

BARRIERS AND FACILITATORS OF BROWN RICE CONSUMPTION AMONG STAFF AT DURBAN UNIVERSITY OF TECHNOLOGY, SOUTH AFRICA

Reddy A^{1*}, Naicker A¹ and E Singh¹



Anjellah Reddy

*Corresponding author email: anjellahr@dut.ac.za

¹Department of Applied Sciences, Consumer Sciences: Food and Nutrition, Durban University of Technology, 70 Steve Biko Road, Musgrave, Berea 4001, South Africa



ABSTRACT

South Africa is experiencing an epidemiological and nutrition transition that is characterised by a surge in the prevalence of overweight and obesity, with an increase in the consumption of energy-dense, low nutritive value foods and beverages and a marked decrease in physical activity. Numerous studies have documented the healthful benefits of making the transitional shift from white rice to brown rice. The aim of this study was to explore the barriers and facilitators of brown rice consumption among staff at Durban University of Technology in South Africa. In this exploratory qualitative study, focus group discussions (FGDs) were conducted to gain an understanding of brown rice consumption among staff at the university. The study sample comprised of non-diabetic, permanent and contract staff at the University. Three focus group discussions were conducted until meaning saturation was reached; two were face to face and one *online*. Data were analysed using the thematic analysis method. Participants perceived healthy foods as safe and nutrient-dense, with consumption leading to positive health outcomes whereas unhealthy foods were perceived as energy-dense, nutrient-poor and hyper-palatable. The main determinants of food choice included peer and family influence, psychological state, education, availability, affordability, state of health and taste. Factors that influenced rice choice included sensory acceptability, availability, affordability, cultural acceptability, and convenience. Major barriers of brown rice consumption included family preferences and influence, sensory acceptability, time-intensive preparation, affordability, knowledge and skills. Two facilitators of brown rice consumption emerged: natural sensory appeal and healthful benefits. The sensory attributes of brown rice have had limited consumer acceptance, compelling the activation of consumer education and visually enticing cues in preparation methods and extended application uses in food products. This study found that the inclusion and acceptance of brown rice into the participants' diet is limited. A multi-stakeholder approach towards consumer education and practical preparation solutions is likely to positively influence consumer acceptance of brown rice. Innovative and creative food behaviour modifications should be promoted to channel change towards healthier food choices for a positive impact on health and wellness.

Key words: Brown rice, focus group discussions, perception, barriers, facilitators, consumption



INTRODUCTION

South Africa is undergoing an increased occurrence of overweight and obesity levels due to shifts in dietary patterns, as indicated by the increased consumption of energy-dense food and beverages and a decline in physical activity [1]. This has resulted in a multi-faceted burden of disease including type 2 diabetes mellitus and cardiovascular diseases, which have moved to the second and third cause of death and disability, respectively, in South Africa [2]. According to the 2020 Global Nutrition Report, South Africa has shown limited progress towards achieving the diet-related non-communicable disease (NCD) 2025 targets [3]. South Africa is not on course towards achieving the target for obesity and at the same time is experiencing a rising prevalence of type 2 diabetes mellitus [3]. There is strong evidence that a healthy diet and an active lifestyle are key elements in the prevention and control of NCDs. Improving diet quality is an important component of lifestyle interventions, particularly given the negative health impact of diets that are high in refined carbohydrates and added sugars [4]. High-quality diets that are low in trans fats and glycaemic load and high in fibre are known to decrease the risk of type 2 diabetes mellitus and are important for maintaining glucose control and reducing cardiovascular risk among individuals with type 2 diabetes mellitus [5]. Food consumption patterns in South Africa have shifted considerably in recent decades and are typified by diets that are high in total fat, sugar, refined carbohydrates and ultra-processed foods. This is likely to continue transforming and amplifying the burden of nutrition-related chronic disease [6, 7]. Ultra-processed foods are made up of snacks, drinks, ready meals and a variety of other product types that are developed primarily from substances extracted from foods or derived from food constituents. The use of various additives including those that mimic or improve the sensory quality of foods enhance the production of ultra-processed foods [8].

The Knorr Plate of the Nation 2022 report showed that an average South African plate comprises of 41% starch and 27% meat, 13% vegetable, 7% dairy, 3% legume and 9% fats and oil categories [9]. It, however, recommends alignment to the Eatwell plate composition, so that the ideal plate composition of a South African should comprise of at least 33% vegetables, 32% starch, 15% dairy, 12% meat and 8% fats and oils [9]. There is scope to change not only the proportionate food group weighting of the average South African plate but among other aspects, the nutritional density of food groups for example in the carbohydrate food group, where unrefined grains should be promoted [6].



Brown rice is a food that is closely associated with a high-quality diet and its healthful benefits are well documented in research studies [10, 11, 12, 13]. Epidemiologic studies indicate that a high intake of whole grains, such as brown rice, is associated with a lower risk of metabolic syndrome, diabetes and cardiovascular disease [11, 12, 13]. Diets that include brown rice have been associated with lower blood glucose levels among adults with impaired fasting blood glucose or type 2 diabetes [12]. It has been suggested that the insoluble fibre in brown rice is responsible for lowering the postprandial blood glucose concentrations in individuals [13]. In a study conducted in Nigeria, when different proportions of brown and white rice were consumed, the mean 2-hour postprandial glucose levels were lower after consuming a meal with a higher proportion of brown rice [14]. In a study, substituting brown rice for white rice, as a staple food item, keeps one full for longer, thereby significantly reducing fasting blood glucose and insulin levels as well as providing a sustained source of energy with reduced spikes in blood glucose levels, making it a superior dietary choice [12].

Although the health benefits and nutritional value of brown rice is well documented, many barriers limit its consumption. Qualitative studies across various cultural groups have alluded to several barriers that hinder the intake of brown rice, including lack of awareness of the health benefits, poor sensory quality, limited availability, and high cost [14, 15, 16]. These studies have made valuable recommendations to overcome barriers to brown rice consumption [15].

In South Africa, the three high-starch foods consumed are maize, wheat products and rice. Rice consumption in South Africa increased by 48% from 1994 to 2009 [17]. More than 90% of the rice consumed in South Africa is parboiled white rice with the balance being made up primarily of basmati rice [17]. Whereas there is cumulative evidence on the benefits of making the transitional shift from white rice to brown rice, this is not evidenced in the South African source of dietary starch. To encourage consumers into changing behaviour, a process approach should be applied to nurture and grow the culture of brown rice consumption. The aim of this study was to determine the barriers and facilitators of brown rice consumption among staff at DUT, in order to promote strategies that encourage consumer acceptance of brown rice.

MATERIALS AND METHODS

The study used the qualitative method to assess the barriers and facilitators of consuming brown rice through three focus group discussions (FGD). Focus group discussions have been shown to be particularly useful in formative research. It is a



supportive tool in promoting discussion and opinions to obtain a deeper level of understanding of people's perceptions on the acceptability and potential barriers that could hinder acceptance of a product [18]. Focus group discussions were intentionally selected to gain a collective level of understanding of staff perceptions of the facilitators and barriers to brown rice consumption.

Sample population

Only non-diabetic, permanent and contract staff from DUT, who were based at Steve Biko, Ritson and ML Sultan campuses, were eligible for this study. Outsourced company staff and staff members who did not consume rice were excluded from the study, mainly because the study focus was on preference between white and brown rice consumption and reasons thereof.

Recruitment

Notice of the study and recruitment of participants for the FGD, was posted on the DUT staff intranet, requesting eligible participants to contact the researcher via email. Participants were recruited through convenience and snowball sampling in 2020. However, in order to obtain a heterogenous sample in terms of gender and job profile, the researcher followed through with recruitment emails to staff in various business units. On initial participant contact, a letter of information with details of the study and informed consent, was shared via email. The second step of recruitment involved the sharing of dates for FGD with eligible participants. Participants selected a date and a reminder was sent to them a week before, a day before and on the day of the interview.

Ethics consideration

The study received full Institutional Research Ethical Clearance (IREC) approval from DUT, ethics number: 139/19. Informed consent and permission to record the FGD was obtained before the start of each of the three FGD. The participants were assured that their personal information would be de-identified and confidentiality maintained throughout the research process through informed consent.

Focus group discussion

The total number of participants in the three FGD groups was 24, comprising 25% (n=6) male and 75% (n=18) female. There were two female groups and one male group to create a comfortable participatory environment. All participants were assigned a participant number identifier, belonging to FGD group 1, FGD group 2 or FGD 3 (for example, P1-2: P=Participant, 1=participant number, 2=focus group discussion group 1). Three FGDs were conducted with 5-10 participants per group. The FGD continued until saturation of core codes were reached. A FGD guide was



developed by the study investigators and was pre-tested to assess content validity (Table 1). Five domains were explored using open-ended questions: perceptions of healthy versus unhealthy foods, food choice determinants, drivers of rice choice, barriers of brown rice consumption, and facilitators of brown rice consumption. Each FGD was moderated by one member of the research team and was assisted by a co-moderator and a note-taker. Each FGD lasted approximately one hour and was conducted in English. Two FGDs were conducted face to face pre- COVID and one in the *online* mode, during the COVID-19 lockdown. The face-to-face FGDs were held in a private room to ensure confidentiality and honest sharing of opinions. At the start of each FGD session, participants completed a demographic questionnaire. At each session, the moderator briefly introduced the study and explained the ethical considerations and procedures for maintaining confidentiality of the participants. The moderator posed open-ended questions and probed for additional information. Microsoft Teams[®], which enables synchronous meetings and the recording thereof, was used for the *online* FGD. This platform was familiar to all employees due to the work from home policy that was adopted during the COVID-19 pandemic. Consent for the *online* FGD was obtained through email. Verbal consent to record the session was obtained at the start of the *online* session. For the *online* FGD, a Microsoft Forms[®] link was shared with participants to complete the demographic questionnaire at the start of the session. The note-taker's role was extended to manage written chats during the *online* call. A debriefing session was held by the research team after the completion of each FGD to assess the quality of data.

Statistical analysis

Qualitative data consisted of translated verbatim transcripts of the FGDs. To ensure quality control, two researchers independently reviewed the transcripts against the audio recording for potential discrepancies or incomplete data. The interview transcripts were coded inductively to allow findings to emerge from the frequent, dominant, or significant themes inherent in the data by the two researchers. This was done, first independently, and then jointly to enhance the validity of the data. A codebook for each set of qualitative data was created, tested for inter-coder reliability, and used to code the transcripts to identify emergent thematic elements. A thematic framework approach was used for data analysis using Braun and Clark's (2006) six-phase framework of thematic analysis [18]. The research team independently familiarised themselves with the pre-defined domains, creating summaries aligned to representative quotes generating core themes. To maintain quality, the research team collectively compared summaries, representative quotes and themes and resolved any differences.



RESULTS AND DISCUSSION

Table 2 depicts the participant characteristics of the FGDs. There were three FGDs, two of which were held face to face, and the third was held in the *online* mode. Twenty-four participants contributed to the three FGDs comprising 25% (n=6) of men and 75% (n=18) of women. Despite several efforts to include an even representation of both male and female participants, including conducting gender-specific FGDs, there was low participation rate by male staff. A possible reason for the poor participation rate among male staff could be due to the nature of the topic, as females in South Africa are still mainly responsible for household food choices and preparation. The mean age of the participants was recorded at 44 years (\pm SD 12), typifying the current Higher Education Institution staff complement of mainly middle-aged staff to an ageing population with a few younger staff. The analysis of FGD participants by race included 42% (n=10) African, followed by 33% (n=8) Indian and 25% (n=6) White staff members. In terms of occupation, 54% (n=13) were academic staff, while 46% (n=11) were administrative staff. No staff from the food science and biotechnology department formed part of the focus group discussions.

All emergent themes with corresponding representative quotes are presented in Table 3. Participants perceived healthy foods as safe, nutrient-dense and that the consumption thereof leads to positive health outcomes, while unhealthy foods were perceived as high in fat, sugar, and sodium (HFSS), refined and ultra-processed but with good taste appeal. According to the results of the FGD, evidenced through the representative quotes in Table 3, the major determinants of food choice included peer and family influence, psychological state, education, availability, affordability, state of health, and taste. Factors that influence rice choice included sensory acceptability, availability, affordability, culturally acceptable and convenience. Major barriers of brown rice consumption included family preferences and influence, sensory acceptability, time-intensive preparation, affordability, knowledge, skills and abilities. Only two facilitators of brown rice consumption emerged: its natural sensory appeal and healthful benefits. A broad range of factors affect the uptake of brown rice among staff at the Durban University of Technology in South Africa and it is likely that some of these factors will be the same for other South African adults.

Generally, participants were able to differentiate between healthy and unhealthy foods. However, there was evidence that participants lacked knowledge in some areas of identifying healthy versus unhealthy food as some participants perceived genetically modified foods as unhealthy and dull looking food as healthy. Health



practitioners refute the so-called healthy or unhealthy food claim, and as an alternative, acknowledge that there are only appropriate or inappropriate foods [19]. However, as consumers continue to perceive certain foods as healthy and other foods as unhealthy, it has thus become imperative to know how consumers make this distinction, by using the term perceived healthfulness [19, 20]. Whilst participants perceived unhealthy foods as energy-dense and nutrient-poor, the taste of unhealthy foods superseded the perceived healthiness of the foods. Plasek [19] affirms that taste and other sensory characteristics of products take precedence over perceptions of healthiness. In the retail world, food marketers capitalise on advertisements to persuade consumers to make unhealthy foods choices [20]. These foods are mostly energy-dense and nutrient-poor (EDNP) [21]. Several terms exist for EDNP foods, including unhealthy food, fast food, junk food, discretionary food, convenience food, party food, extra foods, treats, and snacks. It is probable that these wordings have diverse connotations for different people, and this will vary according to the demographic and state of health of the population group [21]. It was apparent in the FGDs that EDNP foods were clearly identified as unhealthy, but similar to Mai and Hoffmann's findings, the penchant for these foods justified the consumption [20].

Of concern was participants' affinity towards ultra-processed foods. There is growing evidence that ultra-processed foods increase the risk of obesity and several other diet-related non-communicable diseases (NCDs) [8]. The technological processes and the ingredients used in the manufacture of NOVA 4 ultra-processed foods make them highly convenient and hyper-palatable for consumers, and highly profitable for manufacturers [8]. However, processes and ingredients also make ultra-processed foods nutritionally unbalanced and the increased reliance on these foods displaces healthier foods in diets [8].

Factors that determine food choice and influence food consumption is the struggle between short term indulgence and long-term health considerations. Mai and Hoffman [20] posit that health awareness operates only through cognitively controlled processes, using real food products, that impact the influence of composition and labelling on taste and health perceptions. Therefore, the obesity prevalence should be addressed through concentrated activities such as policy changes and product development in the food industry [20].

Peer and family influence, psychological state, education, availability, affordability, state of health and taste featured as drivers of food choice. In South Africa, price is at the forefront, so taste, health, nutrient content, safety of food items and ease of preparation, are considered after price [6]. Given that rice is an imported food



commodity, the rice market in South Africa is extremely price sensitive [22]. With more than 90% of white rice consumed in South Africa being parboiled rice [22], this shows the market favours parboiled white rice which has greater price elasticity and brand variety than brown rice.

The sensory profile of rice is a key factor in its consumer acceptance [23]. Although brown rice is more nutritious than white rice, the consumption of brown rice is much lower than white rice due to sensory characteristics. More recently, in a study conducted in Australia on consumer acceptance between brown rice and white rice varieties, rice texture was found to be the most important sensory decisional attribute among all rice varieties and aroma was important for driving liking between rice varieties [23]. Similarly, in another study conducted in Ghana, apart from market availability and price, sensory acceptability was a driver for choice of rice in terms of swelling capacity, stickiness of grains after cooking, and degree of whiteness [24]. The preference for white rice in this study was further emphasised by the sensory properties perceived by the FDG participants, as soft, fluffy, loose grains and not sticky. White rice was also preferred in terms of having a shorter cooking time, having a bulk purchase option which is more affordable compared to brown rice which is available in smaller packaging. This indicates that there is potential to nurture favourable factors to influence consumer acceptance of brown rice, and once such acceptance is in place, there is strong potential for behaviour to become a habit going forward.

Similar to Mohan [25] who identified the following barriers to brown rice consumption: availability, cultural preferences, cooking characteristics, sensory attributes and shelf-life storage, numerous barriers to the consumption of brown rice were also identified in this study. These included affordability, family preferences and influence, time-intensive preparation, sensory acceptability, knowledge and skills. Although the availability of brown rice is limited in urban and rural areas, globally, brown rice is obtainable at various retail outlets but is sold at a higher price when compared to white rice. A further barrier to the consumption of brown rice is a lack of awareness and knowledge on the health benefits of brown rice, cultural preference, and cooking skills [14, 25]. Brown rice contains a notable number of vitamins, minerals, and beneficial compounds. A collective effort should be made from the grassroots level to mobilise the dissemination of brown rice information to consumers.

In this study, the key facilitators of brown rice consumption were sensory appeal with descriptions of an earthy aroma and flavour with a pleasant nuttiness and crunchy texture, while the healthful benefits of brown rice centred on it being



healthy and high in fibre. While these findings acknowledge first-hand that brown rice has appealing sensory attributes, it also alludes to the need for greater awareness on the health benefits. Feedback on the optimal time needed to cook brown rice as well as the lack of skills to prepare brown rice reinforces the need for more informed cooking instructions to reveal the true potential of this grain. Data transcripts also highlighted the role that cultural practices and family preferences played in directing household consumption patterns as the person doing the shopping was guided by their upbringing and the food choices they were socialised in, and in turn, passed this onto the next generation. This impetus can be “borrowed” to target brown rice inclusion in a bid towards healthy eating [26]. With South Africa having over 40% female headed households, and data analysis indicating their influence over household purchasing decisions, there is scope for them to influence and shape healthier food choices, and specifically towards greater consumption of brown rice.

Amore [27] posits that the main facilitators of brown rice consumption are nutrition knowledge, guidelines from parental influence, social and environmental measures, including an institutional environment with reliable healthy meal choices, a conducive physical environment, with social media and a macrosystem that supports better food choices [27]. In a study conducted by Monge-Rojas *et al.* [16], traditional behaviours and family support were identified as two core drivers for brown rice consumption [16]. The recommended strategies for increasing the consumption of brown rice included presenting it in a more desirable form during childhood, publicising information of the health benefits, reducing the cost, increasing availability, appealing to women to act as agents of change and masking the unpleasant sensory and physical appearance by combining it with current trending ingredients or popular meal pairings. In a recent study by Hartley [28], the benefits made by visual cues were gained through a recurring use of flavour combinations that consumers were familiar with, thus when paired with brown rice, these pairings can influence acceptability. It can include the use of flavouring, herbs and spices in brown rice dishes, and this experience may alter the consumer acceptance and perceptions towards brown rice, thereby enabling an efficacious transition from white rice to brown rice consumption [28].

Rice is a dominant food staple that is consumed globally by over 50% of the world population in over 100 countries using over 110.000 varieties [29]. The brown rice market is projected to grow at a higher pace than white rice due to its whole grain properties [29]. With an upward tendency towards smart dieting choices and supplements, brown rice can be an optimal choice for the wellbeing of consumers worldwide [28]. This study had many strengths. The outcome of the qualitative



approach to the FGD was an important foundational tool to collectively explore the barriers and facilitators for brown rice consumption at Durban University of Technology in South Africa. The FGDs created an opportunity to discover and share a wide range of ideas and suggestions that link the research problem and findings. After the FGDs, verbal feedback was provided by the research team to correct and debunk incorrect comments regarding the perception of healthy versus unhealthy eating. Part of the data collection took place during the peak of the first South African COVID-19 national lockdown. The research team adapted training materials for the *online* FGD, and the full research team was present for the *online* session. Limitations of the study included: poor response from male staff, blue-collar workers and higher management staff which was addressed by having at least one male FGD, comprising of 6 participants and reaching out to all staff during recruitment across job profiles.

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

Participants perceived healthy foods as safe and nutrient-dense, with consumption leading to positive health outcomes, whereas unhealthy foods were perceived as energy-dense, nutrient-poor and hyper-palatable. The main determinants of food choice included peer and family influence, psychological state, education, availability, affordability, state of health and taste. Factors that influenced brown rice choice included sensory appeal, availability, affordability, cultural acceptability, and convenience. Major barriers of brown rice consumption included family preferences and influence, sensory acceptability, time-intensive preparation, affordability, and knowledge, skills, and abilities. Two facilitators of brown rice consumption emerged: natural sensory appeal and healthful benefits. Exploring the perceptions, barriers, and facilitators of brown rice consumption, it was evident that the acceptance of brown rice among consumers in South Africa can be promoted through the following recommendations:

- Inclusion of brown rice in meal plans in school feeding programmes, to facilitate the socialisation and acceptability process to gradually introduce brown rice into households.
- The pricing of brown rice should be reconsidered at a national level so that it is subsidised.
- Using a targeted approach, consumers should be educated on the benefits of brown rice.
- Promoting through community social support campaigns and workplace canteen interventions to stimulate a higher acceptability of the grain.



- Using a range of optimal and regional meal pairings to encourage higher acceptability and uptake.
- Using a multi-stakeholder approach towards the activation of consumer education and practical preparation, influencing the sensory pathways for sustained consumer acceptability.

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Table 1: Focus Group Discussion interview guide

QUESTIONS
1. What do you understand by healthy foods?
2. What do you understand by unhealthy foods?
3. What are the factors that determine your food choice?
4. What influences you to choose healthy food?
5. What prevents you from choosing healthy food?
6. Which type of rice do you and your families frequently eat? Why?
7. What type of qualities you would look for when you buy rice?
8. What do you think of brown rice?
9. Why do you think people prefer white rice rather than brown rice?
10. If I were to tell you that there are several scientific studies that show that eating brown rice is healthier than eating white rice, would you replace white rice with brown rice? Motivate.
11. What factors would influence your willingness to change from white rice to brown rice?

Table 2: Characteristics of the FGD participants

Characteristics	n (%)
Number of FGD	
FGD 1 (Female)	10 (42)
FGD 2 (Female)	8 (33)
FGD 3 (Male)	6 (25)
Gender	
Men	6 (25)
Women	18 (75)
Age (Mean \pm SD)	44 (12)
Race	
African	10 (42)
Indian	8 (33)
White	6 (25)
Occupation	
Academic	13 (54)
Administrative	11 (46)

Table 3: Summary of resultant themes and representative quotes emerging from thematic analysis of the FGDs

Pre-defined domains	Themes	Representative quotes
Perceptions of healthy foods	Positive impact on health outcomes	“Foods that help one lose weight” “Something that does not affect the heart”
	Nutrient-dense foods	“Low fat, low starch, low GI foods” “Healthy foods have all the right nutrients in it and are not processed foods” “Less oil, sugar, salt – fresh as possible”
	Food safe	“Foods that are not harmful.” “Foods that are not genetically modified”
	Appearance	“If food has a dull look, it is healthy”
Perceptions of unhealthy foods	Energy-dense and nutrient- poor foods	“Fried food and processed, sugar. Sweets, chocolate, cooldrink, cake, chips” “Anything that is tasty that we like, junk”
Determinants of food choice	Peer and family influence	“Depends on where you at (location). “The company you have” .
	Psychological factors	“Mood” .
	Education	“Education guides what is good for you”
	Availability	“Availability – seasonal”
	Affordability	“Affordability” “Budget”
	State of health	“My health- Hypertensive and cholesterol, look at labels”
	Sensory acceptability	“Taste”
Factors that influence rice choice	Sensory acceptability	“Fluffy and loose when cooked” “Soft, not sticky” “Colour: must be white. “White rice is dyable”
	Availability	“Easy to find”

Pre-defined domains	Themes	Representative quotes
	Affordability and packaging size variety	“Cost of it is expensive” “2kg is the maximum size”
	Culturally acceptable	“Culturally white rice is acceptable”
	Convenience	“Length of time to cook”
Barriers of brown rice consumption	Family preferences and influence	“Forced to eat brown rice due to health-conscious family” “Person shopping at home only buys white rice”
	Sensory acceptability and limited meal pairings	“Brown rice can be eaten only with certain dishes”
	Time-intensive preparation	“Takes long to cook”
	Affordability	“Expensive”
	Knowledge, skills and abilities	“Don’t know how to cook brown rice”
Facilitators of brown rice consumption	Sensory appeal	“Like the nuttiness” “Not sticky” “Like the aroma and flavour- Earthy”
	Healthful benefits	“Healthy and high in fibre”

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