consumer science compared to the substantial quantity of dietary supplement research on nutrition, dietetics, and medicine. Hence the present study aimed to assess the consumer's attitude toward the physical and sensory attributes of the nutritional supplement.

Methodology: 262 consenting non-diabetic subjects of either gender ≥ 40 years of age participated in this cross-sectional study. After enrollment, the subjects were requested to consume 53.8 gm of nutritional supplement dissolved in 195 ml of cold water, followed by an interview-based survey. The consumer's preference for product sensory and physical characteristics such as appearance, taste, aroma, mouth feel, and post-consumptions feel was inquired. Preferences for the oral (Vanilla flavor) nutritional supplement (Livity®). Factors were assessed using the scoring test of a 7-point numerical scale, i.e., ranging from 1 (Strongly Disagree) to 7 (Strongly Agree).

Results: Around 66.50% of subjects valued the taste of the nutritional supplements the most, followed by flavor (13.0%), aroma (9.20%), color (5.60%), energizing effect (3.60%), mouth feel (3.10%) and aftertaste (0.50%). The mean score for all the physical and sensory parameters was higher than 5, except for grainy mouth feel (mostly perceived as a negative attribute) and energetic feeling post-consumption. Around 92.4% agreed that the mouth feel of the consumed, oral nutritional supplement was smooth, 75.8% agreed on flavor quality, 70.7% were satisfied with the taste, and 82.8% reported that the smell was pleasant.

Conclusion: It is concluded that the physical and sensory attributes of the oral nutritional supplement (Livity®) were highly rated in this consumer attitude-based survey.

Keywords

Oral Nutritional Supplement, Palatability, Flavor, Aroma.

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Introduction

To meet nutrient needs, a well-balanced and nutritious diet is necessary. However, maintaining nutritional status is challenging due to several restrictions in everyday life, such as undernutrition and specific pathologies such as liver and gastrointestinal illnesses, cystic fibrosis, and some malignancies[1]. Oral nutritional supplements can be recommended to compensate for one or more nutrient deficits and restore appropriate body growth and function[2]. These items are intended to supplement a typical diet by offering a concentrated dose of nutrients or other compounds that, alone or in combination, have a nutritional or physiological effect[3]. It may improve hospitalization outcomes, according to a growing body of evidence. Inpatient episode costs, complication rates, depressive symptoms, readmission rates, and length of hospital stay have all been found to decrease when ONS is used, in addition to improved lean body mass recovery[4].

There are many different supplements on the market in pharmacies and drugstores. Their formulation varies depending on the intended audience (chewable, effervescent tablets, supplemented drinks, powders for oral use, or gelled). Oro-dispersible forms can occasionally cause unpleasant perceptions like an aftertaste or an off-taste. Off-tastes are a significant technological barrier to consumer acceptance because the global flavor drives consumer acceptability. As a result, producers of these goods must come up with more creative and successful plans to guarantee acceptance. The flavor characteristics of functional nutrients are not well covered in the literature. Olfaction, gustation, and oral/nasal somatosensory inputs are chemical senses that are functionally integrated to create flavor perception[5].

Due to the growing usage of dietary supplements, there has been a lot of research done in the fields of nutrition, dietetics, and medicine. For instance, earlier studies looked into the demographics of dietary supplement use as well as how supplements affected senior people's cognitive abilities. On the other hand, consumer perceptions of dietary supplements have rarely been tested experimentally. Most published research has concentrated on the demographic, socio-cognitive, and psychological factors that influence dietary supplement use[6]. Dietary supplement use, for example, is higher in older (vs. younger) adults, women (vs. men)[7], and people with more (vs. less) education[8]. Individuals with positive attitudes[6,9], higher subjective norms[9,10], higher perceived behavioral control[9,11], and higher health values are more likely to use dietary supplements, as are those who are prone to illness[9]. The study aimed to assess consumers' attitudes toward the nutritional supplement's physical and sensory attributes.

Methodology

A cross-sectional study was conducted at various Dietician and Nutritionist clinics of numerous institutes in major cities of Pakistan (Karachi, Lahore, Islamabad/Rawalpindi, and Peshawar). The sample size of 245 was calculated using the OpenEpi sample size calculator; considering the dropout rate, 262 subjects were enrolled. The ethical approval was obtained from the AEIRC ethical review committee (Ref. No: ERC/S20/P-013; Dated January 29th, 2022).

All consenting non-diabetic male and female patients≥ 40 years of age with or without the limited ability to consume solid food were included in the study. After initial screening, the subjects were requested to consume 53.8 gm of oral (Vanilla flavor) nutritional supplement (Livity®) dissolved in 195 ml of cold water, followed by an interview-based survey on the preference for product sensory and physical characteristics such as appearance, taste, aroma, mouth feels and post-consumptions feel. Preferences for the oral nutritional supplements (Factors) were assessed using the scoring test of a 7-point numerical scale, i.e., ranging from 1 (Strongly Disagree) to 7 (Strongly Agree).

The statistical analysis was performed on SPSS version 26.0. Mean and standard deviation was used to display all continuous variables, while categorical variables were presented using frequencies and percentages.

Results

The baseline characteristics of the subjects are shown in table 1. The mean age of the enrolled subjects was 52.32 ± 9.45 years. Most of the enrolled subjects were male (62.60%).

Table 1: Baseline characteristics of the study population.

Variables		(n=262)
Age (years); Mean ± SD		52.32±9.45
Gender	Female	98(37.40)
	Male	164(62.60)
Education	Ph.D.	4(1.5)
	Masters	23(8.7)
	Bachelors	33(12.6)
	HSC	30(11.5)
	SSC or below	172(65.6)
Occupation	Self-Employed	61(23.30)
	Employed	86(32.80)
	Retired/Unemployed	59(22.50)
	Housewife	56(21.40)

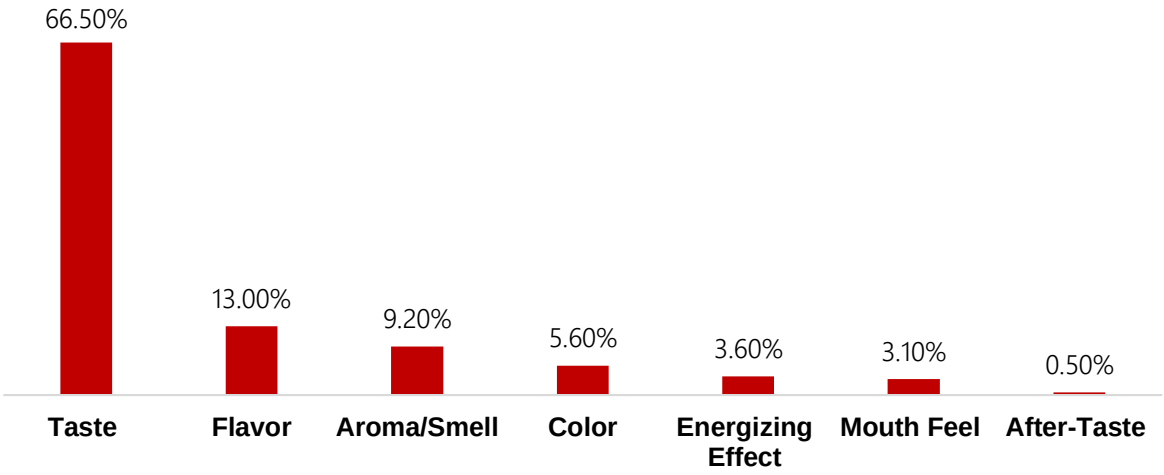

Figure 1: Factor of the nutritional supplement most valued by the consumers.

Figure 1 shows the value of sensory and physical factors of the nutritional supplements. Among all the parameters of the nutritional supplement, the taste is the most valued parameter, followed by flavor, aroma, color, energizing effect, mouth feel, and aftertaste, respectively.

Among the sensory and physical parameters, the subjects were asked questions regarding the appearance, taste, smell, mouth, and post-consumption feel. The preference greatly varied between somewhat agree (5-

points) and strongly agree (7-points), except for grainy feeling in the mouth and energetic feeling after consumption, i.e., a mean score of 2.57 ± 1.75 and 4.61 ± 1.68, respectively.

Table 3: Consumer's response with respect to each factor associated with the palatability of the nutritional supplement.

Variables		Strongly Disagree	Disagree	Some what Disagree	Neutral	Some what Agree	Agree	Strongly Agree	Mean Score
Appearance Parameters	Appealing Color	2(0.80)	5(1.90)	4(1.50)	3(1.10)	7(2.70)	92(35.20)	148(56.70)	6.36±1.07
	Consistency	11(4.20)	18(6.90)	4(1.50)	10(3.80)	6(2.30)	54(20.70)	158(60.50)	5.97±1.75
	Viscosity	6(2.30)	12(4.60)	3(1.20)	7(2.70)	12(4.60)	82(31.50)	138(53.10)	6.05±1.53
Taste Parameters	Taste	22(8.40)	23(8.80)	12(4.60)	20(7.60)	19(7.30)	61(23.30)	105(40.10)	5.27±2.04
	Flavor	12(4.60)	22(8.40)	12(4.60)	17(6.50)	19(7.30)	75(28.70)	104(39.80)	5.47±1.87
	Sweetness	5(1.90)	12(4.60)	11(4.20)	18(6.90)	19(7.30)	87(33.20)	110(42.00)	5.81±1.52
	After Taste	19(7.30)	32(12.20)	7(2.70)	24(9.20)	15(5.70)	69(26.30)	96(36.60)	5.19±2.04
Smell (Olfactory)	Pleasant Smell	5(1.90)	16(6.10)	11(4.20)	13(5.00)	14(5.40)	84(32.20)	118(45.20)	5.81±1.62
Mouth Feel	Smooth	1(0.40)	8(3.10)	3(1.10)	8(3.10)	18(6.90)	102(38.90)	122(46.60)	6.16±1.15
	Grainy	72(27.50)	112(42.70)	22(8.40)	17(6.50)	8(3.10)	13(5.00)	18(6.90)	2.57±1.75
Post consumption feel	Energetic	7(2.70)	32(12.30)	7(2.70)	102(39.10)	10(3.80)	63(24.10)	40(15.30)	4.61±1.68

Preferences for the oral nutritional supplements (Factors) were assessed using the scoring test of a 7-point numerical scale, i.e., ranging from 1 (Strongly Disagree) to 7 (Strongly Agree)

Discussion

The flavor is one of the key elements impacting consumer approval. A basic survival instinct, taste perception, enables people to assess the food's nutrient content and security[12]. It regulates appetite and food intake and plays a significant role in sensory satisfaction[13]. Patients have reported poor flavor quality of ONS, including overall flavor type, unbalanced flavor profile, off notes/taints, or unfavorable aftertastes and sensations, anecdotally in the literature[14-16]. Numerous studies have discovered that inadequate flavor perception dramatically reduces product acceptance and ONS adherence[17,18]. Nutritional components employed in ONS formulations result in several sensory problems, including taints and aftertastes[19]. A complex interaction between factors inherent to the product (unwanted sensory attributes) and factors intrinsic to the consumer (sensory abilities), which influence the overall flavor and palatability of ONS, can be seen in the age-related changes in sensory abilities and physiology. These changes are also likely to further modulate ONS's perceived palatability and consumer experience.

Metallic tastes may result from minerals added to ONS during manufacture, such as iron sulfate[20] and are negative drivers of liking in ONS[15]. Methven et al. examined the effects of ONS's mineral content and determined it to be substantially less metallic than the control than mineral-free ONS. Even so, the change was negligible, and the scientists concluded that, in addition to the minerals added to the ONS formulation, additional ingredients, including calcium and milk proteins, may also be responsible for the metallic flavor in the products[20]. In the current study, the ONS contained 242 mg of calcium, 2.2 mg iron, and other minerals such as sodium, potassium, zinc, magnesium, and others in a single serving of 533.8 gm powder mixed in 230 ml water. Among all the parameters of the nutritional supplement, we found that the taste was

rated as the most valued parameter, followed by flavor, aroma, color, energizing effect, mouth feel, and aftertaste.

According to the literature, the high sweetness of ONS is associated with high liking. Methven et al. discovered that a sweeter ONS resulted in a higher mean initial liking than a sweeter ONS [20]. Additionally, after drinking several successive aliquots of a sweetened ONS, preference for it dramatically declined compared to an unsweetened ONS. According to Den Boer et al., participants consumed 8% more of a sweeter ONS and had considerably greater product pleasantness, liking, and desire[21]. Individuals have a wide range of optimally preferred sweetness concentrations, and researchers can classify consumers as "sweet likers" or "sweet dislikers" based on their sweetness tolerance[22]. In the present study, most of the subjects agreed (82.5%) that the sweetness of the ONS was satisfactory; 5.81 ± 1.52 was the mean score for the sweetness of the ONS consumed.

ONS should have a palatable, product-congruent, and attractive scent to boost hunger and consumption desire. However, studies show that the aroma of ONS is subpar. More than 82.8% of subjects in the present study suggested that the smell of the consumed ONS was pleasant. In support, Lambert et al. also concluded that an 'unpleasant odor' is a significant barrier to ONS consumption, determined based on focus groups with health professionals[14]. In a second study, U Dhuibhir et al. employed a questionnaire to find that dietitians evaluated the sensory attribute "smell" as one of their least favorite ONS sensory qualities. Some individuals claimed to have detected a "medicinal" or "synthetic" odor[23]. The source of the foul odors within ONS has yet to be identified.

On the other hand, it might be because of ONS's vital nutritional components, including proteins, or because of the way it was made. For instance, heat-processing protein components can intensify high-protein dairy drinks' "cooked" flavors[19]. The difference in acceptability between 'fresh' ONS goods and those treated by high-temperature treatment to produce long-life ONS may be explained by the development of disagreeable odors during heat treatment.

A liquid's perceived viscosity in the mouth is referred to as its thickness, a textural characteristic of liquids. According to research by Den Boer et al., there were no differences in subjective feelings of fullness in thin ONS who drank 33.3% more total volume than thick ONS overall (resulting in higher nutrient consumption)[21]. Previous studies have found that the perceived thickness of high-protein drinks influences perceived satiation[24]. The consistency and viscosity of the consumed ONS were satisfactory to most of our enrolled subjects. In addition to the appearance, taste, and smell, the mouth also feels greatly affects the palatability of any ONS. The nutritional supplement consumed in the present study was associated with a smooth mouth feel rather grainy; 92.4% strongly agreed that the ONS was smooth on the tongue and throat. ONS products are rich in proteins and hence cause mouth drying, while on the other hand, mouth coating has also been studied in ONS products[15,20]. If the ONS's sensory qualities are well-liked, mouth coating is desirable[25]. Mouth coating becomes unwanted if the ONS's sensory qualities are unpleasant.

This study has some limitations; the conclusions regarding ONS compliance cannot be drawn because only the palatability was evaluated. Only a single nutritional product was tested in this study, and a broader range of products may produce different results.

Conclusion

In conclusion, the consumers were highly satisfied with the physical and sensory attributes of the oral nutritional supplement (Livity®) consumed. Among them, taste was the most valued parameter for most consumers. The experience and preference varied positively for most parameters associated with appearance, taste, smell, and mouth feel, except for the post-consumption energetic feeling.

Conflicts of Interest

Jahanzeb Kamal Khan and Ali Nasir are employees of Getz Pharma, and all other authors have no interests to declare. The ONS (Livity®) used in the present study were supplied by Getz Pharma.

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