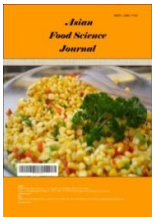

Asian Food Science Journal

18(3): 34-44, 2020; Article no.AFSJ.57104
ISSN: 2581-7752

Consumer Awareness and Preference towards Finger Millet in Sri Lanka

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Authors' contributions

This work was carried out in collaboration among all authors. Authors SASJ and DSS designed the consumer survey and performed the statistical analysis. Author SASJ managed the literature searches and wrote the first draft of the manuscript. Author DSS revised the manuscript. Authors JKRRS, GHCMH and MJG supervised the research and revised the manuscript. All authors read and approved the final manuscript.

Article Information

DOI:10.9734/AFSJ/2020/v18i330220
Editor(s):
(1) Dr. Uttara Singh, Panjab University, India.
Reviewers:
(1) Margarita Išoraitė, Vilniaus kolegija/University, Lithuania.
(2) Adeyeye, Samuel Ayofemi Olalekan, Ton Duc Thang University, Vietnam.
(3) Omar Mohammad Faleh Atrooz, Mutah University, Jordan.
Complete Peer review History: http://www.sdiarticle4.com/review-history/57104

Original Research Article

Received 10 March 2020
Accepted 16 May 2020
Published 14 October 2020

ABSTRACT

Aim: This survey was conducted to evaluate Sri Lankans' awareness and attitudes towards finger millet and preferences towards finger millet-based foods.
Methodology: Pre-tested, self-administrated questionnaires were formulated in the three main languages used in Sri Lanka, namely Sinhala, English and Tamil. The questionnaires consisted of different sections to obtain data on respondents' socio-demographic characteristics, health and food related lifestyles, attitudes towards finger millet and preferences towards finger millet-based food products. Printed and online forms were distributed covering all 25 districts from August to November in 2017 and after excluding incomplete responses 1016 respondents were selected for the study. Data were analyzed using Frequency analysis and Chi-square analysis.

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Results: Although the majority of the respondents (57.5%) were aware of the nutritional value of finger millet, a considerable percentage of the respondents have stated that they are not aware of the nutritional value. The majority of the respondents who were suffering from non-communicable diseases rarely added finger millet to their diets. The majority of the respondents (66.6%) liked to consume finger millet regardless of gender, age, educational level and residing district. However, limited availability of finger millet flour incorporated food products in ready-to-eat form has restricted their regular finger millet consumption. Only 33.9% of the respondents were aware of the finger millet flour incorporated food products currently available in the local market. The majority of the respondents wished to purchase finger millet flour incorporated novel ready-to-eat products to increase their finger millet consumption.

Conclusion: The findings evidently indicated the importance of educating the general public on nutritional value and various health benefits of finger millet. Further, the findings revealed the necessity of effective advertising and promoting approaches for the finger millet flour incorporated products currently available in the local market and reflected market opportunities for novel finger millet flour incorporated ready-to-eat products.

Keywords: Consumer behaviors; consumer survey; finger millet; finger millet-based foods; food industry; market opportunities in Sri Lanka.

1. INTRODUCTION

Finger millet (*Eleusine coracana* (L.) Gaertn.) is the most important small millet in the tropics and cultivated in more than 25 countries in African and Asian continents predominantly as a staple food [1,2]. It is rich in phenolic compounds, dietary fibers and micronutrients which makes it more nutritive when compared to other most commonly consumed cereals including rice and wheat [1-6]. In African and Asian countries, finger millet is often used as a main component of several food products and as a complementary food for infants and young children. It is especially considered as a wholesome food for people who are suffering from diabetic mellitus. Finger millet is used in preparing traditional foods and beverages such as porridge, malted drinks, breads, dumplings, idli, roti, murukku, vada and dosa. The grains are malted and fermented to obtain traditional beer. Sprouted grains are used as a nourishing food for infants and invalids. Relatively new finger millet-based food products such as noodles, vermicelli, pasta, halwa, puddings, cookies, buns (finger millet flour is incorporated to the dough), breakfast cereal, soup mixes, composite flour mixes, laddu and pakora are also available [1,2,6-9].

Finger millet is the third important cereal cultivated in Sri Lanka after rice and maize [10]. It is commonly cultivated as a rain-fed crop since ancient times [11]. In Sri Lanka, finger millet flour is used in preparing string hoppers, porridge, pancakes, puddings, dosa, roti, pittu, *thalapa* (a traditional food made out of finger millet flour, salt and hot water), *wandu* (a traditional food made by steaming a mixture of finger millet flour, rice flour, coconut milk, coconut water, salt and treacle or jaggery) and *helapa* (a traditional food made by steaming a mixture of finger millet flour, scrapped coconut and treacle or jaggery). Finger millet flour incorporated noodles, breads, buns, pasta, breakfast cereal, pre-cooked cereal flour mix, cracker and cookie are also available in the local market. Although finger millet flour can be used in preparing different types of food products at the household level and finger millet flour incorporated food products are available in the market, those food products are less popular among the children and the younger generation. Consumption of finger millet-based food products has been confined only to the elder generation and to the habitual consumers from the areas of finger millet cultivation. No scientific studies have been conducted so far to evaluate consumer awareness and preference towards finger millet in Sri Lanka. A better understanding of consumer attitudes and preferences would certainly helpful in identifying new market opportunities and developing effective marketing strategies [12]. Therefore, the present study was focused on evaluating Sri Lankans' awareness and attitudes towards finger millet and preferences towards finger millet-based food products.

2. MATERIALS AND METHODS

2.1 Data Collection

The consumer survey was carried out based on the methods described by Bae et al. [12], Pupulawaththa et al. [13], Reid et al. [14], Kumar and Kaur [15] and Reid et al. [16]. Self-administrated questionnaires were designed in the three main languages used in Sri Lanka,

namely Sinhala, English and Tamil. The questionnaires consisted of different sections to obtain data on respondents' socio-demographic characteristics, health and food related lifestyles, views and attitudes towards finger millet and preferences towards finger millet-based food products. The questionnaires comprised of both open-ended and closed-ended questions. Knowledge on nutritional value of finger millet, preference towards finger millet consumption, awareness on finger millet-based food products currently available in the local market and preference to buy new finger millet-based food products were evaluated using a five-point Likert scale. Initially questionnaires were piloted among 15 random respondents and minor modifications were made to increase the clarity. Printed and online forms of the pre-tested questionnaires were distributed covering all 25 districts of the country from August to November in 2017 and data were collected from 1025 respondents. The respondents were informed of the purpose for conducting the consumer survey and they participated on their willingness.

2.2 Data Analysis

Data were analyzed using IBM SPSS Statistics (Version 20) software. Frequency analysis was conducted to examine the characteristics of the respondents and Chi-square analysis was used to assess the relationships.

3. RESULTS AND DISCUSSION

3.1 Demographic Characteristics of the Respondents

Responses were collected from 1025 respondents and after excluding incomplete responses only 1016 respondents were selected for the study. Demographic characteristics of the selected respondents are presented in Table 1. Among the selected respondents, the majority were female. The respondents varied in age from 11 to 90 years and the majority of them (77%) were in the age range of 21 to 50 years. The respondents varied in educational level and those who have passed the General Certificate of Education Advanced Level (GCE A/L) examination without further education made the majority followed by graduates. There were respondents from all 25 districts of Sri Lanka. However, the majority of them were from Colombo, Rathnapura, Gampaha, Kurunegala, Hambanthota, Kaluthara, Galle, Kandy, Mathara, Monaragala and Kegalle districts.

Table 1. Demographic characteristics of the respondents

Variables		Percentage (%)
Gender	Male	45.4
	Female	54.6
Age group	11 - 20	7.2
	21 - 30	42.2
	31 - 40	23.8
	41 - 50	11.0
	51 - 60	11.1
	61 - 70	3.0
	71 - 80	1.2
	81 - 90	0.5
Educational level	Received school education	8.1
	Receiving school education	2.2
	Passed GCE O/L examination	14.8
	Passed GCE A/L examination	26.6
	Undergraduate	13.7
	Graduate	17.1
	Post graduate	7.3
	Receiving vocational education	2.1
	Received vocational education	8.3

GCE: General Certificate of Education;
O/L: Ordinary Level;
A/L: Advanced Level

3.2 Health Status of the Respondents

The majority of the respondents did not suffer from diabetes, obesity, high blood pressure, low blood pressure, hypercholesterolemia, heart diseases, iron deficiency and diseases related to bones. Obesity was the most prevalent disease among the respondents followed by diabetes, high blood pressure, diseases related to bones, hypercholesterolemia, iron deficiency and heart diseases. Low blood pressure was the least prevalent disease among the respondents. A considerable percentage of the respondents have stated that they are not sure about whether they are having iron deficiency and diseases related to bones or not. In addition to the aforementioned non-communicable diseases (NCDs), asthma was the most prevalent disease among the respondents followed by catarrh, kidney diseases, hypothyroidism, migraine and psoriasis.

3.3 Awareness on the Nutritional Value of Finger Millet

Although the majority of the respondents were aware of the nutritional value of finger millet, a considerable percentage of the respondents have stated that they don't have any special knowledge about the nutritional value of finger millet and they are not aware of the nutritional value of finger millet (Fig. 1). This observation evidently indicated the importance of educating the general public on nutritional value and various health benefits of finger millet.

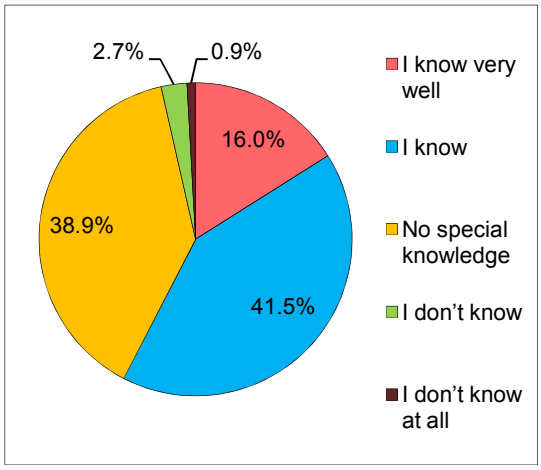

Fig. 1. The respondents' awareness on the nutritional value of finger millet

Statistically, there were no significant differences (χ^2 = 1.45, *P* = .84) between males and females on awareness on the nutritional value of finger millet. More than 50% of males (58.1%) and females (58.0%) were aware of the nutritional value of finger millet. No significant differences were observed among either the age groups (χ^2 = 37.42, *P* = .11) or the educational levels (χ^2 = 19.29, *P* = .96) of the respondents on awareness on the nutritional value of finger millet. From each age group, either 50% or more than 50% of the respondents were aware of the nutritional value of finger millet. Specially, all the respondents (100%) in the age group of 81 to 90 years were aware of the nutritional value of finger millet. The majority of the respondents those who have received school education, received vocational education, passed the General Certificate of Education Ordinary Level (GCE O/L) examination without further education and passed the GCE A/L examination without further education along with the majority of school children and graduates have stated that they are aware of the nutritional value of finger millet.

3.4 Preference towards Finger Millet Consumption

Although the majority of the respondents preferred to consume finger millet, 30.5% of the respondents have stated their preference as "neither like nor dislike" (Fig. 2).

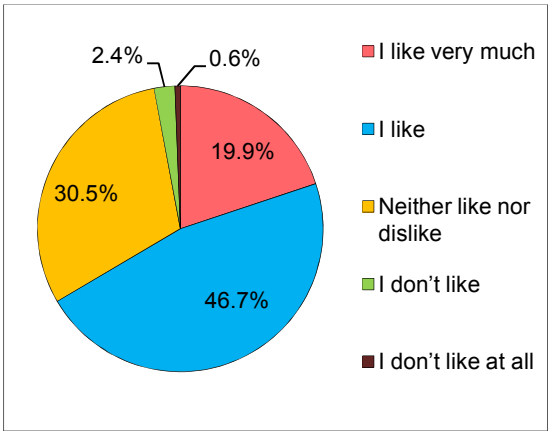

Fig. 2. The respondents' preference to consume finger millet

Consumption decisions are affected by the gender and age of the consumer [17, 18]. However, no significant differences were found either between males and females (χ^2 = 1.42, *P* = .84) or among the age groups (χ^2 = 24.77, *P* = .64) of the respondents on preference to consume finger millet. More than 60% of males (66.6%) and females (67.2%) preferred to add

finger millet to their diets. From each age group, more than 55% of the respondents preferred to consume finger millet. All the respondents (100%) in the age ranges of 71 to 80 years and 81 to 90 years have stated that they prefer to consume finger millet. There were no significant differences among either the educational levels (χ^2 = 38.97, *P* = .19) or the residing districts (χ^2 = 65.33, *P* = .99) of the respondents on preference to consume finger millet. The majority of the respondents from each educational level have stated that they like to consume finger millet. None of the respondents residing in Kegalle, Mathara, Mathale, Nuwara Eliya, Puttalam, Anuradhapura, Polonnaruwa, Monaragala, Ampara, Batticaloa, Trincomalee, Jaffna, Kilinochchi, Mannar and Mullaitivu districts have stated that they do not like to add finger millet to their diets.

3.5 Reasons Behind Preference and Dislike towards Finger Millet Consumption

Out of the 702 respondents who have stated the reason which was behind their preference towards finger millet consumption, the majority (74.1%) have stated that they consume finger millet because of the nutritional properties and health benefits. Out of the 702 respondents, 7.6% have stated that not only the nutritional properties and health benefits but also the unique taste encouraged them to consume finger millet and 6.5% have stated that only the unique taste encouraged them to consume finger millet. The other common reasons behind the consumption of finger millet were recognition as a good source of energy (3.7%), preference for *helapa* (1.6%), easiness to digest (1.2%), because it is a locally grown cereal (1.1%), as a change to usual diet (1.1%), minimal addition of pesticides during the cultivation (1.0%), habit to eat finger millet-based foods from the childhood (0.8%), preference for roti (0.4%), preference for *thalapa* (0.3%) and preference for finger millet porridge (0.3%). One respondent (female, in the age range of 11 to 20 years) has stated that she consumed finger millet-based foods because her mother encouraged her to do so and another respondent (male, in the age range of 21 to 30 years) liked the color of finger millet-based foods.

Out of the 82 respondents who have stated why they don't like to consume finger millet-based foods, the majority (56.1%) have stated that they do not like the unique taste of finger millet. The other common reasons behind the dislike towards the consumption of finger millet-based foods were coarse nature (22.0%), unavailability of finger millet-based processed foods (8.5%), unwillingness to consume a food which has not been consumed since the childhood (3.7%), not preferring the color of finger millet-based foods (2.4%) and allergic conditions (2.4%). Although finger millet allergy is rare, rare occurrences of anaphylaxis to finger millet were reported in previous case studies [19,20]. One respondent (female, in the age range of 21 to 30 years) has stated that she does not like to consume finger millet-based foods since it causes a diarrhea condition and another respondent (female, in the age range of 21 to 30 years) has stated that she does not like to consume finger millet-based foods since it induces gastritis conditions. One respondent (female, in the age range of 41 to 50 years) has stated that finger millet consumption increases the dryness of stools and another one (male, in the age range of 21 to 30 years) don't like the smell of finger millet.

3.6 Frequency of Finger Millet Consumption

Although the majority of the respondents consumed finger millet either once or twice a week or once or twice a month, a considerable percentage of the respondents rarely or very rarely added finger millet to their diets (Fig. 3).

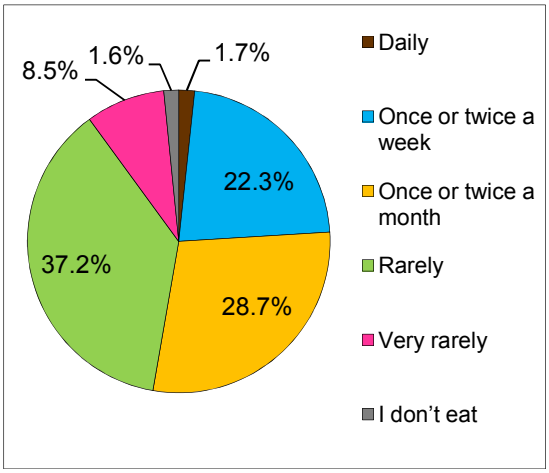

Fig. 3. Frequency of finger millet consumption

No significant differences were observed between males and females (χ^2 = 8.56, *P* = .13) and among the age groups (χ^2 = 31.64, *P* = .63) and the educational levels (χ^2 = 51.59, *P* = .10)

of the respondents on the frequency of finger millet consumption. Only 1.7% of males and 1.6% of females daily added finger millet to their diets. However, more than 15% of males (19.7%) and females (24.7%) added finger millet to their diets once or twice a week and more than 25% of males (30.2%) and females (27.9%) added finger millet to their diets once or twice a month. None of the respondents from 41 to 50 years, 61 to 70 years, 71 to 80 years and 81 to 90 years age groups daily added finger millet to their diets. However, 35.7% of the respondents from 41 to 50 years age group added finger millet to their diets once or twice a week and 40.0% of the respondents from 61 to 70 years age group added finger millet to their diets once or twice a month. None of the respondents above 61 years of age did not consume finger millet.

No significant associations were found between frequencies of finger millet consumption and awareness on the nutritional value of finger millet (χ^2 = 25.72, *P* = .18). Frequencies of finger millet consumption varied among the respondents regardless of their awareness on the nutritional value of finger millet. Unexpectedly, only 2.0% of the respondents who were aware of the nutritional value of finger millet, consumed finger millet daily and the majority of the respondents those who were aware of the nutritional value of finger millet have stated that they consume finger millet rarely. Although they were aware of the nutritional value of finger millet, 1.4% of the respondents have stated that they do not consume finger millet. Under the reasons behind the dislike towards finger millet consumption, 2.4% of the respondents have stated that it causes allergic conditions and this may be the reason which restricted their finger millet consumption.

The frequencies of finger millet consumption significantly depended on the respondents' preferences to consume finger millet (χ^2 = 59.77, *P* < .001). The majority of the respondents (33.3%) who have marked their preference as "I like very much" have stated that they consume finger millet once or twice a month. The majority of the respondents (50.0%) who have marked their preference as "I don't like at all" have stated that they consume finger millet rarely. However, only 1.99% of the respondents who have marked their preference either as "I like very much" or "I like" added finger millet to their diets daily and only 23.88% of them consumed finger millet once or twice a week. The limited availability of finger millet-based processed food products in ready-to-eat (RTE) form may be a possible reason behind this observation and it reflected the necessity of introducing a variety of finger millet-based RTE food products to the market. Changes in socio-demographic characteristics and consumer lifestyles have influenced the increasing demand for RTE foods [12,15]. Chandra et al. [21] have also stated that exploitation of finger millet for preparation of RTE food products would be helpful in increasing the finger millet consumption even among non-finger millet consumers.

No significant associations were found between prevalence of NCDs among the respondents and their frequencies of finger millet consumption. Frequencies of finger millet consumption varied among the respondents regardless of their health status. Although among cereal-based foods, finger millet-based foods are recommended for diabetic patients [22], none of the respondents who were suffering from diabetes mellitus added finger millet to their diets daily. The majority of the respondents who were suffering from obesity, high blood pressure and heart diseases have stated that they consume finger millet once or twice a week. The majority of the respondents who were suffering from diabetes mellitus, low blood pressure, hypercholesterolemia and iron deficiency have stated that they rarely add finger millet to their diets. Lacking the knowledge on health benefits of finger millet (especially antioxidant, antidiabetic and cardioprotective properties and abilities to prevent malnutrition, osteoporosis and other bone ailments) may be a possible reason which was behind this observation and it indicated the importance of educating the general public on nutritional value of finger millet and various health benefits which finger millet can offer to regular consumers.

3.7 The Respondents' Preferences towards Finger Millet-based Foods

Among the respondents, *helapa* was the most popular finger millet-based food product, followed by roti, pittu, porridge, string hoppers, *thalapa*, breakfast cereal, noodles and bread (Fig. 4). Finger millet flour based dosa, cracker, cookies and pasta were not much popular among the respondents. In addition to the common finger millet-based food products, some of the respondents have stated that they consume finger millet flour incorporated aggala, *wandu*, kokis, fish buns (finger millet flour is incorporated to the dough), cake and pancake.

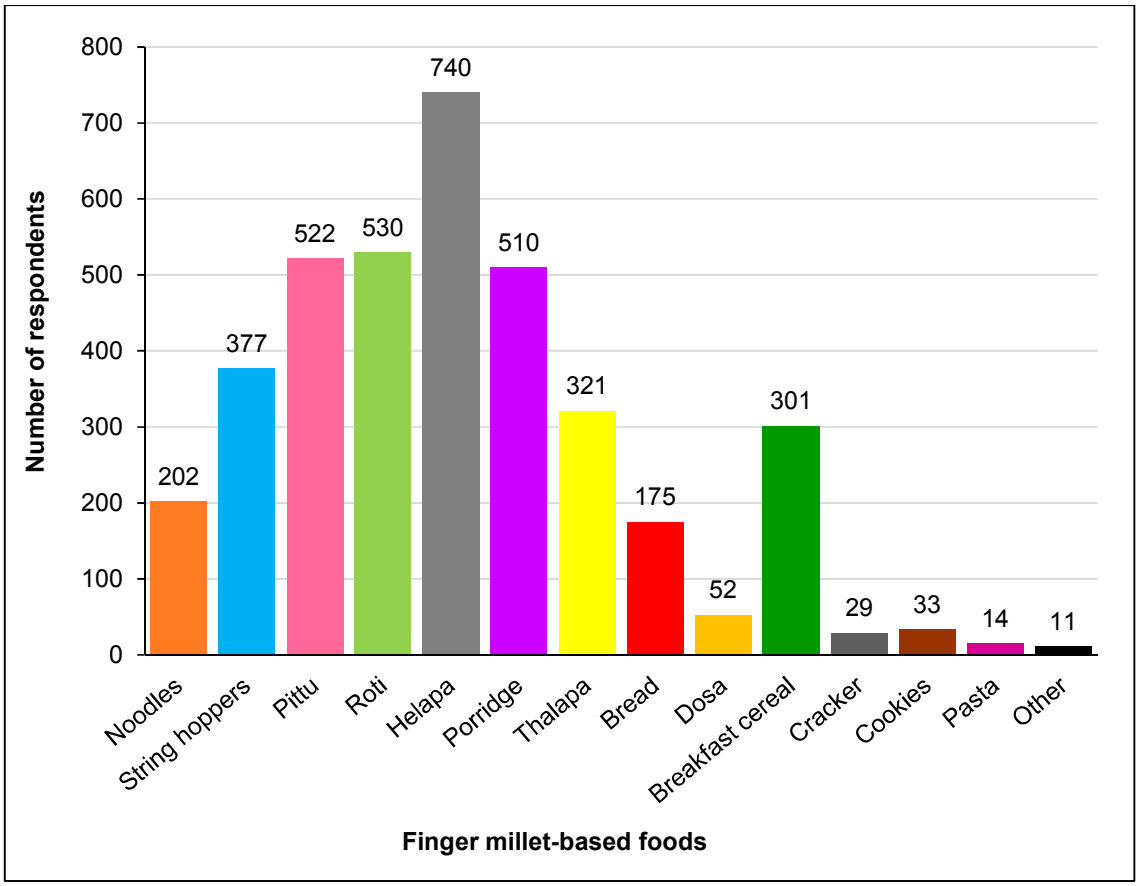

Fig. 4. The respondents' preferences towards finger millet-based foods

3.8 The Respondents' Awareness and Preferences towards Finger Millet-based Food Products Currently Available in the Local Market

The majority of the respondents have stated that they do not have any special knowledge about the finger millet-based food products currently available in the local market and 8.1% of the respondents have stated that they do not know about finger millet-based food products. Only 33.9% of the respondents were aware of the currently available finger millet-based food products in the local market (Fig. 5). This observation evidently indicated the importance of effective advertising and promoting approaches for the finger millet flour incorporated food products currently available in the local market.

No significant differences were found between males and females (χ^2 = 3.76, *P* = .44) and among the age groups (χ^2 = 33.69, *P* = .21) of the respondents on awareness on finger millet-based food products currently available in the local market. Only 31.2% of males and 36.2% of females have stated that they are aware of the currently available finger millet-based food products in the local market. Except the 41 to 50 years and 71 to 80 years age groups, only less than 40% of the respondents from each age group have stated that they are aware of the currently available finger millet-based food products in the local market. There were significant differences (χ^2 = 49.5, *P* = .03) among the educational levels of the respondents on awareness on finger millet-based food products currently available in the local market. Comparatively very low number school children and students who are receiving vocational education were aware of the currently available finger millet-based food products in the local market.

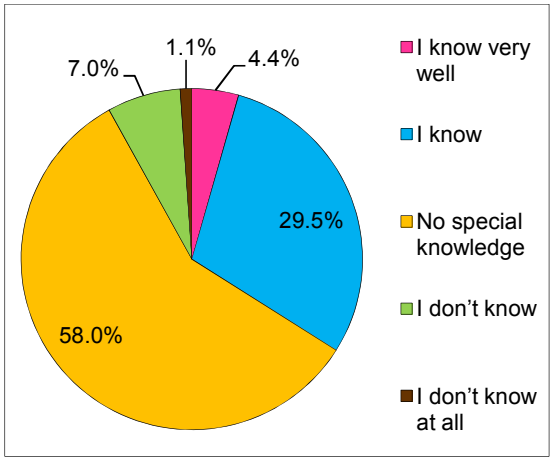

Fig. 5. The respondents' awareness on finger millet-based food products currently available in the local market

Out of the respondents who were aware of the currently available finger millet-based food products in the local market, the majority of the respondents were aware of the finger millet flour incorporated cracker, noodles and bread while comparatively very low number of respondents were aware of the finger millet flour incorporated dosa mix, cookie, pasta and finger millet-based breakfast cereal (Fig. 6). Out of the respondents who were aware of the currently available finger millet-based food products in the local market, the majority of the respondents have consumed finger millet flour incorporated cracker, noodles and bread while comparatively very low number of respondents have consumed finger millet flour incorporated dosa mix, cookie, pasta and finger millet-based breakfast cereal (Fig. 6).

Since only finger millet flour incorporated cracker, noodles and bread were popular among the respondents (Fig. 6), manufacturers of finger millet-based food products should pay their attention to advertise and promote their products highlighting the health benefits since it will be beneficial not only to increase the sales but also to increase the finger millet consumption of the general public.

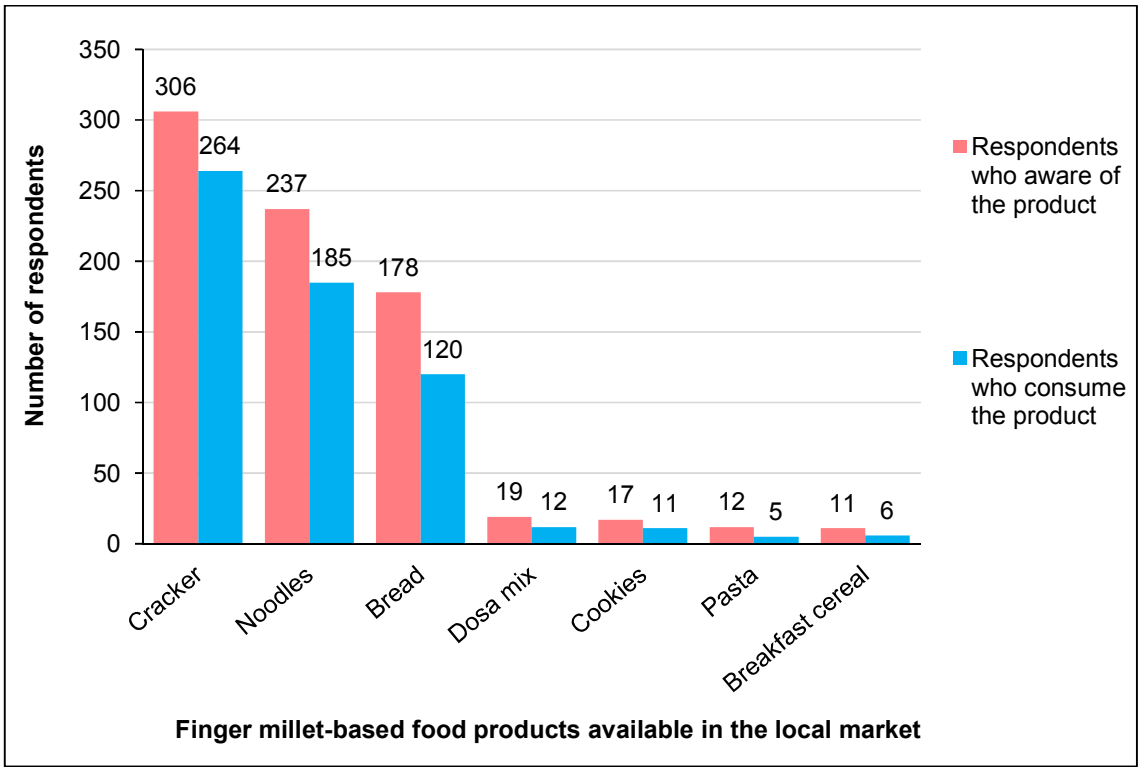

Fig. 6. The respondents' awareness and preferences towards finger millet-based food products currently available in the local market

3.9 New Finger Millet-Based Food Products Respondents Wish to See in the Market

The finger millet flour incorporated food product which the majority of the respondents wished to see in the market was biscuit followed by instant porridge, dessert, yoghurt, cookie and drinking yoghurt (Fig. 7). Since biscuits are popular among all population subgroups regardless of the age [13] and finger millet flour incorporated biscuits available in the local market are only limited to a locally manufactured cracker and an imported cookie, there seems to be a void waiting to be filled by more varieties of biscuits. In addition to finger millet flour incorporated biscuit, instant porridge, dessert, yoghurt, cookie and drinking yoghurt, some of the respondents have stated that they prefer to purchase finger millet flour incorporated ice creams, beverages, baby rusks, halwa, naan, nutrition bars, sandwich spreads, instant pittu mix, savory snacks and sweet snacks from the market. These observations indicated the market opportunities for novel finger millet-based RTE food products.

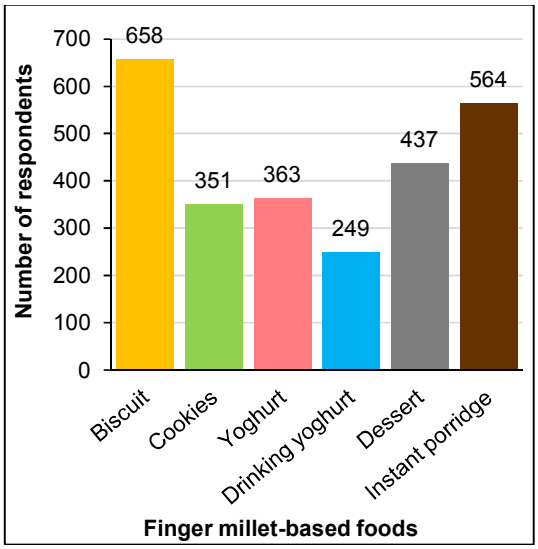

Fig. 7. New finger millet-based food products respondents prefer to buy from the market

3.10 Preference to Buy New Finger Millet-based Food Products

The majority of the respondents (88.1%) have stated their preference to buy the above mentioned new food products (if those are available in the market) either as “Like” or “Like very much” (Fig. 8).

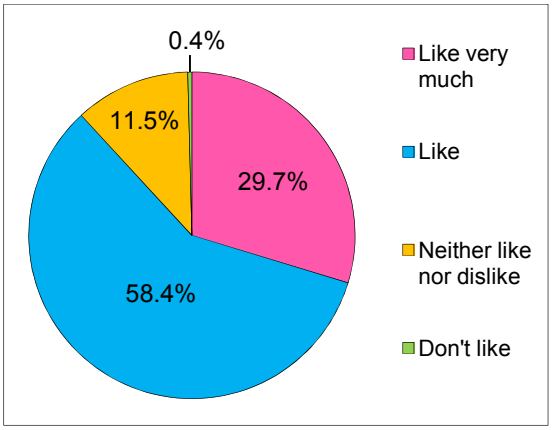

Fig. 8. The respondents’ preference to buy new finger millet-based food products

Although purchasing decisions are affected by the gender and age of the consumer [17,18], there were no significant differences either between males and females (χ^2 = 3.47, *P* = .48) or among the age groups (χ^2 = 22.65, *P* = .75) of the respondents on preference to buy new finger millet-based food products. More than 85% of males (86.8%) and females (89.0%) preferred to buy new finger millet-based food products. From each age group, more than 80% of the respondents preferred to buy new finger millet-based food products. None of the respondents above 41 years of age did not like to buy new finger millet-based food products. No significant differences (χ^2 = 30.31, *P* = .55) were found between the educational levels of the respondents on preference to buy new finger millet-based food products. Except the respondents who have passed the GCE A/L examination without further education and graduates, none of the respondents from the other educational levels have stated that they do not like to buy new finger millet-based food products. These observations indicated the potential of introducing finger millet flour incorporated novel food products including biscuits, instant porridge, desserts, yoghurt, cookies and drinking yoghurt to the market along with the nutritional properties and health benefits, targeting all population subgroups regardless of the age, to fulfill the market demand and to increase the finger millet consumption of the general public.

4. CONCLUSION

To the best of our knowledge this is the first consumer survey conducted in Sri Lanka to

evaluate consumer awareness and preference towards finger millet. This consumer survey is useful in identifying Sri Lankans' awareness and attitudes towards finger millet and preferences towards finger millet-based food products. Although the majority of the respondents were aware of the nutritional value of finger millet, a considerable percentage of the respondents have stated that they are not aware of the nutritional value of finger millet. Further, the majority of the respondents who were suffering from NCDs rarely added finger millet to their diets. These observations evidently indicated the importance of educating the general public on the nutritional value of finger millet and various health benefits which finger millet can offer to regular consumers. The majority of the respondents liked to consume finger millet regardless of the gender, age, educational level and residing district. However, limited availability of finger millet-based processed food products in RTE form have restricted their regular finger millet consumption and the majority of the respondents wished to purchase finger millet flour incorporated RTE products to increase their finger millet consumption. These observations reflected the market opportunities for novel finger millet-based RTE food products. Since the majority of the respondents were not aware of the finger millet flour incorporated food products currently available in the local market and only finger millet flour incorporated cracker, noodles and bread were popular among the respondents, manufacturers of finger millet-based food products should pay their attention to effectively advertise and promote their products highlighting the health benefits. It will be beneficial not only to increase the sales but also to increase the finger millet consumption of the general public.

DISCLAIMER

The products mentioned in this study are commonly and predominantly used products in our area of research and country. There is absolutely no conflict of interest between the authors and the manufacturers of these products and the authors do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Moreover, the research was not funded by any manufacturing company.

ACKNOWLEDGEMENTS

Financial assistance granted by the Treasury of Sri Lanka [Grant number: TG 16/122] is gratefully acknowledged. Authors are grateful to Mr. Priyadharsun Sivadasan, Associate Tech Lead, Geveo Australasia (Pvt) Ltd for being the Tamil translator.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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