

INVESTIGATION OF BEEKEEPERS' PERCEPTIONS ON UTILIZATION OF BEE HONEY PRODUCED IN SOUTH-WEST NIGERIA

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Abstract

This research investigated beekeepers' perceptions on utilization of bee honey produced in south-west Nigeria. Multistage sampling technique was used: Oyo, Osun and Ogun states were purposively selected as states within the desired agro-ecological zones. A Local Government Area was also purposively selected to access beekeepers, from each Senatorial District in the states. Questionnaires were administered opportunistically to 135 associated beekeepers, 15 beekeepers from each of the 9 locations and 113 questionnaires were retrieved. Descriptive statistical analysis was used to analyse data obtained. Mean value of beekeepers' perceptions on utilization of bee honey for Oyo state was the highest (3.5); then Ogun state 3.3; and Osun state 3.08. Analysis of variance within the beekeepers' perceptions on utilization of bee honey shows a significant difference in the study ($p < 0.05$). Adjusted R^2 (0.036) between each of either age or occupation and perceptions of beekeepers on the utilization of bee honey implies that age or occupation of beekeepers has only 3.6% influence on individual's methods of using bee honey. Awareness should be created on harmonised beekeepers' perceptions on bee honey usage for Nigerian populace to benefit maximally from the enlightenment on uses of bee honey either for food, economic or medicinal purposes.

Keywords: Socio-economic factors, Perceptions, Beekeepers, Bee honey, Utilization

Introduction

In Nigeria, the apiary business has helped many people and those practicing bee farming have attested to its profitable nature (Yahaya, 2020). Bee farming is one of the agricultural enterprises that could be established with either less or more capital depending on the intended size of the apiary. Honey use and production have a long and varied history as an ancient activity (Grimaldi and Engel, 2005; Engel and Archibald, 2003). Today, honey is a substance of wealth for many nations in the international market through export and sales of other honey products (USDA, 2020). The demand for honey in Nigeria is continuously increasing because of the nutritional and medicinal benefits. This is supported by the huge botanical endowment and the natural biodiversity, which makes the production very lucrative. The price of honey ranges from \$1.90 – 2.10 a pound for a barrel (USDA, 2020) in the international market depending on type, quality or location. While locally in Nigeria price ranges from ₦3,000 – ₦5,000 a litre. Bee honey is a delicious viscous sweetener made naturally by bees for their own nourishment from the nectar or secretion of flowering plants (Ndife *et al.*, 2014). Honey has a long history of human consumption as a natural food source and is also used as ingredients in various food preparations, in both alcoholic and non-alcoholic beverages as sweeteners and in confectioneries as flavouring agents (Adebisi *et al.*, 2004; Durrani *et al.*, 2011; Eleazu *et al.*, 2012). Thus, honey has been used since ancient times not only as food but as a medicine and in cosmetics.

Honey has been credited for many biological and therapeutic purposes such as: treatment of colds, skin wounds and various gastrointestinal diseases. This beneficial role is attributed to both the antimicrobial and anti-inflammatory properties of honey that arise from the low acid nature, high sugar, mainly of glucose and fructose components (Amril and Ladjama, 2013). Honey is used for cough, asthma, and hay fever. It is also used for diarrhoea and stomach ulcers caused by infection with *Helicobacter pylori* (*H. pylori*) bacteria. Honey is also used as a source of carbohydrate during vigorous exercise. Some people apply honey directly to the skin for wound healing, burns, sunburn, cataracts, and diabetic foot ulcers. Raw honey contains an enzyme called glucose oxidase which combines with water to produce hydrogen peroxide, a mild antiseptic (Amiot *et al.*, 1989). In addition, several enzymes (invertase, glucose oxidase, catalase, phosphatases) found in honey also help in the healing process (Khalil *et al.*, 2010). Honey also contains phytochemicals such as flavonoids and other polyphenols that makes it a potential functional ingredient and as antibacterial agents (Ramanauskiene *et al.*, 2012; Gulfranz *et al.*, 2011; Khalil *et al.*, 2010). Phytochemicals are one broad category of nutraceuticals found in plants that are actively being investigated by scientists for their health-promoting potential. Honey has a phytochemical profile which includes polyphenols that can act as antioxidants. Antioxidants perform the role of eliminating free radicals, which are reactive compounds in the body. Free radicals are created through the normal process of metabolism, these free radicals are the genesis of many serious diseases (Gheldof *et al.*, 2002).

Although the food ranking system did not qualify honey as a dense source of traditional nutrients apart from the sugar content, it did emerge as a veritable source of vitamin B₂, vitamin B₆, iron and manganese (Vanhanen *et al.*, 2011; Alvarez-Suarez *et al.*, 2010). Honey has been credited for many biological and therapeutic purposes such as: treatment of colds, skin wounds and various gastrointestinal diseases (Amril and Ladjama, 2013). Due to its high carbohydrate content, honey is an excellent energy source and possesses some functional effects. It is especially valuable for children and sportsmen. In addition to water, honey contains very small amounts of protein, vitamins, minerals, trace elements, enzymes and polyphenols, including flavonoids from pollen, which can help identify the honey origin (Bogdanov *et al.*, 2008). Honey is generally safe when taken in typical food amounts (Hughes *et al.*, 2008; Klimov *et al.*, 2007). Potential adverse effects or interactions occur with excessive consumption, existing disease conditions or drugs (Klimov *et al.*, 2007). Bees produce some substances used as dietary supplements with possible health benefits (Wilson, 2004; Watanabe, 1994). These substances include propolis (Wilson, 2004), pollen (Watanabe, 1994) and royal jelly (Wilson, 1971), though all of these can also cause allergic reactions.

Honey is a complex mixture of more than seventy different compounds present in varying proportions and many of these are phytochemicals such as polyphenols and flavonoids and they have antioxidant properties (Kesić *et al.*, 2015). Antioxidants of both endogenous and exogenous sources have the ability to donate electrons and are effective in mitigating the damaging effects of reactive oxygen species (ROS) on cellular components causing oxidative stress. Some phytochemicals can reduce parasite loads in humans and other animals. Phytochemicals were generally well-tolerated at levels documented in nectar, honey, and pollen, although clove oil and thymol increased mortality in bees at high doses (Evans, 2006). For Nigerians to have economic breakthrough and improved livelihood in beekeeping and utilization of beekeeping products, it is pertinent that research be conducted on perceptions of beekeepers on utilization processes to discover areas of improved utilization of bee honey for the benefit of all.

Methodology

The Study Area: South western zone of Nigeria was used to conduct the study. It comprised 6 states namely, Oyo, Ekiti, Osun, Ondo, Lagos and Ogun. Oyo, Osun and Ogun states were

purposely chosen as states that falls within the desired agro-ecological zones in south-west Nigeria. The weather conditions vary between the rainy season (March - October) and the dry season (November - February); with the dry season accompanied by Harmattan dust, cold dry wind from the northern desert blown into the southern regions around this time. Longitude 30° and 7°E and Latitude 4° and 9°N (Oni and Odekunle, 2016). Its rainfall is 2000-3000mm, and temperature is over 17°C (Uzoh, 2021).

Sampling Technique: A multistage sampling technique was used: states located within the agro-ecological zones (Rain Forest in Ogun state, Southern guinea savanna in Osun state and Northern guinea savanna in Oyo state) of interest in south-west Nigeria were purposively select. Three Local Government Areas were also purposively selected, one from each Senatorial District in each state for even sampling of locations. A total of 135 questionnaires were administered. Opportunistic approach was used to choose 45 beekeepers from beekeepers Association in each state. About 15 beekeepers from each Local Government Area chosen. Questionnaires were administered to obtain information on socio-economic data and bee honey utilization.

Data collection: A total of 113 questionnaires were retrieved out of 135 administered. These supplied data on socioeconomic and different usage of bee honey by beekeepers.

Data Analysis: Data obtained from questionnaires retrieved were subjected to descriptive statistical analysis (frequencies and percentages, Tables, charts, Figure) and inferential statistics (ANOVA, Duncan Multiple Range Test to separate the means, correlation, and regression) using SPSS.

Results

State of origin, age, gender, marital status, educational background, ethnic group, religion, occupation and monthly income of beekeepers in Oyo, Osun and Ogun States (Table 1), revealed that, 38 (representing 33.6%) of the respondents were from Oyo state whereas, 41 (Osun state) and 34 from Ogun state. A total of 83 out of the 113 respondents were males compared to 28 females. There were more of tertiary education certificate holders (70), followed by secondary (29) and primary (12) education certificate holders. Yoruba ethnic group was highest (108 representing 95.6%) compared to Hausa (3 representing 2.7%) and Igbo (2 representing 1.8%) respectively. Out of the total respondents, 57 (50.4%) were Islam, 55 (48.7%) were Christians and 1 (0.9%) was a traditionalist. A total of 52 (46.0%) of respondents are farmers, 23 (20.4%) are civil servant, students 19 (16.8%), while retirees are 9 (8.0%) and Artisan and trader are both 5 each (4.4%). Majority (30 representing 26.5%) of the respondents receive between 40,000-59,000 naira monthly, followed by 15 (13.3%) for those receiving 100,000 naira and above. The least among the group (1 representing 0.9%) are those receiving between 80,000 – 99,000 naira only and less than 20,000 naira only.

Table 1: Methods of Consuming and Medicinal Uses of Honey Based On Beekeepers' Knowledge on Utilization of Honey in Oyo, Osun and Ogun States.

Question	Response (%)	Oyo	Osun	Ogun	Total
How honey is used as food (Taken alone)	Taken alone	31.6 (12)	12.2 (5)	26.5 (9)	23.0 (26)
	Not taken alone	68.4 (26)	87.8 (36)	73.5 (25)	77.0 (87)
	Total	100.0 (38)	100.0 (41)	100.0 (34)	100.0 (113)
How honey is used as food (Taken with water)	Taken with water	28.9 (11)	19.5 (8)	64.7 (22)	36.3 (41)
	Not taken with water	71.1 (27)	80.5 (33)	35.3 (12)	63.7 (72)
	Total	100.0 (38)	100.0 (41)	100.0 (34)	100.0 (113)
How honey is used as food (Taken with pap)	Taken with pap	39.5 (15)	70.7 (29)	32.4 (11)	48.7 (55)
	Not taken with pap	60.5 (23)	29.3 (12)	67.6 (23)	51.3 (58)
	Total	100.0 (38)	100.0 (41)	100.0 (34)	100.0 (113)
How honey is used as food (Taken with bread)	Taken with bread	15.8 (6)	7.3 (3)	29.4 (10)	16.8 (19)
	Not taken with bread	84.2 (32)	92.7 (38)	70.6 (24)	83.2 (94)
	Total	100.0 (38)	100.0 (41)	100.0 (34)	100.0 (113)
How honey is used as food (Taken with tea)	Taken with tea	36.8 (14)	48.8 (20)	20.6 (7)	36.3 (41)
	Not taken with tea	63.2 (24)	51.2 (21)	79.4 (27)	63.7 (72)
	Total	100.0 (38)	100.0 (41)	100.0 (34)	100.0 (113)
How is honey used as medicine	Alone	30.3 (10)	7.3 (3)	11.8 (4)	15.7 (17)
	With other items	63.6 (21)	80.5 (33)	70.6 (24)	72.2 (78)
	Both	6.1 (2)	12.2 (5)	17.6 (6)	12.0 (13)
	Total	100.0 (33)	100.0 (41)	100.0 (34)	100.0 (108)
What it could also be used for (Revive the Dead)	Yes	8.8 (3)	0.0 (0)	2.9 (1)	3.7 (4)
	No	91.2 (31)	100.0 (41)	97.1 (33)	96.3 (105)
	Total	100.0 (34)	100.0 (41)	100.0 (34)	100.0 (109)
What it could also be used for (Treat Barrenness)	Yes	14.7 (5)	2.4 (1)	17.6 (6)	11.0 (12)
	No	85.3 (29)	97.6 (40)	82.4 (28)	89.0 (97)
	Total	100.0 (34)	100.0 (41)	100.0 (34)	100.0 (109)
What it could also be used for (Treat Impotency)	Yes	41.2 (14)	22.0 (9)	61.8 (21)	40.4 (44)
	No	58.8 (20)	78.0 (32)	38.2 (13)	59.6 (65)
	Total	100.0 (34)	100.0 (41)	100.0 (34)	100.0 (109)
What it could also be used for (Cancer)	Yes	47.1 (16)	82.9 (34)	29.4 (10)	55.0 (60)
	No	52.9 (18)	17.1 (7)	70.6 (24)	45.0 (49)
	Total	100.0 (34)	100.0 (41)	100.0 (34)	100.0 (109)

Source: Field survey, 2023

Methods of consuming and medicinal uses of honey based on beekeepers' knowledge on utilization of honey in Oyo, Osun and Ogun States (Table 1), revealed that majority 36, 25 and 26 (i.e. 87.8%, 73.5% and 68.4%) of beekeepers in Osun, Ogun and Oyo states respectively do not take honey alone but consume it with other food items. However, some beekeepers 12 (31.6%), 9 (26.5%) and 5 (12.2%) in Oyo, Ogun and Osun states respectively usually take their honey alone whenever it is consumed. Majority 23 and 23 (representing 67.6% and 60.5%) of the beekeepers in Ogun and Oyo states respectively do not eat honey with pap; while majority 29 (70.7%) of the beekeepers in Osun state eat honey with pap. Generally, the majority 38, 32 and 24 (i.e. 92.7%, 84.2% and 70.6%) of the beekeepers in Osun, Oyo and Ogun states respectively do not take honey with bread; while a lesser percentage (29.4%, 15.8% and 7.3%) of beekeepers in Ogun, Oyo and Osun uses honey to consume their bread. Majority 27, 24 and 21 (i.e. 79.4%, 63.2% and 51.2%) of beekeepers in Ogun, Oyo and Osun do not take honey with tea.

Also, beekeepers used honey as medicine, as the majority 33, 24 and 21 (i.e. 80.5%, 70.6% and 63.6%) of beekeepers in Osun, Ogun and Oyo states respectively uses honey mixed with other item(s) as medicine. Others 10, 4 and 3 (i.e. 30.3%, 11.8% and 7.3%) in Oyo, Ogun and Osun states respectively uses honey alone as medicine; while 6 (17.6%), 5 (12.2%) and 2 (6.1%) of beekeepers in Ogun, Osun and Oyo states respectively uses both honey alone and at times depending on the type of ailments uses honey with other item(s) as medicine. Generally, majority 41, 33 and 31 (i.e. 100.0%, 97.1% and 91.2%) of beekeepers in Osun, Ogun and Oyo states respectively do not believe and disagreed with the fact that honey could be used to revive the dead. Alternatively, an integral part of the beekeepers [3 (8.8%) and 1 (2.9%)] in Oyo and Ogun states respectively hold the opinion that honey could be used to revive the dead.

Some beekeepers 6, 5 and 1 (i.e. 17.6%, 14.7% and 2.4%) in Ogun, Oyo and Osun states respectively accepted that honey could be used to treat barrenness; while the majority 40, 29 and 28 (i.e. 97.6%, 85.3% and 82.4%) of beekeepers in Osun, Oyo and Ogun states respectively said no, honey cannot cure barrenness. Majority 32 and 20 (i.e. 78.0%, and 58.8%) of beekeepers in Osun and Oyo states respectively do not believe that honey could treat impotency; while other beekeepers 21, 14 and 9 (i.e. 61.8%, 41.2% and 22.0%) from Ogun, Oyo and Osun states respectively agreed that honey could be used to treat impotency in men. Majority 24 and 18 (i.e. 70.6% and 52.9%) of beekeepers in Ogun and Oyo states respectively disagreed that honey could be used to treat cancer. On the other hand, majority (82.9%) of beekeepers in Osun states agreed that honey could be effectively used to treat cancer.

The mean value of perception of beekeepers on utilization of bee honey for Oyo state in the Northern guinea savanna agro-ecological zone is the highest (3.5) (Figure 1); followed by Ogun state located in the rain forest agro-ecological zone with mean value of perception of beekeepers on utilization of bee honey of 3.3; while Osun state situated in Southern guinea savanna agro-ecological zone has a mean value of perception of beekeepers on utilization of bee honey of 3.08. The level of variance within the beekeepers' perceptions on utilization of bee honey subjected to ANOVA table (Table 2), shows that there was a significant difference on the perception of beekeepers on utilization of bee honey in the study ($p < 0.05$). Conclusively, Duncan follow up test conducted ranked the mean values of perceptions of beekeepers on utilization of bee honey (Table 3).

Table 2: ANOVA of Perception of Beekeepers on Utilization of Bee Honey

	Sum of Squares	Degree of freedom	Mean Square	F	Sig.
Between states	3.927	2	1.964	5.022	0.008
Within states	43.009	110	0.391		
Total	46.936	112			

Table 3: Duncan Separate Mean Values of Beekeepers' Perceptions on Utilization of Bee Honey

State	N	Mean
Osun	41	3.0894 ^a
Ogun	34	3.3824 ^b
Oyo	38	3.5263 ^b
Sig.		0.321

In table 4, Pearson correlation between gender and age; and ethnic group and age are significant ($p < 0.05$) (2-tailed). Whereas, Pearson correlation between marital status and age; religion and Local Government Area; religion and age; occupation and gender; occupation and marital status

are highly significant ($p < 0.01$) (2-tailed). Regression equations on perceptions of beekeepers in Oyo, Osun and Ogun States on utilization of bee honey (Figure 5), reveals that both the adjusted R^2 (0.036) between each of either age or occupation and perceptions of beekeepers on the utilization of bee honey shows that age or occupation of beekeepers has only 3.6% influence on individual's methods of using bee honey.

Table 4: Correlation between the Socio-Economic Factors of Beekeepers.

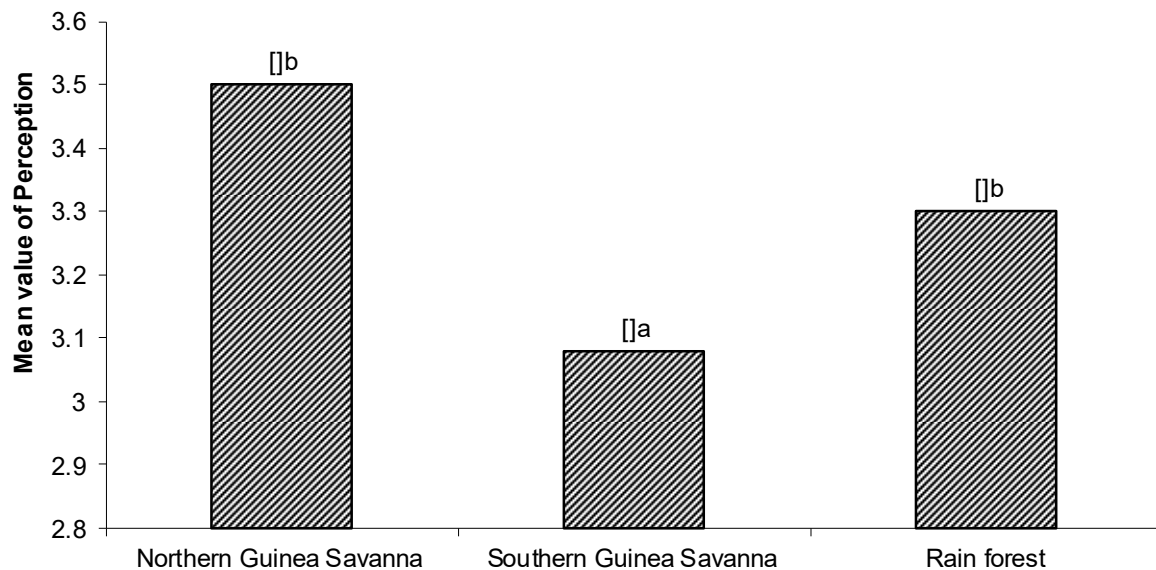
Socio-economic factor		LGA	Age	Gender	Marital Status	Educational Background	Years spent in the Community	Ethnic Group	Religion	Occupation	Total Monthly Income
LGA	Pearson Correlation	1									
Age	Pearson Correlation	.151	1								
	Sig. (2-tailed)	.126									
Gender	Pearson Correlation	.004	-.190*	1							
	Sig. (2-tailed)	.970	.043								
Marital Status	Pearson Correlation	-.102	.549**	-.006	1						
	Sig. (2-tailed)	.302	.000	.950							
Educational Background	Pearson Correlation	.025	-.069	.089	-.126	1					
	Sig. (2-tailed)	.804	.470	.350	.185						
Years spent in the Community	Pearson Correlation	-.126	.100	-.125	.137	.076	1				
	Sig. (2-tailed)	.204	.291	.188	.147	.426					
Ethnic Group	Pearson Correlation	.093	-.205*	.120	-.201*	.089	-.146	1			
	Sig. (2-tailed)	.350	.029	.207	.033	.350	.123				
Religion	Pearson Correlation	-.298**	-.299**	.115	-.004	.064	.159	.131	1		
	Sig. (2-tailed)	.002	.001	.223	.969	.501	.093	.166			
Occupation	Pearson Correlation	.117	-.142	.263**	-.315**	-.026	-.063	.074	.162	1	
	Sig. (2-tailed)	.238	.135	.005	.001	.783	.509	.439	.087		
Total Monthly Income	Pearson Correlation	-.046	-.070	-.167	-.047	.170	.170	-.081	-0.062	.038	1
	Sig. (2-tailed)	0.708	0.571	0.173	0.702	0.166	0.166	0.513	0.618	0.759	

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is highly significant at the 0.01 level (2-tailed).

Table 5: Regression Equations on Perceptions of Beekeepers in Oyo, Osun and Ogun States on Utilization of Bee Honey

S/N	EQUATION	SIG.	RMSE	R	R ²
Perception of beekeepers on the utilization of bee honey					
1	3.701-0.010(Age)	0.025	0.6356	0.045	0.036
2	3.643-0.103(Occupation)	0.024	0.6355	0.045	0.036

Source: Field survey, 2023.



*Significant ($p < 0.05$)

Figure 1: Perception of beekeepers on utilization of bee honey

Discussion

It is generally observed that different people have different ways of consuming bee honey. From the present investigation, the general majority admitted that they do not take bee honey alone. This is in agreement with Bobvos (2020) who reported that people do eat bee honey with cereal, bread and butter, salad, cakes, pancake and roasted nut. Also, the general majority disagreed that they do not take bee honey with water; even though majority of the respondents in Ogun state agreed that they do take bee honey with water. Similarly, the general majority do not take bee honey with pap; although majority of the respondents in Osun state admitted that they do take bee honey with pap. It was observed that the general majority of the respondents do not take bee honey with bread. This is contrary to the findings of Bobvos (2020) who included bread as what bee honey is being eaten with. It may as well be due to the inability of the beekeepers to afford the cost of bread. Likewise, the general majority of the respondents do not take bee honey with tea. It is common knowledge that pap is by far cheaper than ingredients of tea; so many beekeepers would prefer to subsist on eating their bee honey with pap than tea due to cost implications.

The honey produced by beekeepers are used in several ways depending on their individual knowledge and exposition. Apart from using bee honey for food, it is also used as medicine. The general majority of the respondents used bee honey in combination with other items to treat various ailments. Though some use bee honey alone for particular ailment and some of them use both bee honey alone and in some other instances in combination with other things depending on the type of ailment. Almost all of the respondents disagreed that bee honey can be used to revive the dead. The general majority of beekeepers do not accept that bee honey could be used to cure barrenness. However, this is contrary to the report that, one of the traditional methods used to facilitate pregnancy by most spouses is eating a mixture of honey (Çiftçiler, 2019). While the general majority of respondents disagreed that bee honey can be used to cure impotency; the majority in Ogun state agreed that impotency could be treated with bee honey.

Furthermore, even though the general majority accepted that bee honey could be used to cure cancer; the majority of respondents in Ogun and Oyo states rejected the potential of bee honey curing cancer. In agreement with the general majority, Main (2022) had earlier stated that people in the tropics use several types of stingless bee honeys and wax from their hives to treat upper respiratory infections, skin conditions, gastrointestinal problems, and even to treat diabetes and cancer. [Macias-Macias et al. \(2021\)](#) reviewing various researches, reported that hive products contribute positively to the maintenance of good health, well-being and amelioration of chronic diseases. Bee venom had been affirmed to contain many active components namely melittin, mast cell degranulating peptide, apamin, enzymes (phospholipase A2, hyaluronidase) and amino acids (Wehbe, *et al.*, 2019). Melittin (the major substance that produces pain in bee venom) accounts for 40–60% of bee venom composition (Chen, *et al.*, 2016). Bee venom and melittin have been confirmed to be effective in ovarian cancer, prostate cancer, and human malignant hepatocellular carcinoma (Badawi, 2021; Moga, *et al.*, 2018; Li, *et al.*, 2006).

The perception of beekeepers on utilization of bee honey across Oyo, Osun and Ogun states reflected that Oyo state beekeepers in the northern guinea savanna agro-ecological zone has the highest mean value of perception which confirmed that they have a more divergent view about their methods of utilization of bee honey. Whereas, Osun state in the southern guinea savanna agro-ecological zone have the least mean value of perception, which affirmed that they have a more convergent view about their methods of utilization of bee honey. The mean values of perception of the respondents across Oyo, Osun and Ogun states was confirmed to be significant and Duncan multiple range test conducted ranked Oyo and Ogun states' beekeepers as having closely related and most divergent perceptions about their methods of utilization of bee honey; while Osun state beekeepers has the least divergence of perceptions about their methods of utilization of bee honey.

The correlation between socioeconomic factors confirmed that some factors are significantly correlated; while others are highly significantly correlated. For instance, gender and age with ethnic group and age are both significantly correlated; while marital status and age, religion and local government area, religion and age, occupation and gender with occupation and marital status are all highly significantly correlated. The regression equations established the various level of influences that beekeepers' view has on the methods of utilization of bee honey in Oyo, Osun and Ogun states. The socioeconomic factors that are highly significant are both age and occupation which has equal influences on beekeepers' methods of bee honey usage. In conclusion, beekeepers' perceptions should be harmonised so that optimum usage of bee honey could be achieved. Also, awareness should be created in general, on different ways of using bee honey so that the Nigerian populace could benefit maximally from the use of bee honey either as food, for economic or medicinal purposes.

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