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Chemical Composition and Nutrition Information of a Newly Developed Immune Enhancing Power Bar for Immune Deficient Patients

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Abstract: A immune enhancing power bar currently developed in the Vaal University of technology were screened for it's nutritional information considering both analytical and calculated nutritional information. It was found that apart of moisture and total carbohydrate which were underestimated, all values of proximate composition were a bit higher than values obtained by calculation, thus overestimated. There is globally a reduction of micro nutrients like the one of Vit. A and E which show a gap of 70% and 48% respectively between calculated values and analytical values. The differences were found to be less significant for all minerals. Despite this, the new power bar can be considered as a powerful immune-enhancing meal, as it present most of required energy and key nutrients needed by people living with HIV/AIDS. However, in order to complete the development process all ingredients used need to undergo further refinement and optimization in the form of chemical and scientific analysis. This newly developed immune enhancing power bar can be linked to a prompt diagnosis and treatment of people living with HIV/AIDS, including use of antiretroviral treatment (ART) when indicated to improve their nutrition and health status.

Key words: HIV/AIDS, nutrition, food, immune-enhancing meal

INTRODUCTION

In the case of aids/HIV affected peoples, there's a need to boost their immune systems by the means of nutrition (Meyers *et al*., 1995). In these regard many work has been reported wish highlight the process production of energy bars, multimix, porridges for immune deficient patients (Meyer *et al*., 1995). Such energy bar is currently develop in Vaal University of Technology and is expect to be a powerful immune-enhancing pre-cooked cereal base meal, which is quick and easy to prepare. However even thought it theoretically sounds well that by mixing ingredients from different sources (carbohydrates, proteins, lipids….) and fortifying them by addition of Vitamins and some essential minerals (Se, Iron, Zn, Ca….) there's still some questions regarding biochemical and physiological phenomenon development in the new food preparation process. We don't know if the claims developed energy bars can include 100 percent of daily nutrients requirements to provide the basis for optimal nutritional and immune support for the HIV affected population. There's a need to verify by the mean of laboratory evaluation if the expected theoretical benefits of the developed power bars nutrients content are as predicted, if there's not denaturation, or antinutrients factors developments when mixing all ingredients. This work thus aims at determining the overall nutritional value of an immune enhancing power bar.

MATERIALS AND METHODS

The newly developed immune enhancing power bar: This is an energy bar currently developed in the Vaal University of technology which is expect to be a powerful immune-enhancing meal formula, combining a comprehensive blend of nutrients in a pleasant-tasting, pre-cooked cereal base, quick and easy to prepare, nutritious and ethnically acceptable as suggested by the European Food Information Council (2007).

Theoretical nutrition information data generation: Data were, derived from recipes, calculated from the nutrient contents of the ingredients used to prepare the energy bars and corrected for preparation factors: loss or gain in weight, usually referred to as yields, and micronutrient changes, usually referred to as retention factors. All calculations were according to the methods of Marsh (1983) and corrected as describe by Powers and Hoover (1989).

Biochemical analysis:

Proximate composition: The following AOAC methods (1998) were used to determine proximate composition: drying at 105°C for moisture (method 925.098); incineration at 550°C for ash (method 923.03); defeating in a soxhlet apparatus with 2:1 chloroform/methanol, for lipids (method 920.39 C with minor modifications) and micro Kjeldahl for protein (N x 6.25) (method 960.52). Total carbohydrate content was estimated by difference.

Vitamins determination: Vitamins A and E were evaluated as indicated by AACC (1999) as follow. Quantization on high-performance liquid chromatography (HPLC) systems, using UV detection at 313 or 328 nm for retinol and fluorescence detection (excitation 290 nm, emission 330 nm) for α-tocopherol. Vitamin concentrations were calculated by comparison of the peak heights and peak areas of vitamins in samples with those of standards.

Mineral evaluation: Ca, Cu, Fe, Mg, Mn, Zn were determined by AA method as describe by AACC (1999), after mineralization of all samples.

RESULTS AND DISCUSSION

Proximate composition of the new developed immune enhancing Power Bar: Table 1 present an overview of data obtained by analytical method and by recipe calculation taking into account the nutrient contents of all used ingredients to prepare the energy bar and corrected for preparation factors: loss or gain in weight, referred to as yields and micronutrient changes, referred to as retention factors. From this we can notice that apart of moisture and total carbohydrates (CHO) which were underestimated, all values of proximate composition are a bit higher than values obtained by calculation, thus overestimate. This may be due to the fact that all retention factors were not use. As indicated by Bognar (1985) inclusion for the recipes of the following parameters; cooking procedures, weight losses, cooking time and cooking temperature, are essential for a proper validation of data derived from recipe calculation. Estimated values as the calculated values presented here, may also require additional assumptions, such as the proportion of ingredients in a frozen entree and the nutrient contribution of each ingredient (Schakel *et al*., 1989; Westrich *et al*., 1994). However considering both calculated and analytical values, we can notice a good balance of nutrients in this energy bar. It is well known that excess sugar and saturated fat restrict the ability of the immune system to protect body against infection. Most ingredients uses here provide a balanced protein to fat ratio while containing only controlled natural sweetness. Both calculated values and analysis values already give an overview of potentialities of the new developed power bar for peoples living with HIV/AIDS (PLWHA). Values presented on Table 1 and 2 may be discuss accordingly to each situation and cases as an adequate nutrition is best achieved through consumption of a balanced healthy diet, is vital for health and survival for all individuals regardless of HIV status (WHO, 2003).

Macronutrients: As individual macronutrient can to some extent substitute for one another as energy sources and still provide adequate amounts of required nutrients, there is a range of intakes for carbohydrates, fats, and protein, known as the AMDR, that is associated with reduced chronic disease (IOM, 2005; Barr, 2006). The newly developed immune enhancing power bar fulfill the daily requirement of peoples living with HIV/AIDS (PLWHA). The recorded proximate composition data presented in Table 1 give an overview and is discussed below.

Energy: Both values derived by recipe calculation (364.11Kcal/100g) and chemical analysis (377.97 Kcal/100g calculation based on Atwater coefficient), indicate that if we consider approach used to establish recommendations for energy (Barr, 2006; Zello, 2006) for healthy peoples that resulted based on sex, stage of life, size of the individual (i.e., height and weight) and level of physical activity (IOM, 2005), a sedentary-low active man has an EER of approximately 2000 kcal, while a very active may need an EER of approximately 2700 kcal (IOM, 2005; Zello, 2006). Thus theoretically a normal person may need to consume exclusively 5.3 g to 7.2 g of energy bar per day to fulfill his daily energy requirement. However if we consider WHO (2003) recommendations which suggest that, energy requirements are likely to increase by 10% to maintain body weight and physical activity in asymptomatic HIV-infected adults and growth in asymptomatic children, these values may be increase by 10% hence an exclusive daily requirement of 5.83-7.92 g. In case of symptomatic HIV and subsequently during AIDS, WHO (2003) suggest an energy requirement increased by approximately 20-30% to maintain adult body weight thus an daily requirement of 6.89-8.64 g of the new developed enhance power energy bar. In case of children experiencing weight loss energy intakes need to be increased by 50-100% over normal requirements (WHA, 2003) thus theoretically 12-17 g per day is need to fulfill their energy requirements.

Carbohydrates: Using maintenance of normal glucose levels in the brain, determined by arterio-venous difference across the brain (Kety, 1957), as the indicator of adequacy, an Estimated Average Requirement (EAR) for carbohydrate of 100 g/d was set for all age groups of non disease peoples excluding periods of pregnancy

Table 1: Theoretical and laboratory proximate composition of the developed Immune Enhancing Power Bar

	Proximate composition (g/100)					
	Moisture	Ash	Lipids	Proteins	CHO	Energy
Theoretical values Energy Bars	9.24±1.31	4.32±0.99	3.67±0.56	33.43±7.21	49.34±9.32	364.11±10.00
Biochemical values Energy Bars	7.33±1.40	6.02±1.11	6.29±1.2	39.37±5.30	40.99±9.50	377.97±21.01
Differences	-1.91	+1.7	+2.62	+5.94	-8.35	+13.86

Table 2: Micronutrient composition of the new developed immune enhancing Power Bar

	Vitamins		Minerals (mg/100g)					
	Vit A (i.u)	Vit E (mg)	Ca	Cu	Fe	Mg	Mn	Zn
Theoretical values Energy Bars	3.3±0.8	10.0±1.5	800±98	1.0±0.0	14.0±2.1	2.50±0.78	300±75	15.0±1.3
Biochemical values Energy Bars	1.7±0.4	3.0±0.4	750±82	0.9±0.0	12.0±1.8	2.40±0.81	279±84	14.7±2.0
Percentage of losses %	48.48	70	6.25	10	14.29	4	7	2

and lactation in which an additional amount of carbohydrate is required (IOM, 2005). By adding 2 standard deviations (SD), 130 g/d is the RDA (IOM, 2005). Considering this recommendation, an amount of 3 g/day is sufficient to fulfill Carbohydrate requirement of healthy person. However if we consider that carbohydrates are the main source of energy for human and should account for 50-60% of calories consumed each day, we can easily derivate the corrected value to be added to the calculated recommended amount energy for each people leaving with HIV, thus a specific amount is needed according to each case providing the right correction value as describe for energy requirement.

Proteins: The protein contents presented on Table 1 indicate values of 33.43 g/100 (calculated value) and 39.37 g/100 (analytical value). Theses values may be use as reference to calculate the daily requirement, taking into account the amount uses as energy source as protein should account for 10-20% of the calories consumed each day. There's also a need to determine the amount needed to fulfill the requirement of other body functions as protein is essential to the structure of red blood cells, for the proper functioning of antibodies resisting infection, for the regulation of enzymes and hormones, for growth and for the body tissue repair. For people affected or living with HIV this is essential. However, if theoretically there's a need to supply more protein to PLWHA, there are insufficient data at present to support an increase in protein intake for PLWHA above normal requirements for health i.e. 10-20% of total energy intake (Coss *et al*., 1998; Corcoran and Grinspoon, 1999). A rapid calculation indicate that 100g of newly developed energy bars may fulfil protein requirement.

Fats: There is no evidence that total fat requirement are increased beyond normal requirements as a consequence of HIV infection. However, special advice regarding fat intake might be required for individuals undergoing antiretroviral therapy or experiencing persistent diarrhea (Hadigan, 2001). The values of 3.67 g/100 and 6.29 g/100 respectively calculated values and analytical values (Table 1), are just enough for a proper diet as Fat should account for 30% or less of the calories consumed daily, with saturated fats accounting for no more than 10% of the total fat intake. Fats are a concentrated form of energy which helps maintain body temperature and protect body tissues and organs. Fat also plays an essential role in carrying the four fat-soluble vitamins: A, D, E and K.

Micronutrients: Table 2 present Vit. A, Vit. E and most micronutrients calculated and analytical values. The first observation is that all micronutrients are reduced either by the process or by other factors. Some figures like the one of Vit. A and E show that there's a gap of 70% and 48% respectively between calculated values and analytical values, however differences are less significant for minerals. As discuss for macronutrients, one can introduce a good source of protein like soybean in a cereal based product in order to enhance the protein content of this food however none is predicted regarding potential anti nutrient factors capable of interfering with some key nutrients. The same can explain micronutrients losses. None is also know regarding biochemical activities link to the process as Enzymatic browning, racemisation, caramelisation, as well as protein denaturation.

The role of micronutrients in immune function and infectious disease is well established. However, the specific role of individual and multiple micronutrients in the prevention, care and treatment of HIV infection and related conditions are not well understood. We can thus not discuss properly in regard with the requirements for particular situations of PLWHA. However WHO (2003) indicate that to ensure micronutrient intakes at RDA levels, HIV-infected adults and children are encouraged to consume healthy diets; Nevertheless, dietary intake of micronutrients at RDA levels may not be sufficient to correct nutritional deficiencies in HIV-infected individuals. There is evidence that some micronutrient supplements, e.g. vitamin A, zinc and iron, can produce

adverse outcomes in HIV-infected populations. In fact the role of micronutrients in immune function and infectious disease is well established (Baum, 1997; Clark and Semba, 2001; Coutsoudis, 1995; Coutsoudis, 1999). However, the specific role of individual and multiple micronutrients in the prevention, care and treatment of HIV infection and related conditions is also not well understand thus the provided values from the new developed power bars may not be discuss in general.

However, some studies show that there is evidence that supplements of, for example, B-complex vitamins, and vitamins C and E, can improve immune status, prevent childhood diarrhoea and enhance pregnancy outcomes, including better maternal prenatal weight gain and a reduction of fetal death, preterm birth and low birth weight (Fawzi, 1998; Fawzi, 1999; Fawzi, 2000; Fawz., 2002; Fawzi, 2003a,b) Thus the observe low level of Vit E specifically in the new developed new energy bar may be corrected either by fortification after processing or eliminating the factor inducing losses as 70% of losses is to huge. Micronutrients that have produced positive health outcomes in HIVuninfected populations include Iron, folate and zinc supplementation for reducing diarrhoea and pneumonia morbidity in children (Fawzi, 2003; Nerad, 2003; Friis, 2001). The values indicated both by calculated values and analytical values (Table 2) are quite interesting for the new developed immune enhancing Power Bar, as these micronutrients can help boosting immune system thus fighting again secondary infections.

Conclusion: Base on both analytical and calculated nutritional information provided in this study, the newly developed immune enhancing power bar currently developed in Vaal University of technology and can be considered as a powerful immune-enhancing pre-cooked cereal base meal, as it present most of required energy and key nutrients need by People living with HIV/AIDS. Theses key nutrients include Vitamins and some essential minerals (Iron, Zn, Ca….) Even if the claims immune enhancing developed energy bars do not include 100 percent of daily nutrients requirements to provide the basis for optimal nutritional and immune support for the HIV affected population, this can be considered as a great advance in the effort to developed such product. In order to complete the process of developing this power bar, the supplements and other ingredients used in the development process need to undergo further refinement and optimization in the form of chemical and other scientific analysis as we can notice, there is a huge gap between some calculated values and laboratory analysis values. Although PLWHA (People living with HIV/AIDS) may need specific diet to boost their immune system. Nutrition counseling, care and support interventions for PLWHA will vary according to nutritional status and the extent of disease progression (recommendations for specific nutrient requirements are given with the Tables). HIV-related infections, such as tuberculosis and diarrhea, not only have nutritional status as a significant determinant of their incidence and severity, but they also have severe nutritional consequences that commonly precipitate appetite loss, weight loss and wasting. This newly developed immune enhancing power bar can be link to a prompt diagnosis and treatment of these conditions, including use of antiretroviral treatment (ART) when indicated and can contribute to improved nutrition and health.

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