PROFESSIONAL PAPER

Kalahari truffle: An underprized delicacy

Tukuna Alve Hainghumbi[1], Werner Embashu[2], Komeine Kotokeni Mekondjo Nantanga[1]

[1]*Faculty of Agriculture, Engineering and Natural Sciences, University of Namibia, 340 Mandume Ndemufayo, Windhoek, Namibia (knantanga@unam.na)*
[2]*Centre for Research Services, University of Namibia, 340 Mandume Ndemufayo, Windhoek, Namibia*

Abstract
Mushrooms can be edible and are used as food and nutraceuticals. They are mostly collected from the wild and sold as is. Buyers wash and cook them before consumption. This piece assessed the prices of Kalahari truffles mostly at the largest open market where, when they are in season in Namibia, a high concentration of truffles sales occur. It intelligently argues for the creation of veld-food supply chains to improve rural development. The prices of truffles increased towards the end of the growing season. In Namibia and Botswana, the Kalahari truffles are sold in the informal markets at € 4.75 per kg in Namibia, which is significantly lower than € 1496.5 per kg in developed nations. The Kalahari truffles value should be unleashed to enhance the incomes of rural communities via the development of veld-food supply chains.

Key words: veld-food, *Kalaharituber pfeilli*, price, weight, rural development

Introduction

The livelihoods of most rural people in developing nations depend on subsistence farming, fishing, collection of veld and forest resources. In terms of foods, veld/forest products include edible wild fruits, melons, tubers, roots, nuts, insects, lerps, and mushrooms. In Namibia, edible mushrooms are used as food and a source of income. In developed nations, edible mushrooms are regarded as a delicacy with high nutritional and functional value (Valverde et al., 2015). They are also valued for their exceptional sensory attributes including unique aroma and flavour (Villares et al., 2012). Kalahari truffles and *Termitomyces schimperi* are commonly harvested for domestic consumption and/or selling in the informal markets in Namibia. This should be understood within the context of high economic inequality in Namibia, where the GINI coefficient is high at 0.56 as compared to that of 0.25 in the Scandinavian countries (Namibia Statistics Agency, 2018a). More (53.1%) people live in rural areas. About 28% of all households, mostly those in rural and informal shanty locations within the towns in Namibia are poor or severely poor based on their costs of basic needs compared to the poverty lines.

With little value-addition and manufacturing in Namibia, the unemployment rate is 33.4% (Namibia Statistics Agency, 2018b). It is suspected to be as high as 50% among the youths Truffles are fungi that form fruit bodies below the ground (hypogenous) (Danesh, 2015). They are therefore telluric and seasonal (Trappe et al., 2008). They are not only harvested for their culinary properties but for their nutritional value as well (Kagan-Zur and Roth-Bejerano, 2008; Shavit and Volk, 2007). Kalahari truffles (Figure 1) including *Kalaharituber pfeilli,* the common truffle found in Namibia are underprized as compared to other truffles in other parts of the world. For instance in Europe, the market price for truffles ranged from € 187.5 to € 2810.5 per kg (Álvarez-Lafuente et al., 2018), whereas in Namibia, they are harvested for household consumption and/or for selling in the informal market

where prices generally low. Participation of wild food resources collectors in veld-food supply chains has the potential to improve the development in rural communities. This could become true provided that the collected veld-food such as truffles can be afforded market opportunities at the formal national and international levels. Increased incomes can be returned to the collectors through improved product value through enhanced veld-food supply chains. Currently, there is little or no literature on the prices of truffles collected from the veld in Namibia. This study therefore investigated the price of Kalahari truffle in Namibia.

Figure 1. Washed fresh Kalahari truffles

Materials and methods

Typical at any given open market in Namibia, the manner of sale, display and pricing of the products often did not differ among the vendors. This was also the case at the studied open markets (Ondangwa and Omuthiya). To determine the prices of Kalahari truffle, about 15 vendors who were present at the Omuthiya market at the initial time of sampling were asked how much they were selling the truffle batches for. At the Ondangwa open market, there was only one vendor who had only one batch available. In all cases, a customer had the liberty to choose the batch or batches that they want to buy. Truffles were sold fresh in subjectively vendor-determined batches (groups of individual truffles, Figure 2). Vendors did not have weighing balances to weigh the truffles. Therefore, the truffles were sold per batch. Batches were therefore subjectively formed by the vendor. A batch in this study was considered as a sub-population of the purchased truffles.

A total of seven batches of fresh Kalahari desert truffles (*Kalaharituber pfeilli*) were purchased from different vendors at the informal market in Omuthiya and Ondangwa. The batches were chosen to represent those that have large but fewer number and those with small but large number of truffles. One batch was obtained from each of a total of eight vendors. Six batches (T_1, T_2, T_3, T_4, T_5, T_6 and T_7) of truffles were purchased during the peak of the growing season (mid May 2018) while batches T_6 and T_7 were purchased towards the end of growing season (around June). At the end of the growing season, there were only 2 vendors found at the Omuthiya open market. All the truffle batches were bought from different vendors at Omuthiya gwIipundi in Oshikoto region, except for batch T_5 which was bought from Ondangwa in Oshana region. The truffles in their respective batches were then brought in the same day to the Department of Food Science and Technology at the University of Namibia in Windhoek, Namibia. The number of truffles in each batch was counted. The weight of all individual truffle in the different batches was determined using an analytical

balance. Note that the vendors at the time of the study did not have an objective method to constitute a batch. They thus did not know the weight of the truffles in each batch or the weight of the batches.

Figure 2. Representative picture of the batches (11) of truffles sold at the open market during the 2018 growing season. These are batches on display for one vendor.

Results and discussion

In Namibia, truffles are sold at open markets (Figure 2) in vendor-determined batches. Table 1 shows the number of Kalahari truffles, weight and cost of Kalahari truffles sold in open market in Namibia.

Table 1: Prices, weights of Kalahari truffles sold in open markets (Ondangwa and Omuthiya) in Namibia in 2018. Exchange rate was based on the Euro to Namibian Dollar Exchange Rate History For 20 May 2018 (20/05/18) (exchangerates.org.uk).

Batch	Count	Total weight (g)	Average weight (g)	Median weight (g)	Minimum weight (g)	Maximum Weight (g)	Price (€ per batch)	Price (€ kg^{-1})
T_1	7	336.6	48.1	38.7	21.8	117.8	1.35	4.02
T_2	24	506.3	21.1	20.8	8.0	42.0	1.35	2.67
T_3	39	621.9	16.0	14.0	2.7	48.4	1.35	2.18
T_4	11	695.1	63.2	52.0	21.6	184.4	1.35	1.95
T_5	12	647.4	54.0	27.5	8.3	165.5	2.71	4.18
T_6	22	874.0	39.7	23.0	12.0	270.0	4.06	4.65
T_7	15	856.0	57.1	52.0	30.0	122.0	4.06	4.75

It was found that the different batches of truffles had different number of truffles. The number of truffles per batch ranged between 7 and 39 (Table 1). It is important to note that the price per batch is the actual amount that was paid to the vendors based on the vendors-determined pricing. The price/kg is the value that was calculated after the batches of truffles were taken to the laboratory and the weights of all truffles in each batch were measured. The batches with visibly small sized truffles tended to have more counts (e.g. T_3) whereas batches with visibly large sized truffles had fewer counts (e.g T_1). Upon converting the vendor-determined subjective prices to the price per kg, it became clear that batches that were priced the same had in fact different weights and thus the price per kg were different. Customers were therefore not getting the same truffle amount per euro. This means that some customers fetch more truffles per euro (e.g. T_4) while others get less per euro (T_1). This highlights the importance of objective methods of setting prices of truffles sold at the open markets in Namibia.

The prices of truffles followed the general trend of supply and demand. This is evidenced by the fact that the batches T_6 and T_7 that were bought towards the end of the growing season had relatively high prices of € 4.65-4.75 per kg, respectively (Euro to Namibian Dollar Exchange Rate History For 20 May 2018 (20/05/18) (exchangerates.org.uk)) per batch. Based on the prices, it is clear that the truffles in Europe are highly prized and expensive when compared to the Kalahari truffles sold in Namibia. For example, the price of truffle in developed nations can be as high as 1108.5 times than the market price of Kalahari truffles that were sold at the main open market in north-central regions of Namibia. This is based on the market price of truffles in Europe that has been reported to be € 22.1 to € 1496.5 per kg (Morte et al., 2012; Bonito et al., 2013; US Dollar to Euro Exchange Rate History For 20 May 2018 (20/05/18) (exchangerates.org.uk)) in comparison to the market prices of truffles in Namibia (€ 1.95 to € 4.75 per kg). The low prices of the Kalahari truffles in Namibia could be attributed to the general economic status of people living in the study area, which is mostly rural with an average annual consumption per capita of € 1140.90 (Namibia Statistics Agency, 2018a).

Kalahari truffles in rural communities in Namibia are harvested for use at household level and also for selling in the informal markets. Truffle collectors could earn more if they had better access to even low-level technology such as simple packaging equipment or refrigeration technology. Preservation and processing of Kalahari truffles into high value export products and marketing have the potential to penetrate the world market and contribute to the economic growth of countries where truffles currently are underutilised and not well researched. Improving the veld-food supply chains and accessing the international markets can yield increased income for the rural truffle collectors and other actors. This in turn can reduce poverty and lead to improved livelihoods and development of rural communities.

The production of Kalahari truffles is reported to be declining mostly in places where livestock is concentrated (Trappe et al., 2008). Some land practices such as ploughing may also pose a threat to the production of the Kalahari truffles. Studies geared towards sustainable harvesting and possibility of cultivation of the Kalahari truffles are essential to future exploitation of this nutritious food resource.

Conclusions

This piece reports for the first time the price per weight of Kalahari truffles sold at the open market in north-central Namibia. Based on the price, it is concluded that the Kalahari truffles in Namibia are underprized and are sold at significantly low prices (€ 1.35 per kg) when compared to truffles in Europe (€ 1496.5 per kg). It appeared that the pricing of Kalahari Desert truffle depends on the vendor's intuition as the prices were not consistent per count

or weight. Consumers are not guaranteed the same purchase value for their money. Development of a veld-food supply chain of the Kalahari truffles locally and internationally can improve the Namibian rural communities that collect the truffles. Improving the Kalahari truffles quality via value-addition processing, standardisation of pricing per weight and safe packaging, storage and distribution to access the high value market opportunities in developed nations can lead to the high return of income to the Kalahari truffles harvesting communities and thus increase their standard of living, create jobs, reduce unemployment and steps closer to the eradication of poverty in Namibia.

Acknowledgement
The results presented in this paper are an output from a research project that was partly funded by the National Commission for Research, Science and Technology in Namibia.

References

Álvarez-Lafuente A., Benito-Matías L. F., Peñuelas-Rubira J. L., Suz L. M. (2018). Multi-cropping edible truffles and sweet chestnuts: production of high-quality Castanea sativa seedlings inoculated with *Tuber aestivum*, its ecotype *T. uncinatum*, *T. brumale*, and *T. macrosporum*. Mycorrhiza. (28): 29-38.

Bonito G., Smith M. E., Nowak M., Healy R. A., Guevara G., Cázares E., Tedersoo L. (2013). Historical biogeography and diversification of truffles in the Tuberaceae and their newly identified southern hemisphere sister lineage. Public Library of Science One. Vol (8).

Kagan-Zur V., and Roth-Bejerano N. (2008). Desert truffles. Fungi. (1): 32-37.

Morte A., Andrino A., Honrubia M., Navarro-Ródenas A. (2012). Terfezia cultivation in arid and semiarid soils. In Edible ectomycorrhizal mushrooms. 241-263.

Namibia Statistics Agency. (2018a). Namibia household income and expenditure survey 2015/2016 report. Windhoek: Namibia Statistics Agency.

Namibia Statistics Agency. (2018b). The Namibia Labour Force Survey 2018 Report. Windhoek: Namibia Statistics Agency

Shavit E., and Volk, T. (2007). Terfezia and Tirmania, desert truffles (terfez, kama, p/faqa). Delicacies in the sand or manna from heaven. Zugriff. (14): 2010.

Trappe J. M., Claridge A. W., Arora D., Smi, W. A. (2008). Desert truffles of the African Kalahari: ecology, ethnomycology, and taxonomy. Economic botany. (62): 521.

Valverde M. E., Hernández-Pérez T., Paredes-López O. (2015). Edible mushrooms: improving human health and promoting quality life. International journal of microbiology. 2015: 1-4.

Villares A., Mateo-Vivaracho L., Guillamón E. (2012). Structural features and healthy properties of polysaccharides occurring in mushrooms. Agriculture. (2): 452-471.