Acceptance of a ready-to-use supplementary food by stable HIV-treated and HIV and tuberculosis (co-infected)-treated patients

Pillay K, PhD, RD(SA), Lecturer; **Siwela M**, PhD, Senior Lecturer; **Veldman FJ**, PhD, Associate Professor
Dietetics and Human Nutrition, University of KwaZulu-Natal
Amonsou EO, PhD, Senior Lecturer, Department of Biotechnology and Food Technology, Durban University of Technology
Mabaso BP, MSc(Human Nutrition), Dietetics and Human Nutrition, University of KwaZulu-Natal
Correspondence to: Kirthee Pillay, e-mail: pillayk@ukzn.ac.za
Keywords: consumer acceptability, ready-to-use supplementary food, HIV, tuberculosis

Abstract

Objectives: The objective of the study was to determine consumer acceptance and perceptions of a ready-to-use supplementary food (RUSF) by subjects treated for human immunodeficiency virus (HIV) and HIV and tuberculosis (co-infected subjects).

Design: A cross-sectional study was conducted.

Subjects: One hundred and thirty-nine stable HIV-treated and HIV and tuberculosis (co-infected)-treated patients participated in the study. Sixty-eight healthy subjects served as the control group.

Setting: The setting was Northdale Hospital and Grey's Hospital in Pietermaritzburg, KwaZulu-Natal.

Outcome measures: Acceptance of the RUSF was assessed using a five-point facial hedonic scale by stable HIV-treated and HIV and tuberculosis (co-infected)-treated patients (n = 139) from Northdale Hospital and Grey's Hospital in Pietermaritzburg, KwaZulu-Natal. Perceptions of the RUSF were determined through focus group discussions in which HIV-treated and HIV and tuberculosis (co-infected)-treated patients (n = 43) participated.

Results: The overall acceptance of the RUSF was significantly associated with the health status of the subjects (p-value < 0.05). Overall, the product was liked by more than 90% of the HIV-treated and HIV and tuberculosis (co-infected)-treated individuals compared to 85% of the control group. More than 90% of the HIV-treated and HIV and tuberculosis (co-infected)-treated individuals liked the taste, compared to 87% of the control group. The colour and mouth feel were rated to be "good" by more than 80% of the HIV-treated and HIV and tuberculosis (co-infected)-treated group, compared to approximately 70% of the healthy group. Focus group discussions revealed that the subjects perceived the mouth feel of the RUSF to be "rough", and that as a health supplement, the RUSF should be provided free of charge, or at a reasonable cost, at public health centres.

Conclusion: The RUSF was found to be highly acceptable to stable HIV-treated and HIV and tuberculosis (co-infected)-treated subjects, although concern was raised about the mouth feel.

Ⓟ **Peer reviewed. (Submitted: 2013-07-02. Accepted: 2013-10-26.)** **S Afr J Clin Nutr 2014;27(1):31-37**

Introduction

The human immunodeficiency virus (HIV) and tuberculosis co-infection pandemic, coupled with malnutrition, referred to as "triple trouble",[1] have become a serious health problem in South Africa. Malnutrition is common in HIV-, acquired immune deficiency syndrome (AIDS)- and tuberculosis-infected individuals because of physiological, socio-economic and psychosocial factors that accompany the infection. A reduction in food intake is the most important contributing factor in disease-related malnutrition,[2] and weakens the immune system, thereby increasing the risk of opportunistic infection. Infections such as tuberculosis cause a decrease in food intake because of changes in the secretion of cytokines, glucocorticoids, peptides, and insulin and insulin-like growth factors.[3,4] Malnutrition is also exacerbated by decreases in both nutrient absorption and efficiency of utilisation owing to a damaged intestinal lining and increased energy expenditure during HIV-related illnesses.[3,5]

A combination of adequate nutrition and medical treatment for HIV/AIDS and tuberculosis is crucial in improving the nutritional status, and lowering the risk, of co-infections in infected individuals. It is also vital in the management of opportunistic infections, and is believed to delay disease progression, thus improving quality of life and survival.[6] However, meeting the increased nutritional requirements of HIV-infected individuals can be challenging.[7] People living with HIV/

AIDS often fail to acquire nutritious foods. In addition to metabolic changes, the pharmaceutical agents used to treat these conditions also manifest in side-effects that can directly affect food intake, as well as compliance with drug treatment.[8,9]

Various forms of ready-to-use supplementary foods (RUSFs) were introduced to prevent and alleviate malnutrition globally.[10-12] In 2004, a RUSF was developed for use by the Gift of the Givers Foundation, a South African nongovernmental humanitarian and disaster relief organisation. The RUSF is produced in Malawi[13] from peanuts and soya paste, with added micronutrients, which may affect the sensory properties of the product. Sensory properties play a vital role in the eating and purchasing behaviour of consumers.[14] Any supplement must first be acceptable to the target consumers in order for it to be consumed.[15] It is also well accepted that food and beverages should not be produced, distributed or marketed without first assessing consumer acceptance thereof.[14] Yet, no data exist on the consumer acceptance of this RUSF. This product was developed approximately a decade ago at the height of the local HIV pandemic when nutrition intervention was the primary method of treatment, and just before implementation of the first South African National Comprehensive HIV and AIDS Treatment Programme. The prevention of AIDS-related weight loss and resulting malnutrition was the primary focus of most clinical practitioners, who had to deal with large numbers of dying patients. The development of the product was driven by need, and based on its demand, arrived on the market without having the necessary scientific therapeutic backing. Its use was based purely on anecdotal evidence. Yet, even in the era of anti-retroviral therapy (ART), nutrition intervention remains important.[16]

A number of acute and chronic complications associated with ART relate to nutrition, or require nutrition management in some way.[17] Complications mainly occur because of acute interactions of the drug regimens with some nutrients, and chronic metabolic disturbances that result over time. Acute side-effects, mostly gastrointestinal, such as nausea, diarrhoea and bloating, in addition to taste disturbances, appetite suppression, the inability to eat secondary to complicated medical regimens, or fatigue, as well as the presence of opportunistic infections, can impair food intake. It is also not unusual for ART agents in general,[18,19] and didanosine in particular,[20-22] to induce xerostomia (dry mouth syndrome and associated changes in taste perception) by an unknown mechanism. Xerostomia may be observed in up to one third of patients taking didanosine.[23] Taste abnormalities are also common with the protease inhibitors, and oral and perioral paresthesia can be a disturbing adverse effect. Ritonavir, in particular, can give rise to circumoral paresthesia in over 25% of patients.[18,24] Therefore, in this study, the sensory acceptance and perceptions of this RUSF by subjects treated for HIV, AIDS and tuberculosis were assessed.

Method

Study type and objectives

A cross-sectional study was conducted to determine the acceptance and perceptions of a RUSF by stable HIV-treated and HIV and tuberculosis (co-infected)-treated patients through sensory evaluation and focus group discussions.

Ready-to-use supplementary food samples

Samples of the RUSF were provided by the Gift of the Givers Foundation, which purchases and distributes the product as part of its humanitarian and disaster relief efforts. The nutritional composition analysis data (results not shown) were consistent with the nutritional information on the product label.

Study population and sample size

Sensory evaluation

Healthy subjects (control group) were recruited from staff and students of the University of KwaZulu-Natal, Pietermaritzburg, through verbal invitation, written letters and advertisements.

A control group that was free of HIV and HIV and tuberculosis (co-infection) were used to determine whether or not the health condition [HIV, and HIV and TB (co-infection)] affected the sensory acceptance of the product by comparison. The experimental group consisted of two patient types: HIV patients, and HIV and tuberculosis (co-infected) patients. These subjects were also a convenience sample, but recruited from patients who attended the hospital clinics. The co-infected panellists were recruited from Northdale Hospital because more patient consultations took place there per day than at Grey's Hospital. HIV-only patients were recruited from both Northdale Hospital and Grey's Hospital.

Subjects were recruited to participate in the sensory evaluation in the same way as the healthy subjects. The sample size for each group had to include 50 or more subjects, in keeping with the accepted sample sizes for consumer sensory evaluation.[14] In this study, eligible subjects who responded to the invitation participated.

The inclusion criteria for both the experimental group and control group were:

- Being between the ages of 18 to 55 years.
- Should not have smoked 30 minutes before participating in the study.
- Should not have a nut allergy.

In addition, clinic or hospital cards were used to confirm that HIV-only patients were receiving antiretroviral (ARV) drugs. The HIV and tuberculosis (co-infected) patients had to produce the Directly Observed Treatment, Short-course card as confirmation that they were receiving tuberculosis treatment. As outpatients, none of them suffered from serious uncontrolled complications that required additional medical intervention. By contrast, the control group had to be healthy, and not taking medication or treatment for any chronic illnesses, including HIV and tuberculosis.

Focus groups

The focus group discussion participants were sampled from the HIV-treated and HIV and tuberculosis (co-infected)-treated subjects who participated in the sensory evaluation. Subjects who were willing to participate in the focus group discussions were included.

Method of data collection

Sensory evaluation

The sensory evaluation sessions were held in a room with separate, isolated booths set up for each panellist. Sensory evaluation of the

control group was conducted in a food-processing laboratory at the University of KwaZulu-Natal, while evaluation of the HIV-treated and HIV and tuberculosis (co-infected)-treated subjects was performed at the hospital clinics.

Each panellist received a spoon and a small polystyrene cup containing 5 g of the RUSF. The sample was blind-labelled with a three-digit code obtained from a table of random numbers.[25] Prior to each session, the sensory attributes of taste, smell, colour, mouth feel and overall acceptance were explained to the panellists. An equally spaced five-point facial hedonic scale with ratings (5 = "super good", 4 = "good", 3 = "maybe good or maybe poor", 2 = "poor" and 1 = "super poor") was used to rate the sample. This rating scale is recommended for illiterate persons and children.[14] Longer hedonic scales, e.g. 7 or 9 ratings, tend to confuse subjects with lower literacy levels, while rating scales that are shorter than the five-point scale tend to cause end-point avoidance.[14] Background information indicated that some of the study subjects had low literacy levels. The sensory evaluation forms were developed in English and translated into *isiZulu* as the majority of the subjects were *isiZulu* speakers.

Each sensory attribute was described on the form with an accompanying facial hedonic scale. The participants were asked to rate the acceptance of each attribute by marking the appropriate response on the facial hedonic scale. The forms were tested for content and face validity by an expert panel (n = 7) comprising academics working in the field of food science and nutrition. The ratings of the hedonic scale were verbally explained to the panellists in *isiZulu* at the sensory evaluation sessions. The researchers asked the panellists if they understood the ratings, which they confirmed they did.

Focus groups

The aim was to determine if the consumers had perceptions of the RUSF which could affect its acceptance. The focus group discussions where held, separately, with subjects of the two patient types: the HIV-only treatment group and the HIV and tuberculosis (co-infected) treatment group. The HIV-only subjects were divided into four subgroups, each with 6-8 subjects. Three subgroups of the HIV-only subjects consisted of subjects who had never seen and consumed the RUSF before the study. The fourth subgroup consisted of subjects who had previously consumed the product. This decision was taken to reduce the possible influence of those who were familiar with the product on those who were not.

The HIV and tuberculosis (co-infected)-treated subjects were divided into two subgroups. This was owing to the small number of co-infected patients who were treated at the hospital clinic daily. One of the subgroups of the HIV and tuberculosis (co-infected)-treated group comprised subjects who were not familiar with the RUSF, and the other subgroup consisted of subjects who were.

The focus group discussions were conducted in a staff room at Northdale Hospital by a trained facilitator in *isiZulu* to ensure that participants participated and fully understood the questions. The sessions were recorded using a digital voice recorder, and the recordings were translated into English by an *isiZulu*-speaking person. The English translations were then compared with the *isiZulu* recordings and checked for accuracy by another *isiZulu*-speaking person. Healthy consumers were not included in the focus group discussions because the RUSF was developed for malnourished individuals.

Ethical approval

Ethical approval to conduct the study was obtained from the University of KwaZulu-Natal, Humanities and Social Sciences Research Ethics Committee (reference number HSS/0374/011M). Approval was also obtained from Northdale Hospital and Grey's Hospital. Written consent to participate in the study was obtained from subjects. The consent form was translated from English to *isiZulu,* and its contents explained verbally in *isiZulu* to recruited subjects. The identities of the subjects were kept confidential.

Statistical analysis

Data from the sensory evaluation questionnaires were analysed using the Statistical Package for the Social Sciences® version 18 (SPSS Inc, Chicago, USA). Sensory evaluation data were analysed using descriptive statistics analysis techniques. A p-value of less than 0.05 derived from the chi-square test was taken to be significant.

Results

Sample sizes, description and demographic characteristics

Two hundred and seven consumers aged 18-55 years participated in the sensory evaluation (Table I).

They were grouped according to their health status as follows:

- The HIV-treated group (n = 88).
- The HIV and tuberculosis (co-infected)-treated group (n = 51).
- The healthy or control group (n = 68).

The majority of consumers (n = 77) were aged 26-35 years. There was a very high proportion of black participants (92%), compared to other races. Seventy-one per cent of the participants were female. The demographic characteristics of the control group, and the HIV-treated, and HIV and tuberculosis (co-infected)-treated groups, were similar in terms of age and race (Table I). Forty-three subjects participated in the focus group discussions. Thirty-two subjects represented the HIV-treated group and 11 subjects the HIV and tuberculosis (co-infected)-treated group. Of the total sample, 77% (n = 33) were female. The sample comprised mainly black Africans (95%, n = 41). Some coloureds (5%, n = 2) participated.

Consumer sensory acceptance of the ready-to-use supplementary food

Very few subjects from both groups rated the RUSF as "super good" or "super bad". Therefore, a decision was taken to reduce the ratings to three categories of "poor", "neutral" and "good" for simplified and meaningful interpretation of the results. A score ≥ 4 signified that the sensory attribute was good, 3 neutral, and ≤ 2 poor. In terms of overall acceptance of the RUSF (Table II), more than 90% of the consumers in the HIV-treated and HIV and tuberculosis (co-infected)-treated group, respectively, perceived the product to be "good", compared to 85% of consumers from the healthy group who provided the same rating for overall acceptance of the product.

Table I: Consumer panel demographics

Demographic characteristics	Total sample (n = 207)		HIV-treated group (n = 88)		HIV and tuberculosis (co-infected)-treated group (n = 51)		Healthy (control) group (n = 68)	
	n	%	n	%	n	%	n	%
Age								
18-25 years	43	21	10	11	5	10	28	41
26-35 years	77	37	35	40	20	39	22	32
36-45 years	51	25	27	31	13	25	11	16
46 years and older	36	17	16	18	13	25	7	10
Gender								
Female	147	71	75	85	23	45	44	65
Male	60	29	13	15	28	55	24	35
Race								
Black	190	92	88	100	49	96	53	78
Coloured	3	1	0	0	1	2	2	3
Indian	8	4	0	0	1	2	7	10
White	6	2	0	0	0	0	6	9

HIV: human immunodeficiency virus

Table II: Consumer acceptance of the ready-to-use supplementary food across health status, age and gender

Sensory attributes	Health status				Age group					Gender		
	Healthy group n (%)	HIV-treated group n (%)	HIV and tuberculosis (co-infected)-treated group, n (%)	p-value*	18-25 years n (%)	26-35 years n (%)	36-45 years n (%)	> 46 years n (%)	p-value*	Female n (%)	Male n (%)	p-value*
Overall acceptance				0.00					0.45			0.55
Poor	7 (10.3)	4 (4.5)	1 (2)		2 (4.7)	6 (7.8)	2 (3.9)	2 (5.6)		11 (7.5)	1 (1.7)	
Neutral	3 (4.4)	4 (4.5)	1 (2)		2 (4.7)	4 (5.2)	1 (2)	1 (2.8)		5 (3.4)	3 (5)	
Good	58 (85.3)	80 (90.9)	49 (96.1)		39 (90.7)	67 (87)	48 (94.1)	33 (91.7)		131 (89.1)	56 (93.3)	
Taste				0.02					0.27			0.28
Poor	7 (10.3)	5 (5.7)	1 (2)		3 (7)	6 (7.8)	1 (2)	3 (8.3)		11 (7.5)	2 (3.3)	
Neutral	2 (2.9)	3 (3.4)	4 (7.8)		2 (4.7)	3 (3.9)	4 (7.8)	0 (0)		8 (5.4)	1 (1.7)	
Good	59 (86.8)	80 (90.9)	46 (90.2)		38 (88.4)	68 (88.3)	46 (90.2)	33 (91.7)		128 (87.1)	57 (95)	
Smell				0.01					0.31			0.70
Poor	1 (1.5)	7 (8)	0 (0)		2 (4.7)	1 (1.3)	2 (3.9)	3 (8.3)		6 (4.1)	2 (3.3)	
Neutral	11 (16.2)	4 (4.5)	6 (11.8)		8 (18.6)	9 (11.7)	2 (3.9)	2 (5.6)		16 (10.9)	5 (8.3)	
Good	56 (82.4)	77 (87.5)	45 (88.2)		33 (76.7)	67 (87)	47 (92.2)	31(86.1)		125 (85)	53 (88.3)	
Colour				0.00					0.05			0.34
Poor	9 (13.2)	9 (10.2)	3 (5.9)		7 (16.3)	8 (10.4)	3 (5.9)	3 (8.3)		19 (12.9)	2 (3.3)	
Neutral	13 (19.1)	3 (3.4)	4 (7.8)		9 (20.9)	6 (7.8)	2 (3.9)	3 (8.3)		14 (9.5)	6 (10)	
Good	46 (67.6)	76 (86.4)	44 (86.3)		27 (62.8)	63 (81.8)	46 (90.2)	30 (83.3)		114 (77.6)	52 (86.7)	
Mouth feel				0.06					0.00			0.46
Poor	11 (16.2)	10 (11.4)	4 (7.8)		6 (14)	11 (14.3)	3 (5.9)	5 (13.9)		21 (14.3)	4 (6.7)	
Neutral	9 (13.2)	2 (2.3)	4 (7.8)		10 (23.3)	1 (1.3)	2 (3.9)	2 (5.6)		11 (7.5)	4 (6.7)	
Good	48 (70.6)	76 (86.4)	43 (84.3)		27 (62.8)	65 (84.4)	46 (90.2)	29 (80.6)		115 (78.2)	52 (86.7)	

HIV: human immunodeficiency virus

*: p-values generated using the chi-square test

Table III: Consumer perceptions of the ready-to-use supplementary food

Theme	Questioning aspect relating to consumer product perception	Concepts	Quotes	Discussion inferences
Nutritious or healthy food items	Bread spreads	Part of household food basket	• *"Margarine, peanut butter and jam, because these are nutritious common spreads (that) a household cannot live without."* • *"Peanut butter is a healthy fat and boosts the immune system."*	• Peanut butter is a commonly used spread, which the subjects perceived to be healthy and immune-boosting. • The subjects perceived supplements to be substitutes for not eating vegetables, or as part of items provided free of charge at health centres.
	Dietary supplements	"Goodness"	*"Multivitamins, because they are good for you, especially if you do not eat vegetables and they are free from the hospital."*	
Ready-to-use supplementary food acceptance	Sensory characteristics of the ready-to-use supplementary food	Taste	• *"It's nice. It tastes like porridge received from the hospital."* • *"It is oily and cannot be eaten solely."*	• The taste, smell and appearance were perceived to resemble that of peanut butter. • However, the subjects were concerned about the "rough" mouth feel of the product. • They perceived it to be unacceptable for HIV-, AIDS- and tuberculosis-infected patients, and were concerned that the "rough" mouth feel would be intolerable to infants and the elderly. • They suggested that the ready-to-use supplementary food should be smooth and easily spreadable, so that they could use it with their porridge. • In this study, consumers' perceptions were guided by their expectations and experience. • Similar perceptions about the mouth feel of food have been mentioned previously by patients with HIV.[26]
		Smell	*"It is nice. It smells like baby food and is nutty."*	
		Mouth feel	• *"It is like maize meal with oil, and has more powder than nuts."* • *"It is rough. It makes me feel like vomiting."* • *"It's watery."* • *"It is rough or crunchy."* • *"It's too oily for sick people."* • *"It is nice, but a bit choking."*	
		Appearance	• *"It is similar to that of peanut butter."* • *"It should be like peanut butter, smooth and spreadable."*	
Factors influencing ready-to-use supplementary food consumption	Nutritional value	Health benefits	*"It is more nutritious than normal peanut butter."*	• The subjects perceived the ready-to-use supplementary food to have greater nutritional benefits than other regular bread spreads. • Nonetheless, they indicated that the ready-to-use supplementary food was not suitable for daily use. It was regarded as a health supplement, rather than a food. • Because subjects perceived the product to be a health supplement, they believed that it should be provided free of charge from health centres. • The majority of the consumers who were unfamiliar with the product were less interested (than consumers who had eaten the product before) in buying it, despite its nutritional benefits. • By contrast, consumers who had consumed the product before were willing to pay for it. • Other than its nutritional benefits, consumers valued its utility (consumable functionality), and the fact that it could be consumed by all household members. • These consumers suggested that the RUSF should cost approximately R55/500 g, more than the price of peanut butter. • The perception of the product being a health supplement raised the issue of stigmatisation. Participants thought that this would discourage use of the product as it would be assumed that it was only suitable for sick people. • However, it was interesting to note that some consumers were unconcerned about this, saying that people seem to have a changed their mindset towards HIV, AIDS- and tuberculosis-infected patients. • Nevertheless, it was clear from the discussion that if the product was perceived to be and treated as "food", rather than as a health supplement, it would be considerably more acceptable.
	Utility	Consumable functionality (who would consume it?)	• *"It can be used on bread, porridge and in baking."* • *"I can eat it with children too. That is why it has to be cheap."*	
	Affordability	Cost	• *"It should be freely given at the hospital."* • *"It can be R20-80 because I know the benefits of the product."*	
	Health status	Stigmatisation	• *"People are not judgemental anymore like before."* • *"I would be shy carrying it because of my status."*	
		Free government service to sick people	*"Multivitamins are freely given in hospitals."*	

AIDS: acquired immune deficiency virus, HIV: human immunodeficiency virus

Similarly, more consumers in the HIV-treated and HIV and tuberculosis (co-infected)-treated groups rated the taste, smell, colour and mouth feel of the product to be "good" relative to consumers in the healthy group. The acceptance of the RUSF was significantly associated with the health status of the consumer (p-value < 0.05). There was a significant association between the colour and mouth feel acceptance of the product and the age of the consumer (p-value < 0.05), while smell, taste and overall acceptance were not associated with the consumer's age (p-value > 0.05). Approximately 63% of the younger consumers, aged 18-25 years, rated the colour and mouth feel of the product to be "good", compared to more than 80% of consumers in the older age group, who rated the two sensory attributes to be the same. Acceptance of the product was not associated with the gender of the consumer (p-value > 0.05).

Focus group discussions

Table III outlines responses to open-ended questions asked during the focus group discussions. The HIV-treated subjects liked the smell and colour of the RUSF, and associated both properties with peanut butter. However, some of these subjects disliked its mouth feel.

The HIV and tuberculosis (co-infected)-treated group also liked the taste of the RUSF, and associated it with peanut butter and porridge received from the clinic. These subjects also reported that the smell and colour of the product was nutty, and like that of peanut butter. The HIV and tuberculosis (co-infected)-treated group, in particular, seemed to be concerned about the mouth feel of the product. It was suggested that the RUSF should be changed from a rough to a smooth product. Both groups agreed that they would purchase it. Subjects from the HIV and tuberculosis (co-infected)-treated group expressed greater willingness to purchase it, but recommended that it should be affordable. The HIV-treated subjects were of the opinion that the product should be provided free of charge at the public health centre visited. The HIV-treated subjects believed that the product's price should range from R5-R35 per 500 g, while the HIV and tuberculosis (co-infected)-treated group suggested that it should be R13-R80 per 500 g. Consumers from the HIV and tuberculosis (co-infected)-treated group were willing to pay more for the RUSF as they had used it previously, and were familiar with the nutritional qualities therein. Consumers from both groups based the suggested price for the RUSF on the amount of money spent on peanut butter.

Discussion

Sensory evaluation

The high acceptance of the RUSF by consumers treated for HIV, and HIV and TB co-infection, and without serious uncontrolled complications, implies that the ARV and tuberculosis treatment did not negatively affect their perception of the sensory properties of the product.

Physiological changes, such as oesophageal thrush, lack of appetite, nausea and vomiting, are known to have a negative effect on the acceptance of food.[27] This was not encountered in the RUSF consumer acceptance findings as most participants in the study were at the recovery stage of HIV/AIDS, and didn't have severe symptoms of the infection, especially in their mouths.

The RUSF consumer acceptance finding in this study is in agreement with another one that was conducted on the acceptance of a RUSF in Kenya by malnourished, adult HIV-positive patients on ART.[28] However, in yet another study conducted in Kenya on a peanut-based RUSF, malnourished adult AIDS patients on ART reported the supplement to be unacceptably salty or too sweet.[27] High acceptance of the taste and smell of the product by healthy consumers in this study may be owing to the unique peanut butter flavour found in peanut-containing foods.[29] The level of acceptance of the taste, smell, colour and mouth feel of the product decreased in younger consumers (aged 18-25 years), probably because of their higher sensory thresholds (relative to the older consumers). A decrease in sensitivity to sensory properties with age has been reported previously.[30,31] The lower scores on mouth feel relative to the scores for the other sensory attributes are in line with the focus group discussion findings which indicated that the mouth feel of the product should be changed to a smoother one.

Focus group discussions

The subjects perceived the product to have a "rough" mouth feel. The mouth feel was considered to be unacceptable by some. The mouth feel was rated by the majority of the subjects as "good" in sensory acceptance testing, although during the focus group discussions, subjects indicated that they would prefer a smooth product. The subjects seemed to base their perception and expectation of the RUSF mouth feel on the health status of possible users. It was suggested that illness would negatively affect acceptance of the RUSF. The study subjects also perceived the product to be a health supplement. It became evident that viewing it as such, rather than as a food, would affect its provision, regardless of its nutritional attributes. Health supplements are usually provided free of charge at public health centres. Thus, subjects expected this in respect of this RUSF, or for the product to be sold at a reasonable cost. It was also suggested that if the RUSF was issued free of charge as a health supplement, the recipient might be stigmatised for having an illness.

Conclusion

The RUSF was highly acceptable to the HIV-treated and HIV and tuberculosis (co-infected)-treated consumers in this study, who were not suffering from serious uncontrolled complications at the time it was conducted. These consumers perceived the product to be a health supplement. The HIV-treated subjects, in particular, expected it to be provided free of charge at health centres. A change in the mouth feel of the RUSF from rough, crunchy and oily, to relatively smooth and less oily, should be considered by the manufacturer of the supplement. Based on the findings of this study, implementing this change would improve its consumer acceptance, especially by HIV-infected individuals in a more advanced disease state and in therapeutic need of a RUSF, but without symptoms of the infection, especially of the mouth, which can negatively affect acceptance of the product. If the product is reformulated and its properties changed, e.g. the texture, it should be re-evaluated by similar subjects.

Acknowledgements

The authors thank the University of KwaZulu-Natal for funding the study, and the Gift of the Givers Foundation for supplying the samples

of the RUSF used in this study. The authors wish to thank the Grey's Hospital and Northdale Hospital clinic staff for their assistance, the subjects for participating in this study, and Dr Unathi Kolanisi, social scientist at the University of KwaZulu-Natal, for assisting with the focus group discussions.

References

1. Chaparro C, Diene S. "Triple trouble": Malnutrition, TB and HIV. Core group [homepage on the Internet]. 2009. Available from: http://www.coregroup.org/storage/documents/meeting_reports/hiv_tb_sota/fanta_triple_trouble_tb_hiv_malnutrition.pdf
2. Saunders J, Smith T. Malnutrition: causes and consequences. Clin Med. 2010;10(6):624-627.
3. HIV and AIDS in South Africa. Avert [homepage on the Internet]. 2011. Available from: http://www.avert.org/aidssouthafrica.htm
4. Suttajit M. Advances in nutrition support for quality of life in HIV+/AIDS. Asia Pac J Clin Nutr. 2007;16 Suppl 1:318-322.
5. Hsu JW-C, Pencharz PB, Macallan D, Tomkins A. Macronutrients and HIV/AIDS: a review of current evidence. World Health Organization [homepage on the Internet]. 2005.Available from: http://www.who.int/nutrition/topics/Paper%20Number%201%20-%20Macronutrients.pdf
6. Chandra RK. Nutrition and immunity: lessons from the past and new insights into the future. Am J Clin Nutr. 1991;53(5):1087-1101.
7. Castleman T, Seumo-Fosso E, Cogill B. Food and nutrition implications of antiretroviral therapy in resource limited settings. Food and Nutrition Technical Assistance [homepage on the Internet]. 2004. Available from: http://www.fantaproject.org/downloads/pdfs/tn7_ARVs.pdf
8. Macallan DC, McNurlan MA, Kurpad AV, et al. Whole body protein metabolism in human pulmonary tuberculosis and undernutrition: evidence for anabolic block in tuberculosis. Clin Sci.1998;94(3):321-331.
9. Oketch JA, Paterson M, Maunder EW, Rollins NC. Too little, too late: comparison of nutritional status and quality of life of nutrition care and support recipient and non-recipients among HIV-positive adults in KwaZulu-Natal, South Africa. Health Policy. 2011;93(3):267-276.
10. Scherbaum V, Shapiro O, Purwestri R, et al. Locally produced ready-to-use food (RUF): piloting in mild and moderately wasted children, Nias Island, Indonesia. Sight and Life. 2009;1:29-37.
11. World Health Organization. Innovative approach tackles malnutrition in the community. United Nations System Standing Committee on Nutrition [homepage on the Internet]. 2007. Available from: http://www.unsystem.org/SCN/Publications/html/cbm_samalnutrition.htm
12. De Pee S, Bloem MW. Current and potential role of specially formulated foods and food supplements for preventing malnutrition among 6- to 23-month-old children and for treating moderate malnutrition among 6- to 59-month-old children. Food Nutr Bull. 2008;30(S3):S434-S463.
13. Gift of the Givers Foundation [homepage on the Internet]. 2009. Available from: http://www.giftofthegivers.org
14. Stone H, Sidel JL. Sensory evaluation practices. 3rd ed. California: Elsevier Academic Press, 2004; p. 247-277.
15. Young SL, Blanco I, Hernandez-Cordero S, et al. Organoleptic properties, ease of use, and perceived health effects are determinants of acceptability of micronutrient supplements among poor Mexican women. J Nutr. 2010;140(3):605-611.
16. Pronsky ZM, Meyer SA, Fields-Gardner C, editors. HIV medications and food interactions (and so much more). 2nd ed. Birchrunville: Food-Medication Interactions Publishers, 2001; p.6-12.
17. Carr A, Cooper DA. Adverse effects of antiretroviral therapy. Lancet. 2000;356:1423-1430.
18. Scully C, Diz Dios P. Orofacial effects of antiretroviral therapies. Oral Dis. 2001;7(4):205-210.
19. Ceballos-Salobrena A, Gaitan-Cepeda LA, Ceballos-Garcia L, Lezama-Del Valle D. Oral lesions in HIV/AIDS patients undergoing highly active antiretroviral treatment including protease inhibitors: a new face of oral AIDS? AIDS Patient Care STDS. 2000;14(12):627-635.
20. Allan JD, Connolly KJ, Fitch H, et al. Long-term follow-up of didanosine administered orally twice daily to patients with advanced human immunodeficiency virus infection and hematologic intolerance of zidovudine. Clin Infect Dis. 1993;16 Suppl 1:S46-S51.
21. Valentine C, Deenmamode J, Sherwood R. Xerostomia associated with didanosine. Lancet. 1992;340(8834-883):1542-1543.
22. Dodd CL, Greenspan D, Westenhouse JL, Katz MH. Xerostomia associated with didanosine. Lancet. 1992;340(8822):790.
23. Itescu S. Diffuse infiltrative lymphocytosis syndrome in human immunodeficiency virus infection: a Sjogren's-like disease. Rheum Dis Clin North Am. 1991;17(1):99-115.
24. Cameron DW, Heath-Chiozzi M, Danner S, et al. Randomised placebo-controlled trial of ritonavir in advanced HIV-1 disease. Lancet. 1998;351(9102):543-549.
25. Heymann H. Three-day advanced sensory analysis workshop. Irene: Agricultural Research Council; 1995.
26. Zandstra EH, de Graaf C. Sensory perception and pleasantness of orange beverages from childhood to old age. Food Qual Prefer. 1998;9:5-12.
27. Dibari F, Bahwere P, Le Gall I, et al. A qualitative investigation of adherence to nutritional therapy in malnourished adult AIDS patients in Kenya. Public Health Nutr. 2012;15(2):316-323.
28. Bahwere P, Sadler K, Collins S. Acceptability and effectiveness of chickpea sesame-based ready-to-use therapeutic food in malnourished HIV-positive adults. Patient Prefer Adherence. 2009;3:67-75.
29. Nepote V, Mestrallet MG, Olmedo RH, et al. Chemical composition and sensory analysis of roasted peanuts coated with prickly pear and algarrobo pod syrups. Grasas Y Aceites. 2008;59(2):174-181.
30. Dubost NJ, Shewelt RL, Eitenmiller RR. Consumer acceptability, sensory and instrumental analysis of peanut soy spreads. J Food Quality. 2003;26(1):27-42.
31. Koskinen S, Tuorila H. Performance on an odor detection and identification test as a predictor of ortho- and retronasal odor intensity ratings in the young and elderly. Food Qual Prefer. 2005;16:383-392.