Original Article

Protective Role of Nigerian Honey on Sperm indices and Testis in Sucrose-Fed Rats

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Abstract

Objective: This study aimed at investigating the effect of high sucrose diet on male reproductive function and if Nigerian honey could exert a protective role. ***Methods:*** Twenty-four (24) rats were randomly divided into four equal groups of six animals and given water (control); honey (H); high sucrose solution (30%w/v) (HSS); and both high sucrose solution (30%w/v) and honey (HSS+H). Each rat on honey received a daily dose of 10ml honey/kg/5ml of distilled water. Food intake, body weight, organ weight, fasting blood glucose, LH, FSH, testosterone and sperm functions were assessed. ***Results:*** This revealed that sperm motility ($p<0.05$) and count increased in the HSS+ H and H- fed rats compared with HSS fed and control rats. Head and tail abnormalities sperm were also significantly reduced in the H fed rats ($p<0.05$).MDA level in the liver and not in the testes was significantly increased in the HSS fed rats compared with control while SOD activity was significantly increased in HSS+H rats compared with the HSS fed rats. ***Conclusion:*** The results indicate that sucrose feeding impact negatively on sperm function while Nigerian honey supplementation confers protective function on male reproduction.

Key words: Nigerian honey, sucrose, sperm indices, antioxidants,

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Introduction:

The available information on the effect of high sugar on male reproductive function is inadequate, though consumption of sweetened foods is not uncommon in many geographical areas of the World[1, 2].

As a reflection of global changes in dietary behavior, the prevalence of unhealthy diets characterized by high intake of food rich in fats and sugar has increased in women and men within the reproductive age range[3]. Indeed, lifestyle factors arising from unhealthy dietary habit exert a profound influence on reproductive function[4]. A number of studies have shown that various physiologic processes which include reproductive function can be affected by dietary manipulation. For instance, a high fat diet has been shown to impact negatively on both male and female reproductive function[5,6].

Meanwhile, the possibility of a high sugar diet affecting reproductive function has not been verified experimentally to the best of our knowledge although consumption of a high-sugar diet has been associated with the development of obesity, insulin resistance, diabetes, dyslipidemia, fatty liver and high blood pressure[7].

For a long time, honey has been the only available sweetener until its replacement by industrial sugar after 1800[8]. Honey, a natural mixture of fructose, glucose, and more complex sugars[9] is not associated with the same metabolic effect as sucrose, thus its nutritional benefits[10, 11]. The physiological importance of honey includes its antioxidant, anti-inflammatory, antibacterial and antitumor activity among others[12, 13, 14, 15]. As far as reproduction is concerned, honey from different parts of the world has increased

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the sperm count in rats and monkeys and increased vaginal wall epithelium and muscle thickness, without showing any effect on circulating gonadotropins or testosterone[16]. Honey has also been reported to enhance spermatogenesis in rats if given at the appropriate dose[17] and to reduce the toxic effects of cigarette smoke on spermatogenesis[18].

In lay press, sucrose has been assumed to have negative implications on the male reproduction. With this background, this study attempts to investigate whether high sucrose intake will impact negatively on the male reproductive function and if Nigerian honey could exert a protective role.

Materials and Methods:

Honey Sample

Honey was obtained from a reliable supplier in Oyo State who freshly collected honey from sealed honeycombs, and the honey was certified pure[14]. Each rat on honey received a daily dose of 10ml honey/kg/5ml of distilled water[19] by oral gavage.

Animals

Male Sprague-Dawley rats weighing 120-150g were obtained from the Laboratory Animal facility of the College of Medicine of the University of Lagos. Animals were housed in plastic cages with *ad libitum* access to commercial rodent pellet diet (Livestock Feed, Lagos, Nigeria). The light cycle was maintained at 12 h of dark, followed by 12 h of light. The room temperature was maintained at 24±2 °C and humidity of 50% - 64%. The rats were allowed to acclimatize for a period of two weeks before the commencement of the experiment. All animal handling and experimental protocols adopted in this study complied with the international principles for laboratory animals as obtained in the Helsinki's Declaration.

Study Design

Twenty-four (24) rats were randomly divided into four groups of six animals each. The groups are as follows:

Control: was administered water;

H- was administered honey once daily by oral gavage and treatment lasted for 4 weeks ;

HSS- had free access to high sucrose solution (HSS) (30 % w/v) as drinking water according to the method of [20] with slight modification and treatment lasted for 4 weeks;

HSS+H- had free access to high sucrose solution (HSS) (30 % w/v) as drinking water as well as administration of honey (H) once daily by oral gavage and treatment lasted simultaneously for 4 consecutive weeks.

Determination of food intake, body and organ weights

Food intake was measured at 0800hrs daily. Body weight was determined once a week using a digital weighing scale. On the last day of administration, the reproductive organs; testis, caudal epididymis, seminal vesicle and prostate gland were weighed.

Blood glucose measurement

The experimental rats were fasted overnight before blood samples were collected via tail tipping for blood glucose measurement at the 4th week of treatment. The glucose levels were measured using a blood glucose monitoring system (Accu-Chek Glucometer, Roche, Germany).

Sperm Analysis

The testes from each rat were carefully exposed and one of them was removed together with its epididymis. The epididymis was separated and the epididymis fluid was collected while the progressive sperm motility, sperm count and sperm viability was determined[21].

Hormonal Assay

Testosterone, Luteinizing hormone (LH) and Follicle-Stimulating Hormone (FSH) in rat serum were measured by enzyme immunoassays using commercially available kits form Endocrine Technologies (USA), Uscnlife (China) and Biocodehycel (Belgium), respectively. Samples were run in the same assay to avoid inter-assay variations.

Lipid peroxidation level

As a marker of lipid peroxidation, the level of malondialdehyde (MDA) in the liver and testes was measured by the method of [22] as thiobarbituric acid reactive substances (TBARS). The development of a pink complex with absorption maximum at 535nm is taken as an index of lipid peroxidation.

Antioxidant activities

Oxidative analyses of the liver and testes were carried out using previously described standard methods. The reduced glutathione (GSH) was determined using the method described by Van Dooran[23]. The GSH determination method is based on the reaction

of Ellman's reagent 5,5' dithiobis (2-nitrobenzoic acid) DNTB) with the thiol group of GSH at pH 8.0 to produce 5-thiol-2-nitrobenzoate which is yellow at 412nm. Activity of the superoxide dismutase (SOD) was also determined according to the method described bySun and Zigman[24]. The reaction was carried out in 0.05m sodium carbonate buffer pH 10.3 and was initiated by the addition of epinephrine in 0.005N HCl. Catalase (CAT) activity was determined by measuring the exponential disappearance of H_2O_2 at 240nm and expressed in units/mg of protein as described byAebi[25]. Absorbance was recorded using Shimadzu recording spectrophotometer (UV 160) in all measurements.

Statistical Analysis

Data are expressed as mean ± standard error of mean (SEM) and analysed using the ANOVA followed by SNK post-hoc test. $P < 0.05$ was accepted as significant. All the analyses were carried out using the GraphPad Instat Version 3.05 for Window Vista, GraphPad Software, San Diego California, USA.

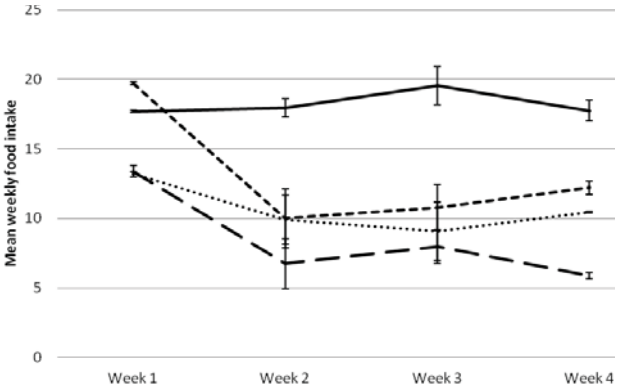

Figure I: Food intake of rats following administration of treatment for four weeks

Body weight

The body weight was measured and recorded weekly as shown in Table I. The H-fed rats had a significant increase (P<0.05) in body weight at week 1, 2 and 4 of treatment when compared with the control and HSS group as indicated.

Table I: Weekly body weight of the experimental groups

	CONTROL	HSS	HSS +H	H
WEEK 1	97.0 ± 5.3	107.6 ± 2.5	119.8 ± 9.6	127.6 ± 7.9 *
WEEK 2	117.4 ± 7.9	114.6 ± 4.2	126.0 ± 15.5	146.0 ± 9.4 * #
WEEK 3	119.8 ± 10.4	130.4 ± 6.5	154.7 ± 15.3	146.0 ± 12.2
WEEK 4	137.3 ± 12.3	133.2 ± 9.2	159.7 ± 17.9	164.0 ± 12.3 * #

Results:

Food Intake

The food intake of all rats measured and recorded from week 1 to 4 was shown in Figure 1. At the first week of study, HSS fed rats had reduced food intake (P<0.05) compared with control. Meanwhile, the H fed rats had a significant increase in food intake compared with the other experimental groups. The food intake in the HSS fed rats at week 2 was also significantly reduced compared with control, while H fed rats maintained an increase in food intake when compared with HSS and HSS+H fed rats. However, at week 3, both the HSS and the H fed rats had a significant reduction in food intake compared with control. At week 4, the HSS fed rat still had a significant decrease in food intake when compared with control, but this was however significantly lower (P<0.05) than the HSS+H fed rats. The food intake was reduced (P<0.05) in the H fed rats compared with control, nevertheless, the food intake was significantly higher than that of the HSS and HSS+H fed rats.

*Values are Mean±SEM; n=5. *-compared with control; # -compared with sucrose P < 0.05, compared to control .HSS- high sucrose solution, HSS+H- high sucrose solution+ honey, H- honey*

Fasting blood glucose

Table II shows the fasting blood glucose of the experimental rats taken at the end of the 4-week treatment. Sucrose and honey consumption did not result in any significant change in the blood glucose of the experimental rats for all comparison.

Table II: Fasting blood glucose (FBG) of the experimental rats

	CONTROL	HSS	HSS+H	H
Fasting Blood Glucose (mg/dl)	112.5 ± 2.5	104.7 ± 6.5	120 ± 15.0	109.7 ± 8.5

Values are Mean±SEM; n=5. P > 0.05, compared to control .HSS- high sucrose solution, HSS+H- high sucrose solution+ honey, H- honey

Reproductive Organ weights

Table III shows the weight of the reproductive organs recorded at the end of the experiment. The weight of the testes and seminal vesicle was significantly increased (P<0.05) in HSS+H and H- fed rats compared with HSS fed rats. The weight of the epi-

didymis was significantly increased in the H-fed rats compared with HSS fed rats.

Table III: Reproductive organ weights (g) of rats following administration of treatments for four weeks

	CONTROL	HSS	HSS+H	H
Fasting Blood Glucose (mg/dl)	112.5 ± 2.5	104.7 ± 6.5	120 ± 15.0	109.7 ± 8.5

Values are Mean±SEM; n=5. # P < 0.05, compared to HSS .HSS- high sucrose solution, HSS+H- high sucrose solution+ honey, H- honey

Sperm indices

Epididymis sperm count and motility were significantly reduced (P<0.05) in the HSS fed rats compared with control, while, the sperm count and motility were significantly increased (P<0.05) in the H fed rats and HSS+H fed compared with the HSS rats (Table IV). The Epididymis volume was not significantly different across treatment groups.

The most common abnormalities encountered during the morphological examination of the sperms was the 'curved tail' and 'curved mid-piece' in the rats that received the HSS treatment. The H group however showed fewer occurrences of the morphological aberration as recorded in Table V.

Table IV: Sperm indices of rats following administration of treatments for four weeks

	CONTROL	HSS	HSS+H	H
Motility (%)	86.30 ± 5.54	68.00 ± 6.63 *	91.70 ± 1.67 #	90.00 ± 3.54 #
Live/Dead ratio	96.50 ± 0.87	92.20 ± 3.38	97.00 ± 1.00	96.50 ± 0.87
EpididymalVolume	5.18 ± 0.03	5.18 ± 0.02	5.17 ± 0.03	5.15 ± 0.03
Count	121.25 ± 5.38	96.5 ± 3.93 *	120.67 ± 1.76 #	131.00 ± 5.82 #

Values are Mean±SEM; n=5. *-compared with control; # -compared with sucrose *P < 0.05. HSS- high sucrose solution, HSS+H- high sucrose solution+ honey, H- honey*

Table V: Sperm abnormalities of rats following administration of treatments for four weeks

Sperm variables	CONTROL	HSS	HSS+H	H
Tailless Head	4.3 ± 0.75	4.4 ± 0.60	4.7 ± 0.76	4.8 ± 0.63
Headless Tail	4.5 ± 0.65	4.6 ± 0.68	4.3 ± 0.88	4.3 ± 0.63
Rudimentary Tail	1.8 ± 0.48	1.8 ± 0.58	2.0 ± 0.58	1.8 ± 0.48
Bent Tail	11.3 ± 0.86	10.8 ± 1.16	10.7 ± 0.67	9.3 ± 1.11
Curved Tail	11.8 ± 0.25	11.0 ± 0.89	8.7 ± 0.33	9.0 ± 0.71*#
Curved mid-piece	11.0 ± 0.41	11.2 ± 0.97	9.7 ± 0.33	8.3 ± 0.25*#
Bent mid-piece	10.3 ± 0.25	9.8 ± 0.49	8.3 ± 0.88	9.0 ± 0.82
Looped Tail	1.8 ± 0.48	1.8 ± 0.37	2.0 ± 0.58	1.8± 0.48
Total No of normal sperm	406.3 ± 3.15	405.0 ± 2.23	401.7 ± 1.67	405.0 ± 2.04
Total No of abnormal sperm	56.5 ± 2.67	55.4 ± 1.83	50.3 ± 1.20	48.5 ± 1.66*
% of abnormal cells	13.9 ± 0.57	13.6 ± 0.46	12.4 ± 0.44	11.9 ± 0.49*

Hormonal Analysis

The Luteinizing Hormone (LH) level was significantly reduced (P<0.05) in the H fed rats compared with control and HSS fed rats. There was no significant difference in LH level in the HSS rats compared with control. The HSS+H fed rats however, had a significant reduction in LH level compared with the HSS fed rats. The H fed rats had a significantly reduced (P<0.05) Follicle-Stimulating Hormone (FSH) level compared with control. However the testosterone level of the H fed rats was significantly higher than in the control as well as the HSS rats (Table VI).

Table VI: Hormonal levels of rats following administration of treatments for four weeks

	CONTROL	HSS	HSS+H	H
LH (iu/l)	0.87 ± 0.06	0.78 ± 0.12	0.34 ± 0.3 #	0.3 ± 0.14* #
FSH (iu/l)	2.21± 0.24	1.47 ± 0.58	0.86 ± 0.64	0.54 ± 0.34 *
TESTOSTERONE (nmol/l)	18.4 ± 3.6	21.9 ± 5.1	22.85 ± 1.15	27.55 ± 8.05 * #

Values are Mean±SEM; n=5. *-compared with control; # -compared with sucrose *P < 0.05. HSS- high sucrose solution, HSS+H- high sucrose solution+ honey, H- honey*

Malonhydialdehyde (MDA) estimation and antioxidant activity in the testis

There was no significant difference observed in MDA level in the testes when compared with control. The Superoxide dismutase (SOD) activity as well as the GSH level was not significantly different in the testes of all the experimental rats. Catalase activity (CAT) was significantly reduced (P<0.05) in the testes of HSS fed rats compared with control while the H fed rats had a significantly increased (P<0.05) level when compared with HSS and HSS+H fed rats (Table VII).

Table VII: Malonhydialdehyde (MDA) estimation and antioxidant activity in the testis following administration of treatments for four weeks

	CONTROL	HSS	HSS+H	H
MDA (µmol/l)	0.54 ± 0.17	0.38 ± 0.01	0.41 ± 0.10	0.23 ± 0.10
SOD (mmol/l)	2.02 ± 0.22	2.03 ± 0.19	3.77 ± 1.48	2.31 ± 0.55
CAT (mol/l)	0.96 ± 0.11	0.69 ± 0.01*	0.70 ± 0.05	0.93 ± 0.06 # π
GSH (µmol/l)	0.32 ± 0.03	0.40 ± 0.05	0.32 ± 0.04	0.43 ± 0.05

Values are Mean±SEM; n=5.?-compared with control; # -compared with sucrose ?- compared with sucrose+ honey P < 0.05. HSS- high sucrose solution, HSS+H- high sucrose solution+ honey, H- honey*

Malonhydialdehyde (MDA) estimation and antioxidant activity in the liver

In the liver of HSS fed rats, there was a significant increase (P<0.05) in MDA level compared with control. The activities of SOD was significantly higher (P<0.05) in the liver of HSS+H fed rats compared with HSS fed rats. CAT and GSH activities in the liver were not significantly different among the experimental groups (Table VIII).

Table VIII: Malonhydialdehyde (MDA) estimation and antioxidant activity in the liver following administration of treatments for four weeks

	CONTROL	HSS	HSS+H	H
MDA (µmol/l)	0.56± 0.06	2.68 ± 0.40 *	2.07 ± 0.43	0.59 ± 0.16
SOD (mmol/l)	3.92 ± 0.92	2.07 ± 0.58	4.92 ± 0.77 #	3.77 ± 0.63
CAT (mol/l)	0.67 ± 0.06	0.70 ± 0.07	0.98 ± 0.20	0.69 ± 0.08
GSH (µmol/l)	0.44 ± 0.05	0.50 ± 0.06	0.55 ± 0.06	0.52 ± 0.05

Values are Mean±SEM; n=5. *-compared with control; # -compared with sucrose *P < 0.05. HSS- high sucrose solution, HSS+H- high sucrose solution+ honey, H- honey*

Discussion:

Different types of geographical locations have attributed different uses to honey, thus this study is in line with justifying the role of Nigerian honey on sperm indices in sucrose-fed rats. In Arab countries for instance, honey is considered to increase human male potency[26]. In another study[27], it was observed in vitro, *that* diluted Egyptian bee honey and royal jelly had an enhancing effect on sperm motility, particularly in subnormal samples. A preliminary study involving a local Malaysian honey, referred to as Tualang honey, has been proposed to enhance spermatogenesis if given at appropriate doses and also to possibly reduce the toxic effect of cigarette smoke on rat spermatogenesis[17]. Nigerian honey has been shown to improve the growth rate and physiological welfare of broilers reared during hot-dry season[28]. Some Nigerian honey samples have also shown varied antimicrobial activities[29]. The known safe use of Nigerian honey without toxic effects suggests that it can be used to treat diseases due to bacterial pathogens[30].

The pattern of food intake was affected by HSS feeding throughout the period of the study. Most of the literatures have shown that adult and children are satiated by sucrose with satiety being prolonged when larger amount of sucrose is consumed[31]. Another study reported that sucrose feeding in rats increased serum leptin concentration[32], thus the observed reduction in food intake in the sucrose-fed rats may be due to the central effect of leptin initiating satiety. Previous studies have shown that honey supplementation decreases energy/food intake in rats [10]. However, the increase in food intake in the honey fed rats from the 1st to 2nd week of treatment followed by reduction in food intake from the 3rd to 4th week of treatment, suggests a prolonged initiation of satiety as against that of sucrose which was noticeable from the beginning of the study. Interestingly, by the 4th week of treatment the HSS+H fed rats reduced their food intake to a considerable level lower than that of the HSS-fed rats, this could possibly indicate a synergetic action of both honey and sucrose on food intake. Oliogosaccharides such as palatinose (isomaltulose) present in honey have been reported to delay digestion and intestinal absorption of glucose resulting in reduced glycemia[33, 34]. Asides delaying absorption, report proposes that fructose consumption lowers food intake [35] and this reduced food intake is attributed to delay gastric emptying [36].This might be the reason for the reduced food intake in the H rats compared with the control.

There was a significant increase in the body weights of the animals in the honey (H) group. This is consistent with a study [14]. Some studies have also found that a composition of honey i.e. fructose consumption at high doses is associated with increased weight gain[37, 38].

Consumption of a high sucrose solution has been implicated in the development of insulin resistance and glucose intolerance in rats [39]. In the present study, there was however no significant difference in fasting blood glucose among the experimental rats. Meanwhile, the duration of treatment may be an important factor to consider since most studies that have reported metabolic disorders due to high sucrose feeding were carried out over a longer duration of eight weeks and over [40]. The short duration of high sucrose feeding (i.e. 4weeks) in this study may have hampered the metabolic changes that become pronounced over time. The fasting blood glucose level of the sucrose fed rats may have appeared to be reduced because serum glucose levels is known to be reduced in starved rats and animals were starved overnight[41].Researchers have

studied non-diabetic subjects and reported that honey has a lower effect on increasing the levels of sugar in the blood, compared to sucrose; in addition, these authors have suggested that honey would cause fewer longterm health problems than fructose or sucrose, in part because it contains nutrients other than carbohydrates[42,43].

Honey supplementation has been shown to have great impact on the testis and other accessory sex organs according to a study by [44]. It is also important to note that the weight of the testes, epididymis, and seminal vesicle were significantly increased in the H and HSS+H fed rats when compared with HSS rats and increase in absolute weight of testes and epididymis have been attributed to increased androgen biosynthesis[45] .The result from this present study is in agreement with the observation byAbdul-Ghani et al [44] where ingestion of 5% honey for 20 days would induce spermatogenesis in rats by increasing relative weight of the epididymis.

In the present result, several sperm indices were positively affected by honey. Significantly higher sperm count higher percentage of normal sperm and lower percentage of sperm head and tail abnormalities especially the 'curved tail' and curved mid-piece' were observed in the honey group in comparison to control and sucrose groups. The authors [44] also reported that honey would induce spermatogenesis in rats by increasing epididymal sperm count and increasing sorbitol dehydrogenase activity. Sorbitol dehydrogenase is an enzyme in carbohydrate metabolism that converts sorbitol, the sugar alcohol form of glucose into fructose[46] A similar increase in sperm count was reported by[16] in rats and monkeys, and enhanced spermatogenesis was reported by[17].Although the present study was conducted using Nigerian honey, the results obtained were similar to that reported from the use of Malaysian honey[26] and Yousef [46] who used propolis. Propolis could provide protection against infertility by improving sperm production, motility, sperm count and quality and increased the process of steroidogenesis and, hence, testosterone production. Royal jelly treatments significantly boosted testosterone level, increased ejaculated volume, increased seminal plasma fructose, improved sperm motility, increased sperm total output, reduced number of abnormal and dead sperm[48]. Sperm motility and concentration are important indicators of male fertility potential [49].Epididymal histophysiology and acquisition of sperm motility are dependent on the presence of androgen[50]. In the present study, the percentage of sperm with progressive motility was reduced in the HSS fed rats compared with both HSS+H and H fed rats. Alterations in motility parameters may lead to an inefficient sperm penetration of cervix mucus, impairing the ability of sperm to reach the oocyte. In addition, a high percentage of sperm with progressive motility is related to a high fertilization index[51]. Animals fed a high sucrose diet presented a reduced sperm concentration, but this was attenuated by honey supplementation in the HSS+H fed rats. Honey could possibly act as physiologic modulator of spermatogenic cells proliferation which influenced the spermatogenic cycle thus, increasing the sperm production[52]. These observations consequently demonstrate the protective role of honey on sperm motility and concentration as against the deleterious effect of sucrose on sperm function. Some authors have also reported that honey supplementation in normal rats improved spermatogenesis[53]. A recent study also demonstrated the beneficial effects of honey on sperm motility and morphology in rats[52].

The hypothalamic pituitary gonadal (HPG) axis was not altered by HSS feeding. Conversely, honey supplementation resulted in decreased level of LH and FSH. These gonadotropins exert a stimulatory effect on leydig cells of the testes for testosterone production. Although low LH and FSH is expected to result in reduced testosterone, there was however a significant increase in testosterone level of the H-fed rats. Contrarily, Mohamed et al [52] found no changes in LH and FSH level of rats supplemented with honey but reported increased testosterone level as well. In another study, no changes were reported on any of the sex hormones[44]. Further studies are thus needed to characterize the effect of honey on the HPG axis, particularly its central effect.

The increased lipid peroxidation in the liver and not in the testes of the HSS fed rats makes it difficult to attribute the alteration of these sperm parameters to the oxidative status of the reproductive organ. However, it brings to fore, that metabolic insult was elicited by HSS feeding regardless on the fasting blood glucose; as the sucrose fed rats did not present

hyperglycemia. Meanwhile,, the increased CAT activity in the testes of the H fed rats demonstrates the antioxidant potential of honey[54, 55, 56] on reproductive organs. Enzymatic scavengers like SOD, CAT and GSH protect the system from deleterious effects of ROS. The improved antioxidant status of the H fed rats in this study may have impacted on the sperm function according to the antioxidative nature of honey[54, 57,58,59,60] since spermatozoa have little defence against oxidative damage and are highly sensitive to free radicals. Previous reports have shown that honeys with a high content of polyphenolic compounds have the capacity to decrease significantly the concentration of lipid hydro-peroxides produced during the lipid peroxidation process, in a process similar to that of other antioxidants like melatonin and vitamin E. The liver is susceptible to oxidative stress and damage; and the beneficial effect of antioxidants on hepatic oxidative stress has been documented[61, 62]. In the liver of young and middle-aged rats, honey supplementation was reported to restore activities of CAT and GPx [63], although in this study the activity of SOD was improved in the HSS+H rats compared to the HSS rats.

Conclusion:

Although several contributory factors have been implicated, the possible role of a sugar-driven dietary lifestyle as a causative factor has gained little or no attention. The result of the present study indeed indicates that a high sugar diet could affect sperm function as evidenced by decreased sperm motility and count in the sucrose fed rats. The observations of this study affirm the statement of hypothesis that a high sucrose diet will impact negatively on male reproductive function while honey consumption will confer a protective effect. The reproductive capacity of male rats is known to be higher than that of men [6]; therefore, such a decrease in sperm quality as observed in the sucrose fed rats may be enough to alter fertility among human males, thus contributing to the alarming incidence of male infertility. Nigerian honey on the other hand appears to be a credible alternative sweetener and exhibits protective function against reproductive dysfunction via high sucrose feeding.

Conflict of no interest statement

We declare that we have no conflict of interest.

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