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Emerging Dairy Sector Conference

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Emerging Dairy Sector Conference

IDF World Dairy Summit 2012 – Cape Town, South Africa – October 2012

FOREWORD

This IDF Bulletin comprises two papers presented at the Emerging Dairy Sector Conference organized during the IDF World Dairy Summit, Cape Town, in October 2012.

The IDF World Dairy Summit 2012 brought together many stakeholders of the dairy chain and offered a unique platform for companies, academia and dairy leaders to share their knowledge and experience. It also provided an opportunity for people involved in the field to engage in a frank and open discussion about innovative research, the progress achieved and lessons learnt.

IDF would like to thank the authors and presenters of these papers, whose contribution helped make the event in Cape Town memorable for the dairy sector and for the many participants. Their written contributions enable those who could not attend to learn about the new information presented at the Conference.

IDF wishes to express its sincere thanks to Dr Cheryl McCrindle for collecting these proceedings.

The next IDF World Dairy Summit will take place in 2013 in Yokohama, Japan. On behalf of IDF, I look forward to welcoming you all there.

Nico van Belzen, PhD
Director General
International Dairy Federation
Brussels, June 2013

Dairy: Nutritional Value for Money for South African Consumers

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ABSTRACT

Nutritional deficiencies and diet-related non-communicable diseases (NCD) considerably contribute to the heavy burden of disease in South Africa, particularly amongst the poor. Milk and milk products may play a beneficial role in addressing under-nutrition and NCD, yet affordability is often cited as a barrier. This paper aims to conceptualize and analyze the affordability of dairy in terms of nutritional value for money of five selected dairy foods and twelve foods typically chosen by low-income urban consumers in South Africa in terms of the cost of meeting 30% of the recommended dietary allowance of seven core nutrients and energy. The findings show that dairy can supply the shortfall micronutrients, especially calcium, but also protein and vitamins B_2 and B_{12}, at a reasonable cost. Regular consumption should be promoted, particularly paired with popular low-cost foods, especially those fortified and subsidized. Nutrient cost metrics should be considered in the promotion of dairy intake for low-income South African consumers.

Keywords: Dairy, diet, Recommended Dietary Allowance, nutrients, cost, South Africa

INTRODUCTION

South Africa is a country in the nutrition transition [1],characterized by urbanization and plagued by a quadruple burden of disease [2]. From a nutrition perspective, the National Food Consumption Surveys (NFCS) of 1999 and 2005 [3, 4] have, on the one hand, indicated multiple nutrient deficiencies but, on the other hand, there is also a high prevalence of diet-related non-communicable diseases (NCD), with the poor from urban areas being disproportionately affected [2]. NCD is a collective term for non-infectious chronic diseases of lifestyle, including hypertension, type 2 diabetes and cardiovascular disease, with overweight and obesity as a cross-cutter. The nutritional implications of HIV and the treatment thereof aggravate the problem. Often, under- and over-nutrition occur in the same household. Overall, children are mainly affected by nutrient deficiencies, whilst adults are affected by or are at risk of developing NCD. However, children are increasingly classified as overweight or obese [5], whilst adults are not spared from hidden hunger (micronutrient deficiencies). Low-income consumers constitute about 65% of total households in South Africa [6], showing the extent of the challenge.

Milk and milk products offer the opportunity to address both problems. Not only can under-nutrition be addressed by filling the identified nutrient intake gaps [7], but and dairy may also reduce the risks for developing non-communicable diseases, since milk and milk products may have favourable effects on blood pressure, metabolic syndrome and weight management [8,9,10]. Yet, the intake of dairy in South Africa is well below the recommended 500–750 ml per day. In fact, a secondary analysis of the NFCS showed that less than 40% of children aged 1–9 years consumed milk, with a per capita daily intake of about 68 g [11]. This was realized by the South African Department of Health in 2011, resulting in a revision of the national food-based dietary

guidelines and the addition of a specific guideline to promote dairy intake:*" Have milk, maas or yoghurt every day"*. The adoption of such a guideline depends on many factors, with the cost of dairy traditionally being cited as a major barrier to increased consumption [12]. At the same time, the cost of not following such guidelines should also be considered.

In developed countries, with much lower burdens of disease than South Africa, calculations for healthcare savings associated with adequate dairy food intake have been made. For example, McCarron and Heaney [13] projected considerable healthcare savings for the USA if adult Americans increased their dairy intakes to the recommended 3–4 servings per day. Recently, the direct healthcare expenditure and burden of disease attributable to low dairy intake in Australia was calculated as a basis for recommending the development of cost-effective interventions that use dairy as vector for reducing the cost of diet-related disease [14]. We are not aware of comparable undertakings for developing countries or countries in transition.

Within this bigger picture, the aim of this paper is to conceptualise and present a preliminary analysis of the affordability of dairy in terms of nutritional value for money by presenting the cost of core nutrients and energy of some appropriate dairy foods and a selection of foods typically chosen by low-income urban consumers in South Africa. The intention is to inform those interested in promoting dairy intake in South Africa: from producers, industry and government, to health professionals and consumers.

Nutritional value for money conceptualized

Nutritional value for money was conceptualized in terms of the cost of 30% of the Recommended Dietary Allowance (RDA) [15, 16] of core nutrients of an adult, non-pregnant, non-lactating female and children of 4–6 years old. From those nutrients that a large number of South African children are known to have inadequate intakes (i.e. vitamin A, thiamin, niacin, riboflavin, folic acid, vitamins B_6, B_{12} and C, calcium, iron and zinc [3]) the following were considered core nutrients because milk and milk products have previously been shown to contribute more than 5% of total nutrient intake of South African children [11]:protein, calcium, zinc, vitamin A, riboflavin and vitamin B_{12}, plus magnesium. In order to crudely reflect a dietary risk factor for developing NCD, specifically obesity, energy was added. The dairy products considered appropriate for this analysis refer to pasteurised full cream milk, ultra-high temperature (UHT) full cream milk, maas (a local term for fermented full cream milk, also called amasi), low-fat sweetened fruit yoghurt and drinking yoghurt. These options are lowest in cost, culturally acceptable, popular as easy food and/or require limited cold storage. For the identification of typical foods and serving sizes currently chosen by low-income urban consumers, we observed and photographed foods sold by street vendors in Pretoria, the capital city of South Africa. This included fast foods and those available at specific times of the day (lunchtime) or places (e.g. close to schools). These observations were supplemented and verified with recent publications about snacking and eating habits in South African metropolitan areas [17, 18].The final food list and the corresponding serving sizes are given in Table 1.

Table 1: Serving sizes of dairy and other foods

Foods		Serving (or unit) size (g)
Dairy products	Pasteurised milk, full cream	250
	UHT milk, full cream	250
	Maas	500
	Yoghurt, low-fat fruit, sweetened	175
	Drinking yogurt	300
Typical foods currently chosen	Pilchards in tomato sauce	115
	Bread ("Government white")	160
	Eggs, boiled	100
	Doughnut, jam	110
	French fries	250
	Fish, fried, hake	120
	Pap (white, fortified, stiff porridge)	500
	Peanut butter	20
	Meat stew (chuck)	150
	Soft drink (Coke)	340
	Meat pie	140
	Crisps (potato crisps)	36

Methods

The prices of the typical foods and the dairy products for the specified serving sizes (Table 1) were collected (fourth quarter of 2012) in Pretoria from two different retailers. The price (in South African Rand, ZAR) of at least three different brands per product was collected, thus at least six prices were used for the mean final, categorized value (see Table 2).The composition of the foods was determined using the South African food composition tables (Food Finder 3) [19]. The nutritional value for money was calculated according to the above conceptualization (cost of 30% of the RDA for an adult, non-pregnant, non-lactating female and for a 4- to 6-year-old child [15; 16] for energy, protein, calcium, zinc, vitamin A, riboflavin, vitamin B_{12} and magnesium).

Figure 1 provides an overview of the conceptualization and methodology.

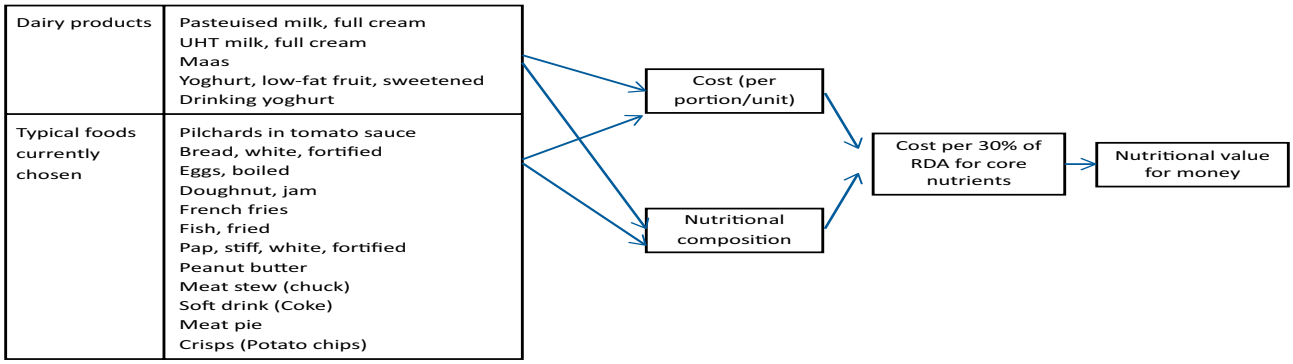


Figure 1: Nutritional value for money conceptualized

RESULTS AND DISCUSSION

In Table 2, the cost per serving or unit of the foods investigated is given. The cost of the foods for 30% of the RDA for women and children of the core nutrients is summarized in Table 3.

Table 2: Ranking of foods by cost per serving or unit

Price category (ZAR)	Food items (from cheapest to most expensive)	Price (ZAR) per serving or unit*
Less than 5.00	Peanut butter	1.20
	White bread (Government)	1.40
	Eggs	3.98
	Potato crisps	4.00
5.00–9.99	Pasteurised milk	5.00
	UHT milk	5.10
	Yoghurt (low-fat sweetened)	5.62
	Pap (fortified, stiff porridge)	5.75
	Jam doughnut	6.00
	Soft drink (Coke)	7.00
	French fries	7.10
	Pilchards in tomato sauce	7.74
	Drinking yoghurt	8.65
	Maas	8.70
	Meat stew	9.00
10.00–19.99	Fried fish	10.20
	Meat pie	11.74

*In quarter 4 of 2012

Table 3: Cost of 30% of the RDA for women (F) and children (C)* of dairy and other foods

Food type	Food items	<R5.00	R5.00–R9.99	R10.00–R19.99	R20.00–R49.00	R50.00–R99.99	R100.00 or more
Dairy	Pasteurised milk, full cream	Vit B2 (F, C) Vit B12 (F, C) Protein (C)	Ca (F, C) Vit A (F, C) Protein (F) Mg (C) Zinc (C)	Mg (F) Zinc (F)	-	-	-
	UHT milk, full cream	Vit B2 (F, C) Vit B12 (F, C) Protein (C)	Ca (F, C) Vit A (C) Protein (F) Mg (C) Zinc (C)	Vit A (F) Mg (F) Zinc (F)	-	-	-
	Maas	Ca (F, C) Vit B2 (F, C) Vit B12 (F, C) Mg (C) Protein (C) Zinc (C)	Vit A (F, C) Protein (F) Zinc (F)	Mg (F)	-	-	-
	Yoghurt, low-fat fruit, sweetened	Protein (C) Vit B2 (C) Vit B12 (C)	Ca (F) Vit B2 (F) Vit B12 (F)	Mg (F) Protein (F) Zinc (F) Vit A (C)	Vit A (F)	-	-
	Drinking yoghurt, sweetened	Vit B2 (C) -	Ca (F, C) Vit B2 (F) Protein (C) Vit B12 (C)	Protein (F) Vit B12 (F) Mg (C) Zinc (C)	Mg (F) Zinc (F)	-	-

Food type	Food items	<R5.00	R5.00–R9.99	R10.00–R19.99	R20.00–R49.00	R50.00–R99.99	R100.00 or more
Other foods	Pilchards in tomato sauce	Protein (F, C) Vit B12 (F, C) Vit B2 (C)	Ca (F, C) Vit B2 (F) Mg (C) Zinc (C)	Mg (F) Zinc (F)	-	-	-
	Bread, white	Vit B2 (F, C) Vit A (F, C) Mg (F, C) Protein (F, C) Zinc (F, C)	-	Ca (F, C)	-	-	-
	Eggs, boiled	Vit B2 (F, C) Protein (F, C) Vit B12 (F, C)	Zinc (F, C)	Vit A (F)	Ca (F, C) Mg (F)	Mg (C)	-
	Doughnut, jam	-	Protein (C)	Protein (F) Vit B2 (C) Zinc (C)	Ca (F, C) Vit B2 (F) Mg (F) Zinc (F)	-	-
	French fries	Mg (C) Protein (C)	Mg (F) Protein(F) Zinc (C)	Zinc (F) Vit B2 (C)	Ca (F, C) Vit B2 (F)	-	-
	Fish, fried	Protein (F, C) Vit B12 (F, C)	Vit B2 (C)	Vit B2 (F) Mg (C)	Mg (F) Zinc (F, C) Vit A (C)	Ca (F) Vit A(F)	-
	Pap, white, fortified	Vit B2 (F, C) Mg (F, C) Zinc (F, C) Vit A (C) Protein (C)	Protein (F) Vit A (F)	-	-	Ca (F, C)	-
	Peanut butter	Mg (F, C) Protein (F, C) Zinc (C)	Zinc (F)	Vit B2 (F, C)	-	Ca (F, C)	-
	Meat stew (chuck)	Protein (F, C) Zinc (F, C) Vit B12 (F, C) Vit B2 (C)	Vit B2 (F) Mg (C)	-	Mg (F)	-	Ca (F, C)
	Soft drink (Coke)	-	-	-	-	Mg (C) Zinc (C)	Ca (F) Mg (F) Zinc (F)
	Meat pie	-	Protein (C)	Protein (F) Vit B2 (C) Zinc (F, C) Vit B12 (C)	Vit B2 (F) Vit B12 (F) Mg (C)	Mg (F) Vit A (C)	Ca (F, C) Vit A (F)
	Crisps	-	Mg (C) Protein (C)	Mg(F)	Protein (F) Zinc (F, C)	-	Ca (F) Vit B2 (F)

*F, Adult, non-pregnant, non-lactating female 19–55years old; C, child 4–8 years old

R, South African Rand; Ca, calcium; Mg, magnesium; Vit B2, riboflavin; Vit B12, vitamin B12

Where nutrients are not listed, they are absent or in traces in the food

Table 3 shows that for the milk and milk products, the core nutrients as a group populated the lower end of the price categories. In particular, the fermented traditional milk product, maas, was a low-cost source of most of the nutrients. Riboflavin, vitamin B_{12} and protein cost less than ZAR5.00 in pasteurised and UHT full-cream milk, maas and yoghurt. Calcium, vitamin A, magnesium and zinc cost less than ZAR10.00 in most of the dairy products investigated, except for yoghurt. A cup (250 ml) of milk, maas or yoghurt provides almost a third of the calcium requirement of 1000 mg per day.

Vitamin A as a fat-soluble vitamin is more abundant in full-cream dairy products (fat content of full-cream milk and maas is 3.4%). Therefore, the vitamin A obtained from full-cream dairy products is cheaper than vitamin A obtained from low-fat dairy products.

Of the non-dairy foods, pilchards in tomato sauce and the two South African products that are fortified (bread and maize meal porridge) also tended to be good sources of the core nutrients at low cost. Calcium was usually the exception nutrient, emerging as relatively expensive in most non-dairy foods. The very commonly consumed food, stiff pap (porridge), costs more than ZAR50.00 for 30% of the RDA of calcium for adult females and children aged 4–6 years.

The animal-source non-dairy foods and peanut butter tended to supply most non-calcium core nutrients at a similar cost to the dairy products; yet the exceptions were fried fish and specifically meat pies. Where plant-source foods are apparently good sources of protein and minerals (zinc and magnesium), lower biological value (for proteins) and bioavailability (for minerals) need to be kept in mind.

If maas is added to pap, not only the calcium intake, but protein and vitamin A intake is improved (Figure 2). By spending ZAR5.00 more, the nutritional picture changes completely.

Figure 2a: Nutritional impact of adding 250 ml maas to 500 g stiff porridge on the contribution to RDA of females

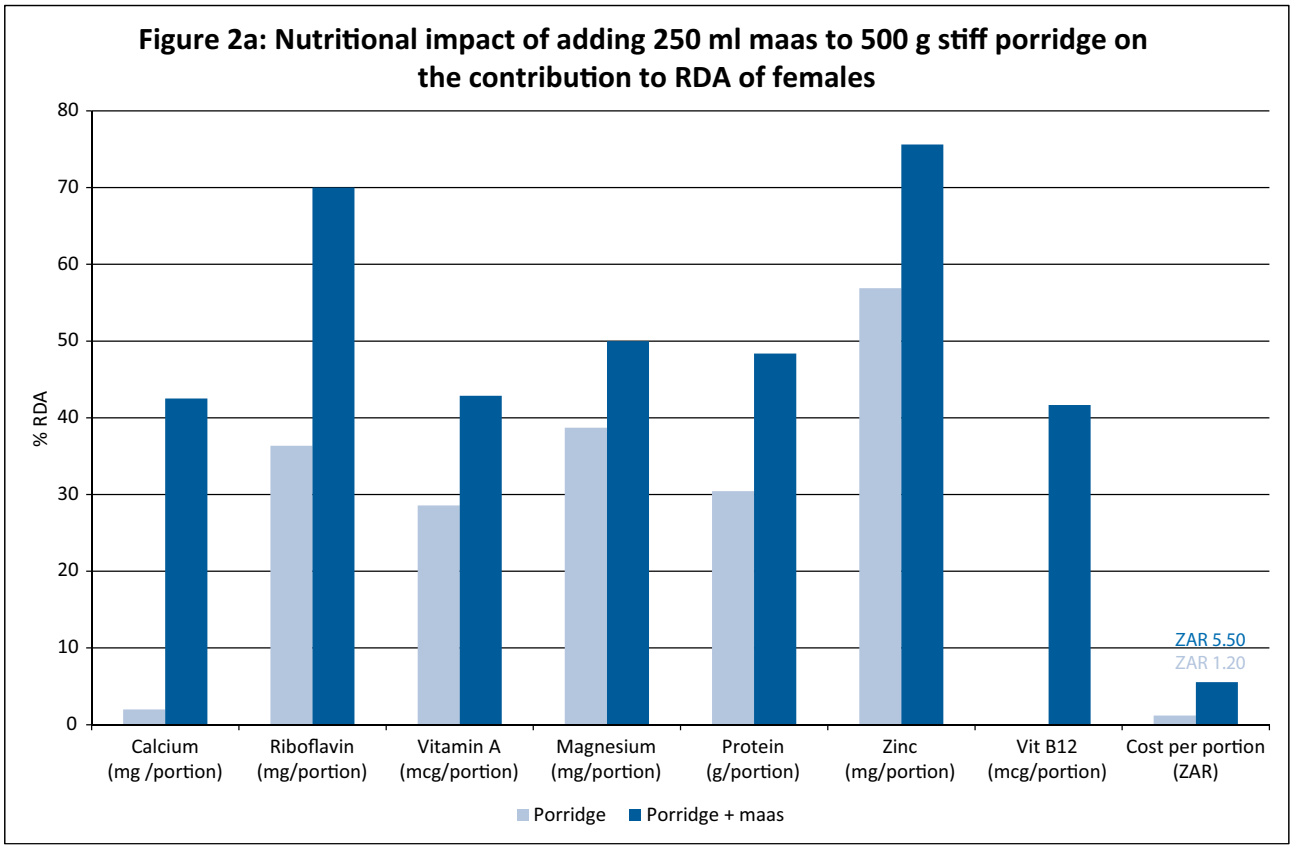
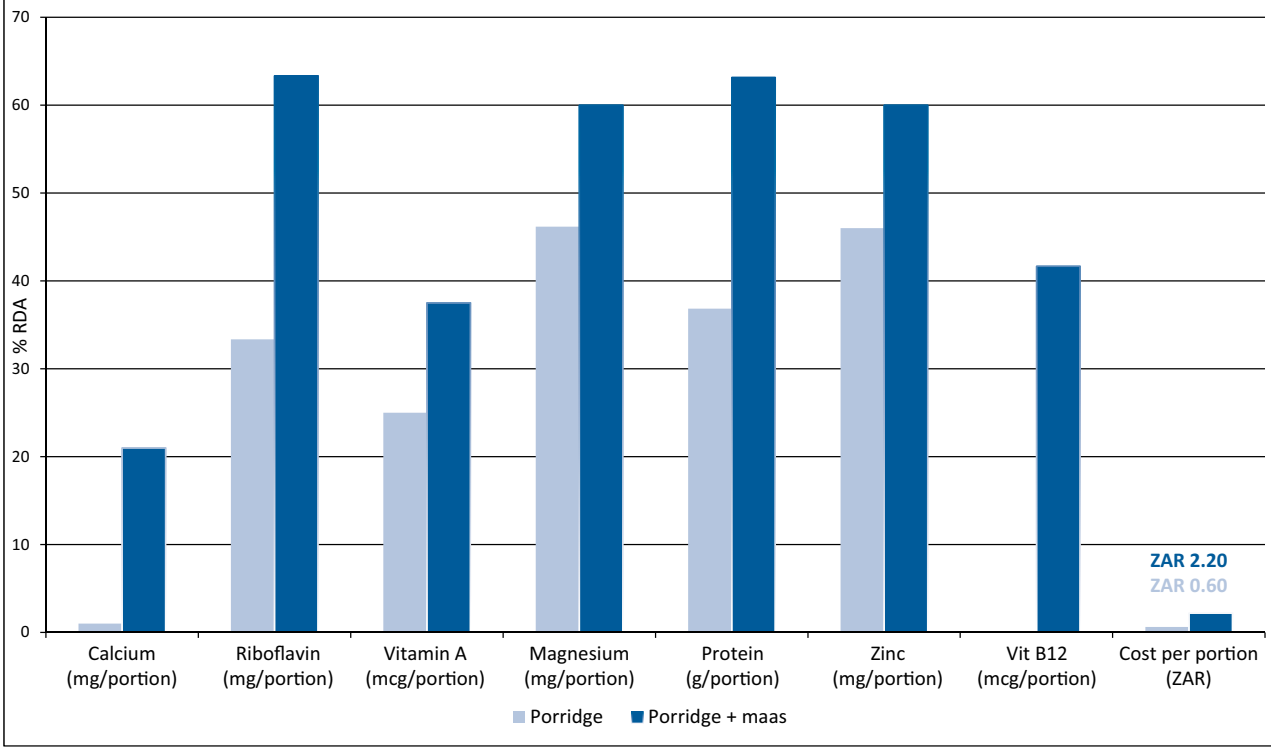


Figure 2b: Nutritional impact of adding 125 ml maas to 250 g stiff porridge on the contribution to RDA of children (4-6 years)



In Table 4, the cost of food energy of the food items is given. From the Table it is evident that soft drinks and all animal-source foods, including dairy, were relatively expensive per kilojoule, with pilchards in tomato sauce supplying the most expensive food energy. As expected, the subsidized bread emerged as the cheapest source of kilojoules.

Table 4: Cost for 100 kJ energy per food item (ranked from lowest to highest)

Food items	Energy cost (ZAR for 100 kJ)
Bread, white (Government)	0.08
French fries	0.22
Peanut butter	0.23
Pap, white fortified, stiff	0.24
Doughnut, jam	0.36
Crisps, potato	0.48
Meat pie (unit)	0.55
Maas	0.64
Eggs, boiled	0.65
Meat stew (chuck)	0.74
Pasteurised milk, full-cream	0.76
UHT, full-cream	0.78
Yoghurt, low-fat, sweetened	0.86
Fish, fried hake	0.89
Drinking yoghurt	0.91
Soft drink (Coke)	1.18
Pilchards in tomato sauce	1.27

The answer to the question of whether dairy is more expensive than foods commonly chosen by urban South African consumers depends on how the price is measured. Typically the price of edible weight (e.g. ZAR per 100 g food) or of an average serving (e.g. ZAR per 250 ml milk) is used as basis for the comparison. We propose an additional emphasis, namely the price of food energy (e.g. ZAR per 100 kJ) and the cost of significantly contributing towards the dietary requirements of shortfall nutrients in the target group. This would consider the local risk of overweight (including NCD), which affects about 50% of adult South African women, and of nutrient deficiencies.

Similar approaches have been conducted before, for example by Drewnowski [20] and the US Department of Agriculture [21]. Drewnowski used the cost of 10% recommended daily value as reference and found that in spite of their low energy contribution, milk and milk products were by far the lowest-cost source of dietary calcium and among the lowest cost sources of riboflavin and vitamin B_{12} in the American context [20]. Our findings support this, but also show that the picture in South Africa is a little more complex. Mandatory fortification has had a favourable impact on the nutrient costs of bread and maize porridge, but the cheap food energy may in the longer term contribute to the obesity pandemic among low-income consumers. Regularly pairing dairy with the popular foods (e.g. stiff porridge with maas) should be encouraged to increase nutritional value, biological value and bioavailability, thereby providing an affordable solution to the nutritional problem at hand.

The findings of our study confirm that it is not easy for the low-income consumer to choose a healthy diet. Dairy is an indispensable part of a healthy diet, essential for addressing critical shortfall nutrients and supportive of long-term health, particularly the low-fat versions. Dairy stands out as a good, difficult-to-replace, low-cost source of calcium. Overall, the basic principles of dietary variety, balance (through daily inclusion of dairy) and moderation, even on a severely restricted budget should be strived for.

We are aware of certain limitations of our study. At this stage, the findings cannot be generalised to the whole of South Africa since they are time- and place-bound relatively informal observations, particularly in terms of prices and food choices. Methodological refinement regarding the nutritional reference value (type and cut-off) and linkage to food profiling should be considered. The latter has been used to effectively identify foods with good nutritional qualities relative to their price [22], but the usefulness in a developing country context has to be investigated first. Also, the statistical and practical significance of differences in nutritional value for money between dairy and other options should be investigated before the concept is presented to consumers. Complexity and information overload, which could lead to “option paralysis” [23] in the consumer should be avoided through proper testing.

We believe that the approach and the results of this study provide a starting point for overcoming a considerable barrier in achieving the new food-based dietary guideline for South Africa, i.e. “*Have milk, maas or yoghurt every day*”. Merging cost and nutrition considerations is novel, complex and requires a mind shift, yet the concept of nutritional value for money appears to be core for informed food choices in the battle against the nutrition-related burden of disease in the low-income consumer of South Africa. Without contributing to the burden of NCD, dairy (in particular low-fat versions) can fill critical nutrient intake gaps in those most affected by nutritional-related disorders.

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The Benefits of Animal Welfare for Farmers and the Environment in Emerging Economies

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ABSTRACT

The challenge has never been greater to ensure a secure food supply in emerging economies. The need for truly sustainable dairying, posed against this ever-growing food demand, requires new thinking. In that context, demands for increased attention to animal welfare are sometimes seen as an added burden. Yet this paper outlines the integral role of animal welfare in dairy production and how attention to animal welfare can bring profound benefits to dairy producers. Animal welfare reflects both physical health and mental wellbeing. The five freedoms reflect animals' needs for shelter, freedom from hunger and thirst, freedom from disease, freedom from pain and distress and freedom to perform natural behaviour. As demands to increase production grow, specialisation of dairy breeds for high yield has brought the promise of ever-greater output per animal, but also increased animal welfare challenges, such as lameness and mastitis, and metabolic issues that lead to compromised fertility and longevity. This paper outlines how attention to robustness can lead us toward solutions that balance productivity, profit and animal welfare, through selection, system design and sound husbandry. Case studies of real farmers in Asia and Africa show how successful, resource-efficient dairying, knowledge-transfer practices and co-operative marketing and access to professional services can boost animal wellbeing and productivity, benefiting people's lives and livelihoods. Environmental pressures are shaping future farming methods. Higher welfare farming can help improve carbon efficiency. Better understanding and support for humane sustainable farming methods is needed to make the best of our dairy farmers' innovations and skills in emerging economies.

Keywords: Animal welfare, Animal wellbeing, Dairy, Milk, Sustainable

OVERVIEW

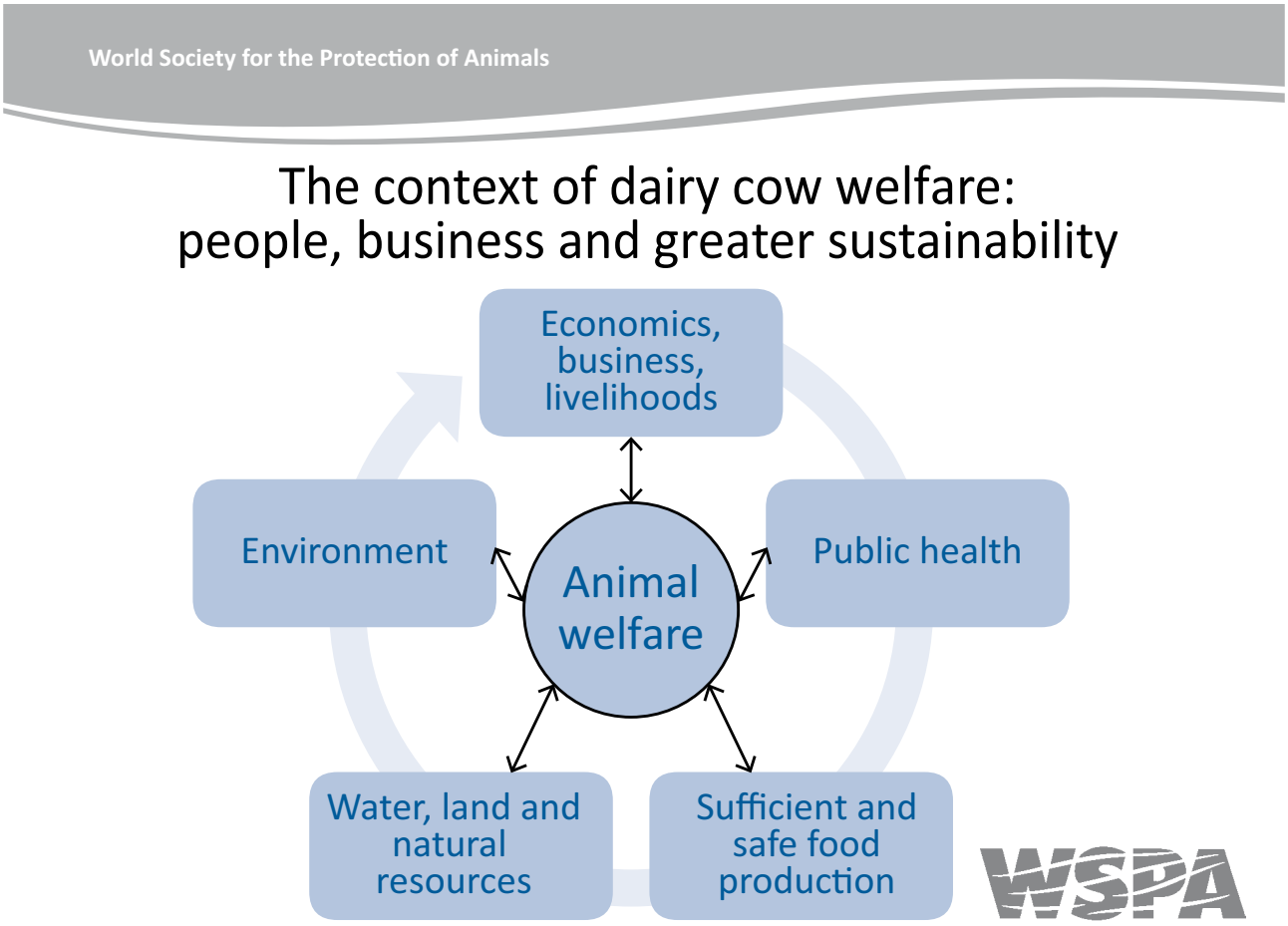
The challenge has never been greater to ensure a secure food supply in emerging economies. Milk is an important part of that solution – nutritious, protein-rich and relatively cheap. The need for a truly sustainable future for dairying requires new thinking: we face major global and regional challenges that change our environment unpredictably, limit our access to fuel and feed resources, push up feed prices, yet at the same time drive up demand (FAO 2006, Beddington et al. 2012).

Much of the expansion in dairying will be in our emerging and developing economies, or sold to these regions (FAO 2006, Informa 2011).In this context, animal welfare might be seen as a luxury concern when we are feeding people in a world of nearly a billion hungry. However this paper aims to show that animal welfare is not an additional cost, but is central to delivery of successful, sustainable dairying. It will present examples showing that dairying is not just good for cow welfare, but for people and the planet too. It will share solutions adopted in emerging economies, based on the wisdom and skill of existing dairy farmers and demonstrates lessons learned about achieving a humane, sustainable and productive future for dairy farming.

Dairy cow welfare in context

Farm animal welfare is integral to other considerations in agriculture and food production (see Figure 1), such as economics, environmental impact, public health and food security. How do we find solutions that are win-wins in such a complex picture?

Figure 1: The context of dairy cow welfare. Animal welfare is integral to a successful agricultural model



We often look to technology for answers. Breeding and feeding technologies have been effective at driving up milk yields to the extent that dairy cows have been selected for production traits such that that they are now at or beyond the limit of their productive capability and require highly managed nutrition, often permanent housing and specialised husbandry skills to achieve this (EFSA 2009a, EFSA 2009d). However, the push for such increased yields per cow brings significant challenges to the dairy sector. For emerging economies, especially for small-scale farmers that want to scale up production, the investment, technology and novel skills required to develop highly intensive forms of dairying are often a prohibitive barrier (McCleod and Sutherland 2012). Indeed, leading food security analysts propose that the best potential for increasing yields from smallholder farmers comes from improving management of existing systems rather than simply adopting models that are designed for highly integrated, infrastructure- and input-driven economies (Beddington et al. 2012).

Environmentally, high yield dairy production presents challenges because it is resource hungry in terms of inputs, especially of soy and cereals, which increasingly compete for land for human arable production (Erb et al. 2012). Systems focused on high yield can waste valuable meat production resources in terms of male calves, seen as uneconomic to rear, and quickly use up their core resource – the dairy cow, so that failed fertility, reduced longevity and replacement are now major costs of the high yield dairy system (EFSA 2009a–d). Higher risks of lameness and

mastitis in intensive indoor systems increase this burden further (e.g. EFSA 2009a–c). Indeed the cost to animal welfare of selecting mainly for production is profound. This begs the question whether there is another way to meet this growing demand without the yield-per-cow-per-year-driven industrialisation of dairy farming in emerging economies?

One way to determine the potential of dairy systems is to assess whether they meet the goals of a successful sustainable business model. Sustainable dairying by definition means that businesses are economically, environmentally and ethically robust in the long term. This requires:

- A profitable business that enables sound livelihoods and all that comes from them
- Long-term approaches to sustainability – for future generations and as a platform for growth
- Protection of animal welfare
- Environmentally sound, efficient and minimised resource inputs, use and waste

What is animal welfare?

Often, when talking with friends in the dairy industry, the concept of welfare seems to equate to health, as measured by incidence of disease over the month or year. However, reducing incidence of mastitis, for example, managing lameness, ensuring effective nutrition at the birth of the calf and during lactation, or other aspects of veterinary care are all important aspects of welfare. People have very differing concepts of animal welfare, so this section outlines a framework that encompasses our global scientific and practical knowledge.

Firstly, animal health is, of course, a central concern. We know lameness and mastitis impact on productivity and fertility and that sick animals do not thrive, need to be replaced more frequently, and leave their owners vulnerable. Food, water and shelter from extremes are basic physiological needs. But animal welfare goes beyond physical health and includes the mental wellbeing of animals. What does science tell us about mental welfare? Animals are often stressed by restrictive environments, by the inability to perform important behaviours and by fear-inducing stimuli such as pain. Stressed animals, and those who cannot perform natural behaviours, are suffering, but are also often less productive. For an overview of animal welfare science see Appleby et al. (2011) and Webster (2012).

The five freedoms are widely recognised as a simple way of describing the basic tenets of animal welfare: freedoms from hunger and thirst, pain and disease, discomfort and lack of shelter, freedom to perform important natural behaviour and to be free of fear and distress. Indeed, the need to perform innate patterns of behaviour is recognised as important for welfare by The World Organisation for Animal Health (OIE, 2012).

Welfare also greatly depends on the way the animals are bred (for example, some animals bred for maximal yield may have more health risks or be inherently prone to lameness), the system in which they are kept and the way that is managed.

Animal welfare concepts and definition

The World Organisation for Animal Health (OIE 2012) defines animal welfare as:

> "Animal welfare refers to the state of the animal. An animal is in a good state of welfare if it is … healthy, comfortable, well nourished, safe, able to express innate behaviour, and if it is not suffering from unpleasant states such as pain, fear, and distress. Good animal welfare requires disease prevention and veterinary treatment, appropriate shelter, management, nutrition, humane handling and humane slaughter/killing."

The five freedoms

1. Freedom from hunger and thirst – by ready access to fresh water and a diet that maintains full health and vigour.
2. Freedom from discomfort – by providing an appropriate environment, including shelter and a comfortable resting area.
3. Freedom from pain, injury or disease – by prevention and/or rapid diagnosis and treatment.
4. Freedom to express normal behaviour – by providing sufficient space, proper facilities and company of the animal's own kind.
5. Freedom from fear and distress – by ensuring conditions and treatment that avoid mental suffering.

What does this mean for the dairy cow? The potential for good welfare depends on the way the animals are bred (for example, some animals bred for maximal yield may have more health risks or be inherently prone to lameness); design of the production system in which they are kept; and the way that is managed. The design of the system sets a baseline for what welfare can be achieved, while the husbandry determines what is realised in practice.

In terms of health, the "iceberg indicators", which give an overall picture of health, are widely recognised and include lameness, mastitis, body condition and energy balance. Breed has a major impact on longevity, calf care and whether calves are reared for meat in systems that can provide good welfare. The ability to perform natural behaviour means providing for aging, resting and social behaviours. Physiological needs include managing heat stress and adequate shelter.

Benefits of animal welfare in emerging economies

More than 60% of dairy is supplied into partially or completely informal markets, i.e., those that have short chains between producer and consumer and often involve direct interaction between the ends of the chain (FAOSTAT 2012, McCleod and Sutherland 2012). These markets are highly important for emerging economies as they provide the basis for growth of income, and thus profit, to empower smallholders to develop The markets are also a highly localised source of nutrition security. Informal markets often enable large numbers of independent farmers to benefit from their efforts directly. This type of system also provides significant employment in the local area. However, there are also benefits for smallholders when integrated into more formal supply chains. As McCleod and Sutherland (2012) note, there is a diversity in types of food production chains in emerging economies, bringing different benefits.

Humane sustainable dairy in practice

How does animal welfare relate to the success of dairy enterprises in emerging economies? Good animal welfare has benefits in each type of food supply chain. Firstly, good animal health enables business resilience, ensuring ongoing productivity and product quality, and minimising the risk of zoonoses. The system of production may also enable farmers' resilience to price shocks, for example, pasture systems tend to rely on feed sourced on the farm through grazing, rather than on imported purchased feed product. In informal, semi-formal and formal supply chains, animal welfare can be marketed as part of provenance and enhanced product quality to growing middle-class populations who are increasingly concerned about what they consume and often prize local, niche products. In addition to providing income and nutrition from milk, dairy cows also provide manure, marketable products such as calves and beef from culled dairy cows, and other tangible benefits including financial security and social status.

Two examples from Kenya and India are presented here to illustrate how farmers and communities have benefitted from including animal welfare as a core component of their business models.

The first case study looks at the benefits of improving animal health and welfare for economics and livelihoods in Kenya (WSPA 2012a). Dairy production is Kenya's leading agricultural sector, with almost two million small-scale farmers delivering 80% of all milk in the country.

Lessos Livestock Breeding Network Dairies Limited (LELBREN) was founded in 2004 in the Nandi and Uashin Gishu counties of the Rift Valley province of Kenya. LELBREN supports the production and marketing of milk from small-scale farms. Originally 29 farmers, LELBREN is now a limited company of almost 4,000 small-scale dairy farmers.

LELBREN aims to improve the livelihoods of the community through advising on improved farm management, increasing milk distribution levels and facilitating access to markets, knowledge and inputs by dairy farmers. One of the ways LELBREN has been successful is by paying attention to the management and husbandry of health and welfare of individual animals through:

- Extension services – including Good Dairy Practice courses for farmers
- Providing technical support at the farm level in management and production
- Giving access to inputs such as feed and veterinary care

The co-operative model builds strength and enables farmers to directly benefit from their business. Through this model, we see gains in productivity and improvement in the welfare of both animals and the community (WSPA 2012a). Average annual milk marketed per household increased from 1,880 litres in 2008 to 2,880 litres in 2010, a 53% increase. The higher productivity and a premium price for milk resulted in farmers increasing their earnings by 18% per litre in 2009.

Figure 2: LEBREN main office. LELBREN has enabled almost 4000 small farmers to work together to process and market their milk, with significant benefit for economics and the community

How does this relate to animal welfare? Most farmers have adopted a system of pasture production, which is seen by the farmers as key to the success of the business. Animal welfare is not the sole reason that the pasture system was chosen, but good welfare is clearly good for business. They improved animal welfare by:

- Including more traditional genetics, producing breeds that were healthier and more resilient to local environmental conditions
- Returning to pasture following a period of zero grazing – keeping feed costs low, limiting labour requirements and providing a more reliable feed source
- Using the co-op's facilities and knowledge to boost production within a low input system.

At LELBREN, the co-operative found that good animal welfare is also highly sustainable, providing sound livelihoods.

Figure 3: LEBREN. LELBREN has achieved a sound economic model that minimises feed costs, includes pasture access and robust breeds and aims for better animal welfare

The second case study is the commercial dairy farm Kisan Dairy in the Indian State of Haryana (WSPA 2012b). The farm has 90 dairy cows in production and a total of 220 cows and calves. The herd is now entirely composed of Holstein Friesian crossbreeds, which combining a higher milk yield with robustness of breed; crossing with indigenous cattle means that they are better suited to the local hot and humid conditions. Although they do not graze, cows have access to fresh air and can exercise freely outdoors during the day and can rest on sand or ash to provide comfort and a nonslip walking surface. They have access to shelter outdoors or indoors on straw. A recent innovation was the building of a wallowing tank to help cows regulate body temperature. Cows can be seen using the tank, especially during the hot summers.

Figure 4: Longevity is an important aspect of the success of the operation. Cows have between 7 and 8 lactations. The owners attribute this to the good quality feeding, genetics appropriate to the local environment and the good levels of care, which result in good health and welfare.

Figure 5: Wallowing tank. At Kisan Dairy, a recent innovation is the building of a wallowing tank to help cows regulate body temperature. Cows can be seen using the tank, especially during the hot summers

Cow longevity is important to the success of the operation and these cows have between seven and eight lactations. The owners attribute this to the good quality feeding, genetics appropriate to the local environment and the good levels of care, which result in good health and welfare. Kisan Dairy's productivity is nearly six times the national Indian average. They are now considering further investment in a new mechanised milking parlour to increase efficiency, improve hygiene and reduce milking times. Feed is sustainable, provided locally and processed on the farm, rather than being imported.

Does this business model, which integrates animal welfare, work? Naresh Kumar, one of the owners, put it in clear business terms: "These cows are able to pay for their feed, my bank loan instalments, feed for non-milking cows, maintenance of calves, the salary of workers and run my household. I can't ask for anything else." (WSPA 2012b)

Is the model replicable? Dr. Kamboj, Senior Scientist at the National Dairy Research Institute in Karnal gave his view of the farm: "the cows appear comfortable, well fed, satisfied and performing well without major health or behavioural problems, this farm could be rated as very good from cattle welfare perspective. The farm may, therefore, be considered as a model which could be replicated under most of Indian farming conditions for promoting commercial dairy farming." (WSPA 2012b)

These approaches put into practice the concept of designing a production system that has "the animal fit for the environment, which is in turn fit for the animal" by:

- Meeting the needs of the animal's natural way of being (their "telos"), in other words their innate nature and behaviour
- Reducing animal stress and consequently boosting productivity
- Reducing hazards such as injury (to people and animals)
- Using easy care, resilient breeds limits the increased need for human labour and minimises, e.g., painful mutilations
- Utilising local and traditional knowledge

Environmental benefits of humane sustainable dairy: a first look at the research

What about the other big challenges we face as a sustainable dairy sector? This section looks at the pressing challenge of greenhouse gas emissions. The prevailing view of dairy carbon efficiency is that increasing the yield per cow decreases emissions per kilogram of milk. From an animal welfare perspective, the push for increasing yields has been one of the biggest drivers of poor welfare in dairy cows (EFSA 2009a, 2009d). It also introduces greater production waste in terms of reduced cow longevity and higher replacement rates, and reduces the amount of beef produced as a co-product from the dairy system.

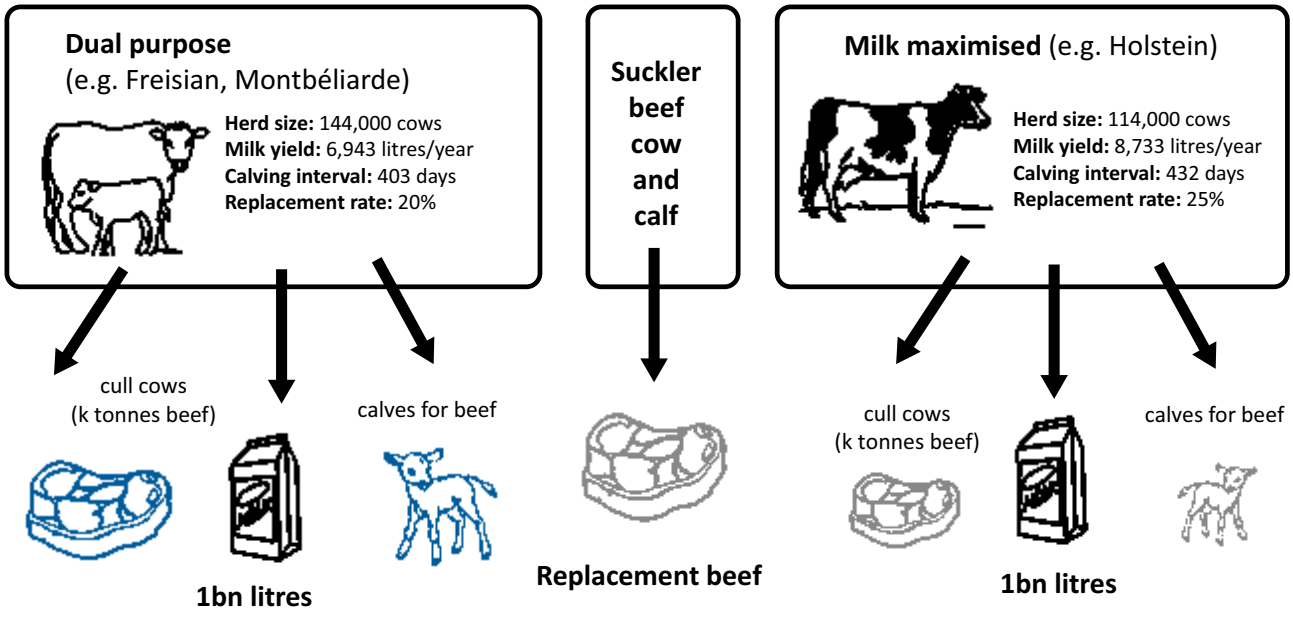
But are there win–win alternatives, i.e. ways of achieving the environmental goals of carbon

efficiency that are also beneficial for dairy animal welfare? Most studies of dairy carbon footprinting allocate the majority of emissions to milk. This pays limited attention to the consequences of changing the dairy system for co-products such as dairy beef. It can also artificially inflate the greenhouse gases attributed to milk. To date, a limited number of studies have explored this topic, although it is rising fast in the research agenda.(e.g. Cederberg and Stadig 2003, Flysjo et al. 2011).

WSPA commissioned independent lifecycle analysis experts Best Foot Forward to model two key questions for UK dairy production (where data is readily available) as a pilot for further research. Firstly, they assessed the impact of better animal health on greenhouse gas emissions. Secondly, they asked:"what is the impact of the dairy production system, including breed and pasture access"? They assessed three model systems: a high-yield breed with permanent indoor housing; a high-yield breed with grazing; and a dual-purpose dairy breed that produces a calf suitable for rearing for beef and the dairy cows on pasture during the growing season. The lifecycle analysts modelled emissions from milk production at the herd level rather than at the individual cow level, basing their model on representative UK dairy industry figures for production system and breed. These were applied to a widely accepted FAO-authored methodology (Gerber et al. 2010). The results are a first look, and as such descriptive, but are indicative of the potential of such a system to achieve particular carbon footprints, without requiring extensive and expensive on-farm data collection specifically for the study, providing a launch pad for further study.

The method of assessing carbon production used in this study deals with the challenge posed by allocating emissions to milk only. It takes into account the expanded milk production system: the milk produced, plus beef from cull cows and from calves reared on for beef. It compares carbon output per kilogram of energy corrected milk for equivalent amounts of milk produced, and assesses the consequential impact on beef production where one system produces less than another, and thus to gain the same amount of meat the additional beef is substituted from suckler beef systems.

Figure 6: Conceptual example of carbon footprinting system expansion model. The model produces the same amount of milk from each system and assesses the consequences of milk produced for beef production in each system



The final results of the study will be released in 2013, but the draft results already provide indications that attention to animal health and welfare pays dividends for greenhouse gas efficiency. Firstly, the study has found that better health provides better carbon efficiency; by improving health through reducing mastitis and lameness, it is possible to increase carbon efficiency by up to 12%.

Comparing milk production only from the three dairy systems, the results show (as prior studies suggest) that the higher yield systems have a marginally lower carbon footprint. However, when the model takes into account the whole picture of dairying, including the extent of meat production from dairy cows and calves, and the beef required to substitute for that lost when higher yield dairy breeds no longer produce as much beef, then the carbon footprint picture fundamentally changes.

Once you look at production of both milk and beef, the dual-purpose system's efficiency is revealed: the dual-purpose, pasture-based system is just as efficient as the high-yield milk system. If we consider what is known from dairy beef carbon footprinting, this is the result one would expect. In other studies that look at carbon efficiency in the beef supply chain (EBLEX, 2012), dairy beef is the highest efficiency beef production.

In conclusion, this research shows that the expected environmental benefits of high-yield intensification of dairying are lost when the whole picture is considered. Pasture systems and robust beefier dairy breeds deliver good production of milk and beef, good welfare and good environmental performance. It seems that the carbon-efficient solution that we so keenly seek may be already with us.

Why should the dairy industry be concerned about the carbon footprint of the beef from milk production systems? Obviously there is an ethical issue, which is of direct concern to consumers: the welfare of dairy cows and the utilisation of male dairy calves, rather than their destruction at birth or a very young age. This issue presents a significant reputational risk for dairy businesses, as well as being an area of disquiet for the vast majority of farmers who are keen to ensure the wellbeing and stewardship of their calves. However, there is another powerful benefit for the dairy industry in looking at their expanded dairy production system, including the co-product beef, when assessing emissions. This method of greenhouse gas assessment dramatically reduces the proportion of carbon attributed to milk production because it takes into account the amount of carbon related to the beef coming from the same production system. It also makes clear the consequences of choices made in dairy production (such as selecting dual-purpose animals and pasture) for the wider picture of efficiency, revealing some unintended consequences of intensification.

Concluding perspectives

Humane, sustainable dairy *is* optimal farming – a sustainable optimum production method that achieves according to the core criteria of a successful sustainable dairy business: a profitable business model with long-term sustainability; animal welfare protected; and environmentally sound in its resource inputs, usage and waste.

While humane sustainable farming systems are clearly good business models, is the market big enough to enable optimal farmers to succeed? There is more we can do to ensure that systems that are humane and sustainable are given the chance to thrive:

- We need to quantify, fully understand and communicate the benefits of humane sustainable farming, which is often a 'Cinderella' in research terms, with relatively little investment. Humane, sustainable agriculture and the benefits of animal welfare are research priorities, and we need more linked evidence that reflects real resource use and impact (life-cycle assessments and co-products) and the wider implications for animal welfare, environment and livelihoods.
- Small-scale pasture farmers need access to processing infrastructure, veterinary services, marketing and markets in order to succeed. Development projects, policy and fiscal measures should champion the wider benefits in terms of jobs, livelihoods and communities that smaller scale farmers can achieve.
- At an international level, policy and standards need to reflect the value of optimal models of humane sustainable agriculture in standards, major developments such as the forthcoming Global Agenda for Action (http://www.livestockdialogue.org) and climate policy implementation.

From WSPA International's perspective, this is the start of a journey to promote humane sustainable dairy farming internationally. We are keen to work proactively and constructively to communicate and promote the achievements of dairy farmers who deliver good welfare. It is hoped this paper will encourage growing positive dialogue on a humane, sustainable future for dairy in emerging economies.

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EMERGING DAIRY SECTOR CONFERENCE
IDF WORLD DAIRY SUMMIT 2012 – CAPE TOWN, SOUTH AFRICA – OCTOBER 2012

ABSTRACT

DAIRY: NUTRITIONAL VALUE FOR MONEY FOR SOUTH AFRICAN CONSUMERS

F. Wenhold, C. Leighton

The affordability of dairy is analyzed in terms of nutritional value for money of five selected dairy foods and twelve foods typically chosen by low-income urban consumers in South Africa. The findings show that dairy can supply the shortfall micronutrients, especially calcium, but also protein and vitamins B2 and B12, at a reasonable cost.

Keywords: Dairy, Diet, Micronutrients, Milk, Nutrients, RDA, Vitamins

THE BENEFITS OF ANIMAL WELFARE FOR FARMERS AND THE ENVIRONMENT IN EMERGING ECONOMIES

L. Lambert, M. Appleby, S. Parente

This paper describes how attention to animal welfare in terms of health, housing, hygiene and nutrition can bring profound benefits to dairy producers. Two case studies of farmers in Asia and Africa show how successful, resource-efficient dairying, knowledge-transfer practices, co-operative marketing and access to professional services can boost animal wellbeing and productivity.

Keywords: Animal welfare, Animal wellbeing, Dairy, Milk, Sustainable

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ANNEX 1

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"	Usually double quotes and not single quotes
? !	Half-space before and after question marks, and exclamation marks
±	Half-space before and after
microorganisms	Without a hyphen
Infra-red	With a hyphen
et al.	Not underlined nor italic
e.g., i.e.,...	Spelled out in English - for example, that is
litre	Not liter unless the author is American
ml, mg,...	Space between number and ml, mg,...
skimmilk	One word if adjective, two words if substantive
sulfuric, sulfite, sulfate	Not sulphuric, sulphite, sulphate (as agreed by IUPAC)
AOAC INTERNATIONAL	Not AOACI
programme	Not program unless a) author is American or b) computer program
milk and milk product	rather than "milk and dairy product" - Normally some latitude can be allowed in non scientific texts
-ize, -ization	Not -ise, -isation with a few exceptions
Decimal comma	in Standards (only) in both languages (as agreed by ISO)

No space between figure and % - i.e. 6%, etc.

Milkfat	One word
USA, UK, GB	No stops
Figure	To be written out in full
1000-9000	No comma
10 000, etc.	No comma, but space
hours	Ø h
second	Ø s
litre	Ø l

the Netherlands

Where two or more authors are involved with a text, both names are given on one line, followed by their affiliations, as footnotes

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