## ORIGINAL ARTICLE

# Identification and prioritization of pigeon pea-based products tailored to consumer preference perspective: A mixed method assessment approach

Zahra Majili<sup>1</sup> | Cornelio N. Nyaruhucha<sup>1</sup> | Kissa Kulwa<sup>1</sup> | Khamaladin Mutabazi<sup>2</sup> | Constance Rybak<sup>3</sup> | Stefan Sieber<sup>3,4</sup>

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<sup>1</sup>Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, Morogoro, Tanzania

<sup>2</sup>College of Economics and Business Studies, Sokoine University of Agriculture, Morogoro, Tanzania

<sup>3</sup>Leibniz Centre for Agricultural Landscape Research (ZALF e.V.), Müncheberg, Germany

<sup>4</sup>Department of Agricultural Economics, Faculty of Life Sciences Thaer-Institute, Humboldt-Universität zu Berlin, Berlin, Germany

#### Correspondence

Zahra Majili, Department of Human Nutrition and Consumer Sciences, Sokoine University of Agriculture, 3006 Morogoro, Tanzania. Email: majilizahra11@gmail.com

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#### Abstract

Pigeon pea is frequently consumed in Southern Tanzania but in limited value-added recipes. The aim of this study was to identify and prioritize pigeon pea-based products that could be developed to improve organoleptic preferences and increase the diversification of the recipes. A descriptive cross-sectional study was conducted involving 355 consumers. Quantitative and qualitative information was collected through focus group discussions (FGDs) and face-to-face interviews. Pairwise comparison (PC) method and assigning scores in order of their preference was used in ranking pigeon pea-based products at the group and individual levels, respectively. PC counts and Garrett rank scores were computed and ranked using the Rank command in Excel software Version 2016. Ordinal regression was used to summarize the effect between groups' overall levels of the outcome at p-value < 0.05. Twelve and eleven pigeon pea-based products were identified during face-to-face interviews and FGDs, respectively. The highest Garret mean scores were observed on pigeon peabased noodles (70.6), flour (61.4) and chapati (60.4). Similarly, the highest PC counts were observed on pigeon pea-based noodles and chapati. The PC rank scores differed significantly by consumers' age categories. Pigeon pea-based noodles, flour and chapati are the utmost prioritized products due to their perceived value, sensory attributes, convenience and attitudes about the food product. However, knowledge and skills about using pigeon peas on producing the product were mentioned as limiting factors. Hence, the provision of practical hands-on skills on the preparation of pigeon pea-based products will increase the chances of diversifying pigeon pea recipes at the household level for improving food security and nutrition well-being.

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#### KEYWORDS

identification, mixed method, pigeon pea-based products, prioritization

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#### INTRODUCTION 1 |

Pigeon pea is widely grown in the developing world including Asia, Latin America, the Caribbean region and Africa (Sharma et al., 2011). It is mainly grown in semi-arid tropical regions (Sarkar et al., 2020). In sub-Saharan Africa, about 7.8 million households grow pigeon peas. In Tanzania, 209,299 households (URT, 2012) and more than threequarters of farmers in southern zone grow pigeon peas (Mponda et al., 2014; Simtowe et al., 2011). It is cultivated mainly for household consumption as an alternative protein food source as well as source of income (Mergeai et al., 2001; Shiferaw et al., 2007). Pigeon peas are rich sources of protein and amino acids (lysine, methionine, tryptophan), fibre, vitamins (riboflavin, niacin) and minerals (phosphorus, iron, magnesium) (Karri & Nalluri, 2017; Saxena et al., 2002). Despite being used as a food source, consumption of pigeon peas in all forms is very limited during lean season where only 18 g/p/d of all legumes, pigeon pea inclusive, is consumed (Majili et al., 2020). The less amount consumed will also lead to less intake of recommended amount of protein, amino acids, fibre, vitamins and minerals if not replaced by other foods rich in particular nutrient. The low consumption was due to different factors such high post-harvest losses due to pest attack, which leads to unavailability of pigeon pea throughout the year. Another factor is less diversified products (Majili et al., 2020), which limit consumption frequency of pigeon pea due to monotonous taste. Furthermore, inadequate knowledge on different ways of pigeon pea preparation practices owing to limited exposure on different pigeon pea-based recipes necessitates the need of identifying new recipes that can increase diversification and household consumption of culturally acceptable pigeon pea-based products as well as increase perennial availability of pigeon pea through product development. It is therefore important to consider consumer needs and preferences as rational agent in acceptability of newly developed products. Hence, consumer studies are essential from identification, development, testing and launching of new products. This article present one of the specific objectives of a bigger research project that aimed at developing value-added pigeon pea-based product for improved nutrition through diversification of the recipes. Hence, the article explains the identification and prioritization approach of pigeon pea-based products. Information collected will provide an insight on typical choice preferences that can increase chance of product acceptance among households. According to Van Kleef et al. (2005), the successful product acceptance is mainly based on the quality of the identification and prioritization process.

Prioritization is one of the most important aspects to ensure better results in production process. However, the task is complex when you have various aspects that require judgement of large group of people with diverse consumption behaviour and preferences. Several methods have been used in product identification and prioritization depending on the objectives of the study. For example, multi-voting technique (Anand & Dinakaran, 2017), nominal group technique (Olsen, 2019; Søndergaard et al., 2018), the Hanlon method (Choi et al., 2019; Mokhtari et al., 2013) and prioritization matrix (Tovar-perilla et al., 2018) have been used in health and agricultural

sectors. With special attention to food sectors, prioritization such as Fuzzy MoSCoW method (Burgess & Sunmola, 2021), KANO (Ponnam et al., 2011; Ulewicz, 2016) and pairwise comparison (PC) method (Kou et al., 2016) has been used in food product identification and prioritization. All these methods have merits and demerits. They are adapted to each analytical situation (contextualization) and therefore tailored with the highest adequateness for use, quality of results and feasibility. Generally, all methods aim at minimizing distortional effects such as domination of opinion holders and strategic behaviour of respondents. Thus, use of quantitative rankings, charts and matrices reduces domination of one idea during discussion. In this study, mixed techniques will be used, whereas the PC and Garrett techniques have been used in ranking products in order of their preference. The PC is the simplest type of interviews that weigh the importance of comparing two food products (i.e. binary choices). It is also considered as an effective decision tool in decision making where there are many alternatives (Kou et al., 2016). Additionally, it uses individual knowledge and experiences to make binary comparison of their choices and bring together in a comparison's matrix. The Garrett technique is also considered simple in rating the choices in order of merits. It provides the change of orders of choices into numerical scores based on their preference whereas the same product may have given different rank by different consumer (Zalkuwi et al., 2015).

On other hand, knowing the consumer choice priorities is a key element on designing and developing new products. Therefore, it is important to understand consumer choice preferences. Each consumer has a set of preferences and values that are determined by several interrelating factors related to food product, individual person and environment they live in (Barjolle et al., 2013). These are guided by consumer desires that satisfy his/her needs as believed and acceptable to their living environment. Therefore, it is important to understand consumer behaviour towards food consumption and choice preferences as well as ability to access the food product or wealth, availability of the product and preference. Based on random utility theory, each consumer has different preferences, which appear to behave in a certain way (Barjolle et al., 2013). These behaviours make them to rank order all possible combinations of consumption bundles placed in front of them based on their preferences and level of satisfaction. Hence, it is important to consider relationship between consumer concepts about the product, needs/wants, their behaviours and the environment around them. In order to select a pigeon peabased product that fit their preferences, this study aims to (i) identify pigeon pea-based product that preferred to be developed, (ii) rank identified pigeon peas-based product in order of their priority and (iii) determine the motives behind their prioritization preferences.

#### 2 METHODS AND STUDY APPROACH

#### Study design, sample and participants 2.1

A descriptive cross-sectional study was conducted in Mibure (Ruangwa district) and Mitumbati (Nachingwea districts) villages in Lindi region Tanzania in March 2020. The selection criteria of the two village was explained elsewhere (Majili et al., 2020). The sample was determined using Fisher's formula and the principles stipulated earlier (Moser & Korstjens, 2018). A total of 355 consumers were included based on their age, sex, participation in baseline study, knowledge about pigeon pea recipes and willingness to participate in the study. Among these consumers, 303 were involved in face-to-face interviews, and 52 were involved in focus group discussions (FGDs). The ones involved in face-to-face interviews participated in the previous study conducted in 2019 (Majili et al., 2020). A total of six FGDs sessions were conducted in both villages involving different age groups of consumers.

## 2.2 | Data collection and analysis

A participatory approach was used to identify and rank pigeon peabased products to be developed. Face-to-face interviews and FGDs were conducted in each respective village. In both methods, information on social demographic characteristics of all consumers was recorded. The process approach involved presentations, listing of preferred pigeon pea-based products and ranking of the listed products and analysis as indicated on process approach flow chart (Figure 1).

# 2.3 | Presentation of existing products in and outside the study site

Before the interviews and discussions, feedback of identified pigeon pea-based recipes in the area was presented to consumers in pictorial form (Figure 2). Then presentation of other existing different pigeon pea-based recipes in the world was followed (Figure 3). Each recipe was elaborated to consumers to make them familiar with the composition and technology used to prepare it.

#### 2.4 | Listing of potential products to be developed

FGDs and face-to-face interviews were used during listing of the potential products. During interviews and discussions, consumers were asked to mention pigeon pea-based recipes of their choice that





## **EXISTING PIGEON PEAS RECIPES CONSUMED IN** MIBURE NA MITUMBATI VILLAGES IN LINDI REGION

#### **INTRODUCTION**

Pigeon peas is among tropical legumes grown and consumed in different parts in developing countries. It is one of the most drought tolerant legumes and it is ranked the third most important legume after beans and groundnuts in Tanzania. It is used as food as well as source of income. It is also among legumes that are affordable and important sources of protein, vitamins and minerals for most of the households that can help in improving nutrition security. In Lindi region pigeon peas is used for household consumption as a relish and source of income.



can be developed and consumed in their locality as part of their daily meal or as a source of income. At individual level, the interviewer recorded all pigeon pea-based recipes mentioned before the ranking exercise. At group level, for each pigeon pea-based product mentioned, it was allowed to develop consensus prior listing in the flip chart by the moderator. The discussion was based on their ability to develop the products in their locality, consumers of the product and shelf life of the product. After consensus all pigeon pea-based recipes were listed in a flip chart for ranking.

#### 2.5 Prioritization

At the individual level, prioritization was done by ranking food in order of their preference. The consumers were asked to rank the food item of their choice and all responses were recorded. Garrett's ranking

techniques as described by Dhanavandan (2016) was used to arrange the pigeon pea-based products based on consumer's choice preferences in such a way that the same number of consumer on two or more pigeon pea-based products can have different rank scores. The count and per cent position for each product rank preference estimated was converted into scores. The following is Garrett's formula used for converting ranks into per cent:

$$Per \, cent \, position \,{=}\, 100 \,{\times} \left( \frac{R_{ij} \,{-}\, 0.5}{N_j} \right)$$

where  $R_{ii}$  = rank given for *i*th constraint by *j*th individual

 $N_i$  = number of constraints ranked by *j*th individual

The Garrett value or score was determined using Garrett ranking conversion table. The score of each product for everyone was added. Then total Garret score and Garrett mean score (GM score) were

FIGURE 2 Existing pigeon peas recipes consumed in the area

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## PIGEON PEAS RECIPES CONSUMED IN DIFFERENT PARTS OF THE WORLD

#### INTRODUCTION

Pigeon peas (PPs) are used as food for human being and can be prepared or cooked in different ways for short or long shelf life use. Dried pigeon peas can be dehulled to get dhal which can be stored for longer period of time. It can also be milled to get flour which can be used to prepare different food stuffs. This poster shows some food stuffs that are made by pigeon peas in different areas in the world.



calculated. The GM score was then ranked in using Rank command in Excel software Version 2016.

On the other hand, the PC method was used for ranking the competing pigeon pea-based recipes of their preference during FGDs session. Binary comparison was used to understand which pigeon peabased product was most ideal than the other. Each product preference was then tabulated for the importance. Six steps were involved in PC. The first step was listing of pigeon pea-based product to determine objectives products design. Then the chart of design was drawn on the second flip chart, and all products mentioned were first written along the first raw and column (Table 1). Third step involved blocking identical products by putting a dash diagonally downwards the chart. The pairs for the product were then identified and noted down for reference of the members. A total of 132 pairs were identified and discussed with the guide of the facilitator. Consumers were asked to compare two pigeon pea-based products under comparison starting with Pair 1 to Pair 132 and choose the most important product on each pair. The preferred product over the two in each pair was given a score of 1, which was written against the row of the important product preferred. Besides a zero (0), score was also written on the row of less preferred product. For FGD, this was done after all participants agreed based on their discussion. In case the two products were equally important, the value of 1 was written on both corresponding cells. The matching of the product continued until all boxes were filled up.

Summation of row score was done and ranked hierarchically. The PC matrix was summarized by summing up the score of each product to get PC counts. The PC counts were then ranked using Rank command in Excel software 2016 to get rank scores of each pigeon peabased product for each consumer group. The summation of the PC

#### TABLE 1 Chart of design (PC matrix)



Variables	All (355) n (%)	Individual consumer (n = 303) n (%)	FGD members (n = 52) n (%)	TABLE
Age				-
Children (<15 years)	18 (5)	0 (0)	18 (34)	
Youth (15–35 years)	160 (45)	153 (51)	17 (33)	
Adults (>35 years)	177 (50)	150 (49)	17 (33)	
Sex				
Male	210 (59)	186 (61)	24 (44)	
Female	145 (41)	117 (39)	28 (56)	
Area of residence				
Mibure	174 (49)	152 (50)	22 (42)	
Mitumbati	181 (51)	151 (50)	30 (58)	

counts for each pigeon pea-based product from different consumer category was computed, and the rank scores were obtained using Rank command. Furthermore, descriptive analysis was computed, whereas frequencies were used to summarize participants' characteristics (age, sex and residence). Using SPSS software Version 25, ordinal regression analysis was computed to summarize the effect between groups over all levels of the outcome. Preference ranks of the products were set as outcome variables against explanatory variables (consumer categories and pigeon pea-based food types) at p < 0.05 with an assumption that ranking of pigeon pea-based food types are the same across consumer categories. The following is an ordinal regression equation used to explain an outcome variable.

From

Logit (Y) = 
$$\beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... \beta_n X_{n-1}$$

 $\begin{array}{l} \textit{Logit} \ (\text{Pigeon}) = 5.351 + 5.112 \times \text{Noodles} + 3.298 \times \text{Chapati} + 0.552 \\ \times \ \text{Bread} + 1.156 \times \text{Samosa} + 2.585 \times \text{Bhajia} + 1.700 \\ \times \ \text{Dhal} - 4.005 \times \text{Milk} + 2.812 \times \text{Biscuit} - 3.022 \\ \times \ \text{Cake} + 5.351 \times \text{African donut} + 5.587 \times \text{Kebab} \end{array}$ 

#### 3 | RESULTS

#### 3.1 | Participants' characteristics

A total of 355 consumers were involved in identification and prioritization of pigeon pea-based products. Among them, 303 (85%) were involved in face-to-face interviews and 52 (15%) in FGD sessions. About 50% of consumers interviewed were adults aged above 35 years, and 5% were children (Table 2).

#### 3.2 | Identified pigeon pea-based products

A total of 12 and 11 pigeon pea-based products were identified during face-to-face interviews and FGD, respectively. All foods mentioned during face-to-face interviews except pigeon pea-based flour were also mentioned during FGD session (Table 1). On the other hand, kebab was only mentioned during FGD and not during face-toface interviews.

## 3.3 | Prioritized pigeon pea-based product

The GM scores indicated that noodles, pigeon pea-based flour and chapati ranked the first three preferred pigeon pea-based products compared with cake, soup and African donuts, which scored the lowest (Table 3). In terms of area of residence and gender, there was no significant difference on the first two preferred pigeon pea-based products, whereas noodles scored the highest followed by pigeon pea-based flour.

Figure 4 indicates the total PC counts for each pigeon pea-based product identified by different consumers of varied age during FGD sessions. Noodles have the highest total counts compared with other products mentioned followed by chapati, bread and samosa, whereas kebab has the lowest score.

In addition, priority of pigeon pea-based product differed among age groups (Table 4). For children, chapati scored the highest followed by noodles, whereas for adults, noodles and milk ranked the second most important products. However, noodles, chapati, soup, dhal, milk, cake and African donuts were among the products ranked highest among different groups.

In ordinal regression analysis, the log-likelihood ratio chi-square test ( $\chi 2 = 43.067$ , p = 0.001) indicated that the model fitted well in ranking pigeon pea-based products among consumer type and pigeon pea-based food types. The likelihood ratio (Nagelkerke pseudo  $R^2 = 0.703$ ) suggested that there is a relationship between outcome variable (preference rank scores) and explanatory variables (consumer categories and pigeon pea-based food types). The test parallel line ( $\chi^2 = 133.808$ , p = 0.392) revealed that rank food type is different

			Area of residence				Gender			
	All		Mibure		Mitumbati		Male		Female	
Pigeon pea-based product	GM score	Rank	GM score	Rank	GM score	Rank	GM score	Rank	GM score	Rank
Soup	36.74	11	20.32	10	16.42	11	23.07	11	13.66	12
Bhajia	48.26	7	23.66	7	24.60	7	29.75	7	18.51	7
Milk	42.40	9	20.71	9	21.69	8	25.32	9	17.07	9
Samosa	43.02	8	21.41	8	21.60	9	25.93	8	17.08	8
Dhal	57.78	4	30.36	3	27.42	5	35.55	4	22.23	4
Cake	35.48	12	17.18	12	18.30	12	21.75	12	13.73	11
Biscuits	52.39	6	25.87	6	26.51	6	32.48	6	19.91	6
Pigeon pea-based flour	61.40	2	31.09	2	30.30	2	37.72	2	23.67	2
Noodles	70.40	1	35.28	1	35.11	1	42.90	1	27.48	1
Bread	54.52	5	26.48	5	28.04	4	33.06	5	21.45	5
Chapati	60.41	3	30.32	4	30.09	3	37.43	3	22.97	3
African donut	38.68	10	19.01	11	19.67	10	24.22	10	14.44	10

TABLE 3	Prioritized pigeon pea-	based product among individua	I consumers based on Garrett mean scores
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**FIGURE 4** Prioritized pigeon pea-based product among individual consumers based on PC total counts for each identified pigeon pea-based product

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TABLE 4 Prioritized pigeon pea-based product among different consumer age groups based on PC

	Children (<15 years)		Youth (15-35 y	rears)	Adults (>35 years)		
Pigeon pea-based products	PC counts	PC rank scores	PC counts	PC rank scores	PC counts	PC rank scores	
Noodles	85	2	95	1	106	1	
Chapati	91	1	69	3	93	2	
Bread	71	5	67	5	72	4	
Samosa	81	4	54	6	62	6	
Soup	82	3	69	3	42	9	
Bhajia	46	7	29	10	66	5	
Dhal	0	12	54	6	75	3	
Milk	23	11	81	2	23	10	
Biscuit	50	6	32	9	44	8	
Cake	36	9	36	8	48	7	
African donut	33	10	20	11	0	11	
Kebab	39	8	0	12	0	11	

# TABLE 5 Ordinal regression results for pigeon pea-based food type identified

Pigeon pea-based products	β	Sig
Intercept	5.351	0.002
Noodles	5.112	0.017
Chapati	3.298	0.069
Bread	0.552	0.704
Samosa	1.156	0.430
Bhajia	2.585	0.090
Dhal	1.700	0.252
Milk	-4.005	0.012*
Biscuit	2.812	0.067
Cake	-3.022	0.050
African donut	5.351	0.002*
Kebab	5.587	0.001*
Soup	0 <sup>a</sup>	-

<sup>a</sup> The parameter is set to zero because it is redundant.

\*Significant at p < 0.05.

across consumer categories. The estimated logit regression coefficient (Table 5) for noodles, milk, African donut and kebab indicated a significant variation on ranking pigeon pea-based food types.

## 3.4 | Motives for preference ranking

It was reported during FGD sessions that familiarity about the product was the key motivation against their prioritization. Other reasons mentioned were sensory attributes, availability, preparation skills and convenience to prepare. Chapati ranked highest among school-age children; the reason was due to familiarity, whereas noodles were selected due to desire and perception. They said, 'chapati is among the food prepared at home and we like it because it is accustomed to us'. On the other hand, they perceived noodles as something sweet that someone should never miss. For the case of the youth, they said that 'noodles and milk are the quickest foods to prepare, you need hardly 20 minutes to have both on the table. They are also available from different food vendors where you can buy for only 1000 Tanzanian shillings'. Similarly, adults said they ranked noodles the highest due to short time to prepare as well as that it is a meal that can be consumed by all family members.

## 4 | DISCUSSION

#### 4.1 | Listed pigeon pea-based products listed

Pigeon pea-based products mentioned were based on prior knowledge of similar products available in their area. For example, we observed availability of noodles, bhajia, chapati, breads, African donuts, biscuits and samosa in the local food vendors around their village or nearby village. This indicates that the product is customarily consumed in the area. However, these foods have been made by food ingredients other than pigeon pea. Therefore, listing them was not by mistake, but because of familiarity and availability as the key driver for their consumption behaviour. Past experience about food was reported to be among factors that significantly affect food consumption behaviour (Majili et al., 2020; Mak et al., 2012). Furthermore, changing of recipes influence food experiences. In this study, dhal was among the products itemized, due to its familiarity. It is consumed as relish to main staple food to change recipes/variety as well as sensory attributes. Recipe variety was reported to be one of the key attributes that affect food experience (Chang et al., 2011). However, inadequate processing technique such as use of stones to process dhal is time consuming, hence limiting availability of variety of pigeon pea recipes. Pigeon pea were not adequately used in preparation of different

recipes. This was due to lack of exposure to different recipes as reported by FGD members. Lack of exposure affect consumption preferences. Repeated exposure to different foods increases familiarity hence a tendency to increase preference (Beckerman et al., 2017; Boyland & Whalen, 2015; Luckow et al., 2006; Promsivapallop & Kannaovakun, 2020).

Despite the scarcity of milk in the area, milk was mentioned due to participants' wish to for it to be available in their locality. They said that 'milk is good for the health of our children however we cannot get it, so if it is possible to have pigeon pea milk it will be of great importance for our children'. The scarcity of milk was due to a small number of cattle kept in Lindi region. It is estimated that 203,446 cattle are kept in Lindi region, which is equivalent to 0.59% of all cattle kept in Tanzania in the year 2019/2020 (URT, 2021). This results in a limited supply of milk among residents, hence low per capita consumption. It is estimated per capita consumption of milk in Tanzania in the year 2019/2020 was 52.4 L/person/year (URT, 2021), which is less than 200 L/person per year recommended by FAO (Katjiuongua & Nelgen, 2014).

## 4.2 | Prioritized pigeon pea-based products

Consumers identified noodles as higher priority items due to its sensory aspects and ability of improved shelf-life when not cooked. Consumers during FGD sessions said that 'we like noodles because it has good taste and aroma and can be stored for longer time when not cooked'. Taste and aroma preferences are established over repeated consumption, which develop experiences that are influenced by their attitudes and perception about the product. Based on Aizen's theory of reasoned action (TRA), consumers will perform a behaviour if they have a feeling (Ajzen, 1991). This feeling could be a positive or negative attitude towards a particular behaviour. A positive attitude will result if a consumer has a promising feeling towards a given behaviour that will result in progressive outcome. From this model, a consumer may accept a product if he/she has knowledge about it and associated risk factors as well as acquisition of new skills or technology if has rational decision about technology used to get a particular product. Therefore, consumers in this study prioritized noodles due to their perceptions and attitudes about the product. They perceived noodles as the food consumed during Ramadan as well as the food for people of certain income position. However, knowledge and skills about producing noodles and cost were mentioned as limiting factors for availability, accessibility and consumption of noodles. This creates an opportunity for provision of knowledge and skills on noodles production using locally available ingredients that can reduce production costs as well as maintain sensory attributes, increase nutritional value and make them available for household consumption.

Preference ranking can also be influenced by food characteristics such sensory attributes, convenience and perceived value of the food (Costell et al., 2009; Konuk, 2019). Pigeon pea-based flour and chapati were the second choice during the interviews and FGD sessions, respectively. The pigeon pea-based flour is perceived as a key ingredient in production of different pigeon pea-based products. Therefore, having it in the household may ease diversification of the pigeon pea recipes. Chapati is among the foods consumed in the areas during breakfast. It is preferred due to its convenience and perceived value. The perceived value and portion size of the products are important factor for consumer choice (Konuk, 2019; Livingstone et al., 2020; Steenhuis, 2011). The portion size of chapati observed is bigger compared to African donuts and bhajia. Also, the price of one piece of chapati is lower compared with an African donut of similar weight. On the other hand, the process of preparing the dough for chapati and cooking time is more convenient than African donut and bread, which require time to rise up before cooking. These factors make chapati to be placed on the highest rank.

Preference ranking is also related to consumer age and is influenced by multiple factors including intrapersonal, interpersonal and environmental factors (Dwyer et al., 2008; Fitzgerald & Spaccarotella, 2009; IOM (Institute of Medicine) and NRC (National Research Council), 2013; Larson & Story, 2009). The intrapersonal factors are individual level factors include personal knowledge and skills about the food, personal traits, taste preferences, perception and motivation (Fitzgerald & Spaccarotella, 2009). The food preferences are also influenced by social relationships surrounding of an individual such as food availability at home, social support, culture and time constraints. It is also influenced by food environment such as accessibility of food (Dwyer et al., 2008; IOM (Institute of Medicine) and NRC (National Research Council), 2013). In the current study, it was observed that the prioritization of pigeon pea-based products differed among children, the youth and adults. In early life, children's food choices are influenced by parents' habits and home food environments until when they start to interact with the outside home environment (Larson & Story, 2009) This could be the reason why the noodles and chapati were ranked almost the same as mentioned by adults. In addition, pigeon pea soup was also among the three highest top ranked foods by children. This is because soup is one of the foodstuffs sold by street food vendors whereby children pass on their way to school or around the environment they play. They see people consuming it, but for them, they cannot afford it; that is why children selected it so as to be able to have it in their households.

On the other hand, the youth as emerging adulthood group experience transitions from family to personal dependency. At this life stage, the youth increase self-dependency in decision making, establish self-identity and financial independence and increase selfsufficiency and non-compliance to most of family rules (Nelson et al., 2008). These changes impact their life style behaviour including food preferences. The food preferences of the youth are influenced by personal and environmental factors including lack of time to plan, prepare and cook their meal, peer influences and preference taste (Livingstone et al., 2020). Due to this, they prefer to eat convenient tasty food; that is why their ranking focuses on noodles, milk, chapati and soup, which does not cost them time to prepare compared with dhal mentioned by adults. The chapati and soup ranked the same as in most places of Tanzania; these foods are sold together and can be found in many places where cooked food vendors are available. However, the chapati and soup in these places are of different ingredients. Noodles and milk require approximate 10-15 min to be ready for consumption, hence preferred food to youth. Furthermore, during the survey, the study found that cooked noodles and milk were sold around the village and the major consumers were the youth. This may be due to the fact that most youth have not yet establish families, so eating from food vendors is convenient and saves time to plan, prepare and cook food. Also, at this life stage, most youth spend less time with their parents looking for their self-identity and financial independency through different opportunities such as involving in petty or vending business. This situation makes them to eat where they are. These behaviours are also reported in different studies (Forsythe et al., 2017; Munt & Partridge, 2016; Van Zyl et al., 2010).

Furthermore, noodles and chapati were ranked highest by the youth and adults. This may be because adults are key agents of influencing food behaviour since early childhood. Unlike school-age children and the youth, adults also prioritized dhal among the foods to be developed. The reason behind is that dhal is commonly used as relish in the society. However, the use of stones to process dhal hinders their consumption frequency. Therefore, innovative technologies for developing dhal will have great importance to the community. Production of dhal is one of the key process of making pigeon pea flour that can be used for developing different pigeon pea-based products. This will increase availability of dhal for household consumption as well as aid in development of different products by reducing processing time.

#### 5 **CONCLUSION AND** RECOMMENDATIONS

Prioritization of pigeon pea-based product is important in identifying the suitable products that will be acceptable among consumers and hence maximizing its utility. The PC and Garrett ranking techniques simplify the preferential ordering of pigeon pea-based products as these are easy to administer and require less skills in collection of information. The analysis of the two techniques leads to unbiased decision making on selection of the product to be developed. Hence, food product developer should consider using these techniques in prioritizing food products before actual food production. Pigeon peabased noodles, flour, chapati and dhal are among the products identified and ranked highest that should be considered for production due to their perceived value, sensory attributes and convenience. It is also important to consider multiple interrelated factors such as price per portion size and familiarity about the product to increase chances of product acceptability.

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#### CONFLICT OF INTEREST

The authors of this article declare no conflicts of interest.

#### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

#### ORCID

Zahra Majili D https://orcid.org/0000-0002-0499-1310

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