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Riemann's Hypothesis and Conjecture of Birch and Swinnerton-Dyer are False

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ABSTRACT

All eyes are on the Riemann's hypothesis, zeta, and L-functions, which are false, read this paper.
The Euler product converges absolutely over the whole complex plane. Using factorization method, we can prove that Riemamn's hypothesis and conjecture of Birch and Swinnerton-Dyer are false. All zero computations are false, accurate to six decimal places. Riemann's zeta functions and $L-$ functions are useless and false mathematical tools. Using it one cannot prove any problems in number theory. Euler totient function $\phi(n)$ and Jiang's function $J_{n+1}(\omega)$ will replace zeta $L-$ and functions.

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Keywords: Zeta and L-functions. Riemann hypothesis.

1.Introduction

The function $\zeta(s)$ defined by the absolute convergent series

$$\zeta(s)=\sum_{n=1}^{\infty}\frac{1}{n^s} \tag{1}$$

In complex half-plane, Re$(s)>1$ is called the Riemann's zeta function.

The Riemann's zeta function has a simple pole with the residue 1 at $s=1$ and the function $\zeta(s)$ is analytically continued to the whole complex plane. We then define the $\zeta(s)$ by the Euler product

$$\zeta(s)=\prod_P (1-P^{-s})^{-1}, \tag{2}$$

Where the product is taken all primes P, $s=\sigma+it, i=\sqrt{-1}$, σ and t are real.

The Rieman's zeta function $\zeta(s)$ has no zeros in Re$(s)>1$. The zeros of $\zeta(s)$ in $0<$ Re$(s)<1$ are called the nontrivial zeros. In 1859 G. Riemann conjectured that every zero of $\zeta(s)$ would lie on the line Re$(s)=1/2$. It is called the Riemenn's hypothesis (Riemann, 1859). We have

$$\zeta(s=\sigma+it,\sigma\geq 1)\neq 0 \tag{3}$$

We define the elliptic curve (Coates, 2007)

$$E_D : y^2 = x^3 - D^2 x, \tag{4}$$

Where D is the congruent number?

Assume that D is square-free. Let P be a prime number which does not divide $2D$. Let N_P denote the numbers of pairs (x, y) where x and y run over the integers modulo P, which satisfy the congruence

$$y^2 \equiv x^3 - D^2 x \text{ Mod } P. \tag{5}$$

Put

$$a_P = P - N_P \tag{6}$$

We then define the $L-$function of E_D by the Euler product

$$L(E_D, s) = \prod_{(P,2D)=1} (1 - a_P P^{-s} + P^{1-2s})^{-1} \tag{7}$$

Where the product is taken over all primes P which do not divide $2D$. The Euler product converges absolutely over the half plane Re$(s) > 3/2$, but it can be analytically continued over the whole complex plane. For this function, it is the vertical line Re$(s) = 1$ which plays the analogue of the line Re$(s) = 1/2$ for the Riemann zeta function and the Dirichlet $L-$ functions. Of course, we believe that every zero of $L(E_D, s)$ in Re$(s) > 0$ should lie on the line Re$(s) = 1$. It is called a conjecture of Birch and Swinnerton-Dyer (BSD). We have

$$L(E_D, s = \sigma + it, \sigma \geq 3/2) \neq 0 \tag{8}$$

2. Riemann's Hypothesis is false:

Theorem 1. Euler product converges absolutely in Re$(s) > 1$. Let $s_0 = 1/2 +$ it, using factorization method we have

$$\zeta(s_0 = 1/2 + it) \neq 0 \tag{9}$$

Proof. Let $s = 2s_0, 2.2s_0, 2.8s_0, 3s_0, 4s_0, 5s_0, \cdots P_0 s_0$

We have the following Euler product equations

$$\zeta(2s_0) = \zeta(s_0) \prod_P (1 + P^{-s_0})^{-1} \neq 0, \tag{10}$$

$$\zeta(2.2s_0) = \zeta(s_0) \prod_P (P^{-1.2s_0} + \frac{1 - P^{-1.2s_0}}{1 - P^{-s_0}})^{-1} \neq 0, \tag{11}$$

$$\zeta(2.8s_0) = \zeta(s_0) \prod_P (P^{-1.8s_0} + \frac{1 - P^{-1.8s_0}}{1 - P^{-s_0}})^{-1} \neq 0, \tag{12}$$

$$\zeta(3s_0) = \zeta(s_0) \prod_P (1 + P^{-s_0} + P^{-2s_0})^{-1} \neq 0, \tag{13}$$

$$\zeta(4s_0) = \zeta(s_0) \prod_P (1 + P^{-s_0})^{-1} \prod_P (1 + P^{-2s_0})^{-1} \neq 0, \tag{14}$$

$$\zeta(5s_0) = \zeta(s_0) \prod_P (1 + P^{-s_0} + P^{-2s_0} + P^{-3s_0} + P^{-4s_0})^{-1} \neq 0, \tag{15}$$

……

$$\zeta(P_0 s_0)=\zeta(s_0)\prod_P (1+\cdots+P^{-(P_0-1)s_0})^{-1}\neq 0, \tag{16}$$

Since the Euler product converges absolutely in Re $(s)>1$, the equation (10)-(16) are true.
From (10)-(16) we obtain

$$\zeta(s_0)\neq 0 \tag{9}$$

All zero computations are false and approximate, accurate to six decimal places. Using three methods we proved the RH is false (Jiang, 2005). Using the same Method we are able to prove that all Riemann's hypotheses also are false. All $L-$ functions are false and useless for number theory.

3. The Conjecture of Birch and Swinnerton-Dyer is false:

Theorem 2. Euler product converges absolutely in Re $(s)>3/2$. Let $s_1=1+it$. Using factorization method, we have

$$L(E_D, s_1=1+it)\neq 0 \tag{17}$$

Proof. Let $s=2s_1, 3s_1, 4s_1, \cdots$

We have the following Euler product equations.
we have the following Euler product equations.

$$L(E_D,2s_1)=L(E_D,s_1)\prod_{(P,2D)=1}\left(P^{-2s_1}+\frac{1-(a_P+1)P^{-2s_1}+a_P P^{-3s_1}}{1-a_P P^{-s_1}+P^{1-2s_1}}\right)^{-1}\neq 0 \tag{18}$$

$$L(E_D,3s_1)=L(E_D,s_1)\prod_{(P,2D)=1}\left(P^{-4s_1}+\frac{1-a_P P^{-3s_1}-P^{-4s_1}+a_P P^{-5s_1}}{1-a_P P^{-s_1}+P^{1-2s_1}}\right)^{-1}\neq 0 \tag{19}$$

$$L(E_D,4s_1)=L(E_D,s_1)\prod_{(P,2D)=1}\left(P^{-6s_1}+\frac{1-a_P P^{-4s_1}-P^{-6s_1}+a_P P^{-7s_1}}{1-a_P P^{-s_1}+P^{1-2s_1}}\right)^{-1}\neq 0 \tag{20}$$

$$\cdots\cdots$$

Since the Euler product converges absolutely in Re $(s)>3/2$, equations (18)-(20) are true.
From (18) - (20) we obtain

$$L(E_D,s_1)\neq 0 \tag{17}$$

All zero computations are false and approximate. Using the same method we are able to prove all $L(E,s)\neq 0$ in the whole complex plane.

All zero computations are false and approximate. Using the same method we are able to prove all $L(E,s)\neq 0$ in the whole complex plane.
The elliptic curves are not related with the Diophantine equations and number theory (Frey, 1986). Frey and Ribet did not prove the link between the elliptic curve and Fermat's equation (Frey, 1986; Ribet, 1990). Wiles proved Taniyama-Shimura conjecture based on the works of Frey, Serre, Ribet, Mazuer and Taylor, which have nothing to do with Fermat's last theorem (Wiles, 1995). "Taniyama-Shimura conjecture" was in obscurity for about 20 years till people seriously started thinking about elliptic curves. Mathematical proof does not proceed by personal abuse, but by show careful logical argument. Wiles proof of Fermat's last theorem is false (Taylor, 1997; Ribet & Hayes, 1994, Zhivotov,2006a, Zhivotov, 2006b). In 1991 Jiang proved directly Fermat's last heorem (Jiang, 2012a).

4. Conclusion:

The zero computations of zeta functions and $L-$ functions are false. Riemann's zeta functions and $L-$ functions are useless and false mathematical tools. Using it one cannot prove any problems in number theory (Arthur, et al., 2011). The heart of Langlands program (LP) is the $L-$ functions (Gelbart, 1984). Therefore, LP is false. Wiles proof of Fermat last theorem is the first step in LP. Using LP one cannot prove any problems in number theory, for example, Fermat's last theorem (Wiles, 1995). Euler totient function $\phi(n)$ and Jiang's function $J_{n+1}(\omega)$ will replace Riemann's zeta functions and $L-$ functions [Gelbart, 1984; Jiang, 2012b; Chun-Xuan, 2016].

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References

1. Arthur, et al., (2011). On certain functions. AMS, CMI. 2011. 13.
2. Chun-Xuan, J. (2016). Jiang's Function J n+1 (W) in Prime Distribution. The Journal of Middle East and North Africa Sciences, 2(6), 13-20.
3. Chun-Xuan, J. (2005). Disproofs of Riemann's hypothesis. Algebras Groups and Geometries, 22, 123-136.
4. Coates, J. (2007). Number theory, ancient and modern. In ICCM (Vol. 1, pp. 3-12).
5. Frey, G. (1986). Links between stable elliptic curves and certain diophantine equations. Universität des Saarlandes.
6. Gelbart, S. (1984). An elementary introduction to the Langlands program. Bulletin of the American Mathematical Society, 10(2), 177-219.
7. Jiang, C. X. (2012a). Automorphic Functions and Fermat's Last Theorem (1). Rep Opinion, 4(8), 1-6.
8. Jiang, C. X. (2012b). The Hardy-Littlewood prime k-tuple conjecture is false.
9. Riemann, B. (1859). Ueber die Anzahl der Primzahlen unter einer gegebenen Grosse. Ges. Math. Werke und Wissenschaftlicher Nachlaß, 2, 145-155.
10. Ribet, K. A., & Hayes, B. (1994). Fermat's Last Theorem and modern arithmetic. American Scientist, 82(2), 144-156.
11. Ribet, K. A. (1990). On modular representations of arising from modular forms. Inventiones mathematicae, 100(1), 431-476.
12. Taylor, R. (1997). Fermat's Last Theorem. BBC.
13. Wiles, A. (1995). Modular elliptic curves and Fermat's last theorem. Annals of mathematics, 141(3), 443-551.
14. Zhivotov,Y,(2006).Fermat last theorem and Kenneth Ribet mistakes. www.baoway.com/bbs/viewthread.php?tid=18164&fpage=3
15. Zhivotov,Y.(2006).Fermat last theorem and mistake of Andrew Wiles. www.baoway.com/bbs/viewthread.php?tid=18162&fpage=3

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The Hardy-Littlewood Prime k-tuple Conjecture is False

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ABSTRACT

Using Jiang function, we prove Jiang prime k-tuple theorem, and prove that the Hardy-Littlewood prime k-tuple conjecture is false. Jiang prime k-tuple theorem can replace the Hardy-Littlewood prime k-tuple conjecture.

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Keywords: Jiang function, Prime equations, Prime distribution.

(A) Jiang prime k-tuple theorem (Jiang 2002, Chun-Xuan, 2016**).**

We define the prime k-tuple equation

$$p,\ p+n_i, \tag{1}$$

where $2\,|\,n_i,\ i=1,\cdots k-1$.

we have Jiang function (Jiang 2002, Chun-Xuan, 2016)

$$J_2(\omega)=\prod_P (P-1-\chi(P)), \tag{2}$$

where $\omega=\prod_P P$, $\chi(P)$ is the number of solutions of congruence

$$\prod_{i=1}^{k-1}(q+n_i)\equiv 0 \pmod P,\quad q=1,\cdots,p-1. \tag{3}$$

If $\chi(P)<P-1$ then $J_2(\omega)\neq 0$. There exist infinitely many primes P such that each of $P+n_i$ is prime. If $\chi(P)=P-1$ then $J_2(\omega)=0$. There exist finitely many primes P such that each of $P+n_i$ is prime. $J_2(\omega)$ is a subset of Euler function $\phi(\omega)$ (Chun-Xuan, 2016).

If $J_2(\omega)\neq 0$, then we have the best asymptotic formula of the number of prime P (Jiang ,2002, Chun-Xuan, 2016)

$$\pi_k(N,2)=\left|\{P\le N: P+n_i=prime\}\right| \sim \frac{J_2(\omega)\omega^{k-1}}{\phi^k(\omega)}\frac{N}{\log^k N}=C(k)\frac{N}{\log^k N} \tag{4}$$

$$\phi(\omega)=\prod_P (P-1),$$

$$C(k)=\prod_P\left(1-\frac{1+\chi(P)}{P}\right)\left(1-\frac{1}{P}\right)^{-k} \tag{5}$$

Example 1. Let $k=2, P, P+2$, twin primes theorem.

From (3) we have

$$\chi(2)=0, \quad \chi(P)=1 \text{ if } P>2, \tag{6}$$

Substituting (6) into (2) we have

$$J_2(\omega)=\prod_{P\ge 3}(P-2)\ne 0 \tag{7}$$

There exist infinitely many primes P such that $P+2$ is prime. Substituting (7) into (4) we have the best asymptotic formula

$$\pi_k(N,2)=\left|\{P\le N: P+2=prime\}\right| \sim 2\prod_{P\ge 3}\left(1-\frac{1}{(P-1)^2}\right)\frac{N}{\log^2 N}. \tag{8}$$

Example 2. Let $k=3, P, P+2, P+4$.

From (3) we have

$$\chi(2)=0, \quad \chi(3)=2 \tag{9}$$

From (2) we have

$$J_2(\omega)=0. \tag{10}$$

It has only a solution $P=3$, $P+2=5$, $P+4=7$. One of $P, P+2, P+4$ is always divisible by 3.

Example 3. Let $k=4, P, P+n$, where $n=2,6,8$.

From (3) we have

$$\chi(2)=0, \chi(3)=1, \chi(P)=3 \text{ if } P>3. \tag{11}$$

Substituting (11) into (2) we have

$$J_2(\omega)=\prod_{P\ge 5}(P-4)\ne 0, \tag{12}$$

There exist infinitely many primes P such that each of $P+n$ is prime.

Substituting (12) into (4) we have the best asymptotic formula

$$\pi_4(N,2)=\left|\{P\le N: P+n=prime\}\right| \sim \frac{27}{3}\prod_{P\ge 5}\frac{P^3(P-4)}{(P-1)^4}\frac{N}{\log^4 N} \tag{13}$$

Example 4. Let $k=5$, P, $P+n$, where $n=2,6,8,12$.

From (3) we have

$$\chi(2)=0, \chi(3)=1, \chi(5)=3, \chi(P)=4 \text{ if } P>5 \tag{14}$$

Substituting (14) into (2) we have

$$J_2(\omega)=\prod_{P\ge 7}(P-5)\ne 0 \tag{15}$$

There exist infinitely many primes P such that each of $P+n$ is prime. Substituting (15) into (4) we have the best asymptotic formula

$$\pi_5(N,2)=\left|\{P\le N: P+n=prime\}\right| \sim \frac{15^4}{2^{11}}\prod_{P\ge 7}\frac{(P-5)P^4}{(P-1)^5}\frac{N}{\log^5 N} \tag{16}$$

Example 5. Let $k=6$, P, $P+n$, where $n=2,6,8,12,14$.
From (3) and (2) we have

$$\chi(2)=0,\ \ \chi(3)=1,\ \ \chi(5)=4,\ \ \ J_2(5)=0 \qquad (17)$$

It has the only a solution $P=5$, $P+2=7$, $P+6=11$, $P+8=13$, $P+12=17$, $P+14=19$. One of $P+n$ is always divisible by 5.

（**B**）**The Hardy-Littlewood prime k-tuple conjecture (**Hardy & Littlewood, 1923; Green & Tao, 2008; Goldston, 2009a; Goldston, 2009b; Goldston, 2009; Ribenboim, 1995; Halberstam & Richert, 1994; Schinzel & Sierpiński, 1958; Bateman, P. T., & Horn, 1968; Narkiewicz, 2013; Tao, 2009).

We define the prime k-tuple equation

$$P,P+n_i \qquad (18)$$

where $2|n_i, i=1,\cdots,k-1$.
In 1923 Hardy and Littlewood conjectured the asymptotic formula

$$\pi_k(N,2)=\left|\{P\le N: P+n_i=prime\}\right|\sim H(k)\frac{N}{\log^k N}, \qquad (19)$$

where

$$H(k)=\prod_P\left(1-\frac{\nu(P)}{P}\right)\left(1-\frac{1}{P}\right)^{-k} \qquad (20)$$

$\nu(P)$ is the number of solutions of congruence

$$\prod_{i=1}^{k-1}(q+n_i)\equiv 0 \pmod P,\qquad q=1,\cdots,P. \qquad (21)$$

From (21) we have $\nu(P)<P$ and $H(k)\ne 0$. For any prime k-tuple equation there exists infinitely many primes P such that each of $P+n_i$ is prime, which is false.

Conjecture 1. Let $k=2, P, P+2$, twin primes theorem
From (21) we have

$$\nu(P)=1 \qquad (22)$$

Substituting (22) into (20) we have

$$H(2)=\prod_P\frac{P}{P-1} \qquad (23)$$

Substituting (23) into (19) we have the asymptotic formula

$$\pi_2(N,2)=\left|\{P\le N: P+2=prime\}\right|\sim\prod_P\frac{P}{P-1}\frac{N}{\log^2 N} \qquad (24)$$

which is false see example 1.

Conjecture 2. Let $k=3, P, P+2, P+4$.

From (21) we have

$$\nu(2)=1,\ \nu(P)=2 \text{ if } P>2 \qquad (25)$$

Substituting (25) into (20) we have

$$H(3)=4\prod_{P\geq 3}\frac{P^2(P-2)}{(P-1)^3} \qquad (26)$$

Substituting (26) into (19) we have asymptotic formula

$$\pi_3(N,2)=\left|\{P\leq N: P+2=prime, P+4=prim\}\right|\sim 4\prod_{P\geq 3}\frac{P^2(P-2)}{(P-1)^3}\frac{N}{\log^3 N} \qquad (27)$$

which is false see example 2.

Conjecture 3. Let $k=4$, $P, P+n$, where $n=2,6,8$.

From (21) we have

$$\nu(2)=1,\ \nu(3)=2,\ \nu(P)=3 \text{ if } P>3 \qquad (28)$$

Substituting (28) into (20) we have

$$H(4)=\frac{27}{2}\prod_{P>3}\frac{P^3(P-3)}{(P-1)^4} \qquad (29)$$

Substituting (29) into (19) we have asymptotic formula

$$\pi_4(N,2)=\left|\{P\leq N: P+n=prime\}\right|\sim \frac{27}{2}\prod_{P>3}\frac{P^3(P-3)}{(P-1)^4}\frac{N}{\log^4 N} \qquad (30)$$

Which is false see example 3.

Conjecture 4. Let $k=5,\ P, P+n$, where $n=2,6,8,12$

From (21) we have

$$\nu(2)=1,\ \nu(3)=2,\ \nu(5)=3,\ \nu(P)=4 \text{ if } P>5 \qquad (31)$$

Substituting (31) into (20) we have

$$H(5)=\frac{15^4}{4^5}\prod_{P>5}\frac{P^4(P-4)}{(P-1)^5} \qquad (32)$$

Substituting (32) into (19) we have asymptotic formula

$$\pi_5(N,2)=\left|\{P\leq N: P+n=prime\}\right|\sim \frac{15^4}{4^5}\prod_{P>5}\frac{P^4(P-4)}{(P-1)^5}\frac{N}{\log^5 N} \qquad (33)$$

Which is false see example 4.

Conjecture 5. Let $k=6$, P, $P+n$, where $n=2,6,8,12,14$.

From (21) we have

$$\nu(2)=1,\ \nu(3)=2,\ \nu(5)=4,\ \nu(P)=5 \text{ if } P>5 \qquad (34)$$

Substituting (34) into (20) we have

$$H(6)=\frac{15^5}{2^{13}}\prod_{P>5}\frac{(P-5)P^5}{(P-1)^6} \tag{35}$$

Substituting (35) into (19) we have asymptotic formula

$$\pi_6(N,2)=\left|\left\{P\le N: P+n=prime\right\}\right| \sim \frac{15^5}{2^{13}}\prod_{P>5}\frac{(P-5)P^5}{(P-1)^6}\frac{N}{\log^6 N} \tag{36}$$

which is false see example 5.

Conclusion:

The Hardy-Littlewood prime k-tuple conjecture is false. The tool of additive prime number theory is basically the Hardy-Littlewood prime k-tuple conjecture. Jiang prime k-tuple theorem can replace Hardy-Littlewood prime k-tuple Conjecture. There cannot be a really modern prime theory without Jiang function.

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References

1. Bateman, P. T., & Horn, R. A. (1962). A heuristic asymptotic formula concerning the distribution of prime numbers. *Mathematics of Computation*, 16(79), 363-367.
2. Chun-Xuan, J. (2016). Jiang's Function J n+1 (W) in Prime Distribution. *The Journal of Middle East and North Africa Sciences*, 2(6), 13-20
3. Goldston, D. A., Graham, S. W., Pintz, J., & Yıldırım, C. Y. (2009a). Small gaps between products of two primes. *Proceedings of the London Mathematical Society*, 98(3), 741-774.
4. Goldston, D. A., Graham, S. W., Pintz, J., & Yildirim, C. Y. (2009b). Small gaps between primes or almost primes. *Transactions of the American Mathematical Society*, 5285-5330.
5. Goldston, D. A., Pintz, J., & Yildirim, C. Y. (2009). Primes in tuples I. *Annals of Mathematics*, 819-862.
6. Green, B., & Tao, T. (2008). The primes contain arbitrarily long arithmetic progressions. *Annals of Mathematics*, 481-547.
7. Halberstam, H., & Richert, H. E. (1974). Sieve Methods (London Mathematical Society Monographs No. 4).
8. Hardy, G. H., & Littlewood, J. E. (1923). Some problems of 'Partitio numerous'; III: On the expression of a number as a sum of primes. *Acta Mathematica*, 44(1), 1-70.
9. Jiang, C. X., (2002). Foundations of Santilli's Isonumber Theory: With Applications to New Cryptograms, Fermat's Theorem and Goldbach's Conjecture. International academic press.
10. Narkiewicz, W. (2013). The development of prime number theory: from Euclid to Hardy and Littlewood. Springer Science & Business Media.
11. Ribenboim, P. (1995). The new book of prime numbers.

12. Schinzel, A., & Sierpiński, W. (1958). Sur certaines hypotheses concernant les nombres premiers. *Acta Arithmetica*, 4(3), 185-208.

13. Tao, T. Recent progress in additive prime number theory, preprint. 2009. Szemerédi's theorem does not directly to the primes, because it can not count the number of primes.

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Riemann Paper (1859) Is False

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ABSTRACT

In 1859 Riemann defined the zeta function $\zeta(s)$. From Gamma function he derived the zeta function with Gamma function $\bar{\zeta}(s)$. $\bar{\zeta}(s)$ and $\zeta(s)$ are the two different functions. It is false that $\bar{\zeta}(s)$ replaces $\zeta(s)$. After him later mathematicians put forward Riemann hypothesis(RH) which is false. The Jiang function $J_n(\omega)$ can replace RH.

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Keywords: Riemann hypothesis, Gamma function.

In 1859 Riemann defined the Riemann zeta function (RZF) (Riemann, 1859)

$$\zeta(s)=\prod_P(1-P^{-s})^{-1}=\sum_{n=1}^{\infty}\frac{1}{n^s}, \quad (1)$$

where $s=\sigma+ti, i=\sqrt{-1}$ ranges over all primes. RZF is the function of the complex P are real, t and σ, variable s in $\sigma\geq 0, t\neq 0$, which is absolutely convergent.

In 1896 J. Hadamard and de la Vallee Poussin proved independently (Borwin, 2007)

$$\zeta(1+ti)\neq 0. \quad (2)$$

In 1998 Jiang proved (Jiang, 2005)

$$\zeta(s)\neq 0, \quad (3)$$

where $0\leq\sigma\leq 1$.

Riemann paper (1859) is false (Riemann, 1859). We define Gamma function (Riemann, 1859; Borwin, 2007)

$$\Gamma\left(\frac{s}{2}\right)=\int_0^{\infty} e^{-t}t^{\frac{s}{2}-1}dt. \quad (4)$$

For $\sigma>0$. On setting $t=n^2\pi x$, we observe that

$$\pi^{-\frac{s}{2}}\Gamma\left(\frac{s}{2}\right)n^{-s}=\int_0^{\infty} x^{\frac{s}{2}-1}e^{-n^2\pi x}dx. \quad (5)$$

Hence, with some care on exchanging summation and integration, for $\sigma>1$,

$$\pi^{-\frac{s}{2}}\Gamma\left(\frac{s}{2}\right)\bar{\varsigma}(s)=\int_0^{\infty} x^{\frac{s}{2}-1}\left(\sum_{n=1}^{\infty} e^{-n^2\pi x}\right)dx$$

$$=\int_0^{\infty} x^{\frac{s}{2}-1}\left(\frac{\vartheta(x)-1}{2}\right)dx \quad (6)$$

where $\overline{\zeta}(s)$ is called Riemann zeta function with gamma function rather than $\zeta(s)$,

$$\vartheta(x):=\sum_{n=-\infty}^{\infty} e^{-n^2\pi x} \quad (7)$$

is the Jacobi theta function. The functional equation for $\vartheta(x)$ is

$$x^{\frac{1}{2}}\vartheta(x)=\vartheta(x^{-1}), \quad (8)$$

and is valid for $x>0$.

Finally, using the functional equation of $\vartheta(x)$, we obtain

$$\overline{\zeta}(s)=\frac{\pi^{\frac{s}{2}}}{\Gamma\left(\frac{s}{2}\right)}\left\{\frac{1}{s(s-1)}+\int_1^{\infty}(x^{\frac{s}{2}-1}+x^{-\frac{s}{2}-\frac{1}{2}})\cdot(\frac{\vartheta(x)-1}{2})dx\right\}. \quad (9)$$

From (9) we obtain the functional equation

$$\pi^{-\frac{s}{2}}\Gamma\left(\frac{s}{2}\right)\overline{\zeta}(s)=\pi^{-\frac{1-s}{2}}\Gamma\left(\frac{1-s}{2}\right)\overline{\zeta}(1-s) \quad (10)$$

The function $\overline{\zeta}(s)$ satisfies the following

1. $\overline{\zeta}(s)$ has no zero for $\sigma>1$;
2. The only pole of $\overline{\zeta}(s)$ is at $s=1$; it has residue 1 and is simple;
3. $\overline{\zeta}(s)$ has trivial zeros at $s=-2,-4,\ldots$ but $\zeta(s)$ has no zeros;
4. The nontrivial zeros lie inside the region $0\le\sigma\le1$ and are symmetric about both the vertical line $\sigma=1/2$.

The strip $0\le\sigma\le1$ is called the critical strip and the vertical line $\sigma=1/2$ is called the critical line.

Conjecture (The Riemann Hypothesis). All nontrivial zeros of $\overline{\zeta}(s)$ lie on the critical line $\sigma=1/2$, which is false (Jiang, 2005)

$\overline{\zeta}(s)$ and $\zeta(s)$ are the two different functions. It is false that $\overline{\zeta}(s)$ replaces $\zeta(s)$, Pati proved that is not all complex zeros of $\overline{\zeta}(s)$ lie on the critical line: $\sigma=1/2$ (Pati, (2007).

Schadeck pointed out that the falsity of RH implies the falsity of RH for finite fields (Schadeck, 2008). RH is not directly related to prime theory. Using RH mathematicians prove many prime theorems which are false. In 1994 Jiang discovered Jiang function $J_n(\omega)$ which can replace RH, Riemann zeta function, and L-function in view of its proved feature: if $J_n(\omega)\ne0$ then the prime equation has infinitely many prime solutions; and if $J_n(\omega)=0$, then the prime equation has finitely many prime solutions. By using $J_n(\omega)$ Jiang proves about 600 prime theorems including the Goldbach's theorem, twin prime theorem and theorem on arithmetic progressions in primes (Jiang 2002, 2006).

In the same way, we have a general formula involving $\overline{\zeta}(s)$

$$\int_0^{\infty} x^{s-1}\sum_{n=1}^{\infty} F(nx)dx=\sum_{n=1}^{\infty}\int_0^{\infty} x^{s-1}F(nx)dx$$

$$=\sum_{n=1}^{\infty}\frac{1}{n^s}\int_0^{\infty} y^{s-1}F(y)dy=\overline{\zeta}(s)\int_0^{\infty} y^{s-1}F(y)dy , \qquad (11)$$

where $F(y)$ is arbitrary.

From (11) we obtain many zeta functions $\overline{\zeta}(s)$ which are not directly related to the number theory.
The prime distributions are order rather than random. The arithmetic progressions in primes are not directly related to ergodic theory, harmonic analysis, discrete geometry, and combinatories. Using the ergodic theory Green and Tao prove that there exist infinitely many arithmetic progressions of length k consisting only of primes which are false (Kra, 2006; Green & Tao 2008; Tao, 2005). Fermat's last theorem (FLT) is not directly related to elliptic curves. In 1994 using elliptic curves Wiles proved FLT which is false (Wiles, 1995; Zhivotov,2006a; Zhivotov, 2006b). There are Pythagorean theorem and FLT in the complex hyperbolic functions and complex trigonometric functions. In 1991 without using any number theory Jiang proved FLT which is Fermat's marvelous proof (Jiang,2002).

Primes Represented by $P_1^n+mP_2^n$ (Jiang, 2003)

(1) Let $n=3$ and $m=2$. We have

$$P_3=P_1^3+2P_2^3 .$$

We have Jiang function

$$J_3(\omega)=\prod_{3\le P}(P^2-3P+3-\chi(P))\neq 0 ,$$

Where $\chi(P)=2P-1$ if $2^{\frac{P-1}{3}}\equiv 1 \pmod P$; $\chi(P)=-P+2$ if $2^{\frac{P-1}{3}}\not\equiv 1 \pmod P$; $\chi(P)=1$ otherwise.

Since $J_n(\omega)\neq 0$, there exist infinitely many primes P_1 and P_2 such that P_3 is a prime.
We have the best asymptotic formula

$$\pi_2(N,3)=\left|\{P_1,P_2:P_1,P_2\le N, P_1^3+2P_2^3=P_3\text{ prime}\}\right|$$

$$\sim\frac{J_3(\omega)\omega}{6\Phi^3(\omega)}\frac{N^2}{\log^3 N}=\frac{1}{3}\prod_{3\le P}\frac{P(P^2-3P+3-\chi(P))}{(P-1)^3}\frac{N^2}{\log^3 N} .$$

where $\omega=\prod_{2\le P}P$ is called primorial, $\Phi(\omega)=\prod_{2\le P}(P-1)$.
It is the simplest theorem which is called the Heath-Brown problem (Heath-Brown, 2001).

(2) Let $n=P_0$ be an odd prime, $2|m$ and $m\neq \pm b^{P_0}$.
we have

$$P_3=P_1^{P_0}+mP_2^{P_0}$$

We have

$$J_3(\omega)=\prod_{3\le P}(P^2-3P+3-\chi(P))\neq 0 ,$$

where $\chi(P)=-P+2$ if $P|m$; $\chi(P)=(P_0-1)P-P_0+2$ if $m^{\frac{P-1}{P_0}}\equiv 1 \pmod P$;
$\chi(P)=-P+2$ if $m^{\frac{P-1}{P_0}}\not\equiv 1 \pmod P$; $\chi(P)=1$ otherwise.

Since $J_n(\omega)\neq 0$, there exist infinitely many primes P_1 and P_2 such that P_3 is a prime.
We have

$$\pi_2(N,3)\sim\frac{J_3(\omega)\omega}{2P_0\Phi^3(\omega)}\frac{N^2}{\log^3 N} .$$

The Polynomial $P_1^n+(P_2+1)^2$ **Captures Its Primes** (Jiang, 2003)

）1（Let $n=4$, We have

$$P_3=P_1^4+(P_2+1)^2,$$

We have Jiang function

$$J_3(\omega)=\prod_{3\le P}(P^2-3P+3-\chi(P))\ne 0,$$

Where $\chi(P)=P$ if $P\equiv 1$ (mod 4); $\chi(P)=P-4$ if $P\equiv 1$ ）mod 8（; $\chi(P)=-P+2$ otherwise.

Since $J_n(\omega)\ne 0$, there exist infinitely many primes P_1 and P_2 such that P_3 is a prime.

We have the best asymptotic formula

$$\pi_2(N,3)=\left|\{P_1,P_2:P_1,P_2\le N,P_1^4+(P_2+1)^2=P_3\ \text{prime}\}\right|$$

$$\sim\frac{J_3(\omega)\omega}{8\Phi^3(\omega)}\frac{N^2}{\log^3 N}.$$

It is the simplest theorem which is called Friedlander-Iwaniec problem (Friedlander, & Iwaniec 1998).

）2（Let $n=4m$, We have

$$P_3=P_1^{4m}+(P_2+1)^2,$$

where $m=1,2,3,\cdots$.

We have Jiang function

$$J_3(\omega)=\prod_{3\le P\le P_i}(P^2-3P+3-\chi(P))\ne 0,$$

where $\chi(P)=P-4m$ if $8m|(P-1)$; $\chi(P)=P-4$ if $8|(P-1)$; $\chi(P)=P$ if $4|(P-1)$; $\chi(P)=-P+2$ otherwise.

Since $J_3(\omega)\ne 0$, there exist infinitely many primes P_1 and P_2 such that P_3 is a prime. It is a generalization of Euler proof for the existence of infinitely many primes.

We have the best asymptotic formula

$$\pi_2(N,3)\sim\frac{J_3(\omega)\omega}{8m\Phi^3(\omega)}\frac{N^2}{\log^3 N}.$$

）3（Let $n=2b$. We have

$$P_3=P_1^{2b}+(P_2+1)^2,$$

where b is an odd.

We have Jiang function

$$J_3(\omega)=\prod_{3\le P}(P^2-3P+3-\chi(P))\ne 0,$$

Where $\chi(P)=P-2b$ if $4b|(P-1)$; $\chi(P)=P-2$ if $4|(P-1)$; $\chi(P)=-P+2$ otherwise.

We have the best asymptotic formula

$$\pi_2(N,3)\sim\frac{J_3(\omega)\omega}{4b\Phi^3(\omega)}\frac{N^2}{\log^3 N}.$$

）4（Let $n=P_0$, We have

$$P_3 = P_1^{P_0} + (P_2+1)^2.$$

where P_0 is an odd. Prime.
we have Jiang function

$$J_3(\omega) = \prod_{3 \le P} (P^2 - 3P + 3 - \chi(P)) \neq 0,$$

where $\chi(P) = P_0 + 1$ if $P_0 | (P-1)$; $\chi(P) = 0$ otherwise.
Since $J_3(\omega) \neq 0$, there exist infinitely many primes P_1 and P_2 such that P_3 is also a prime.
We have the best asymptotic formula

$$\pi_2(N,3) \sim \frac{J_3(\omega)\omega}{2P_0\Phi^3(\omega)} \frac{N^2}{\log^3 N}.$$

The Jiang function $J_n(\omega)$ is closely related to the prime distribution. Using $J_n(\omega)$ we are able to tackle almost all prime problems in the prime distributions.

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References

1. Borwin, P., Choi, S., & Rooney, B. (2007). The Riemann Hypothesis.

2. Chun-Xuan, J. (2005). Disproofs of Riemann's hypothesis. Algebras Groups and Geometries, 22, 123-136.

3. Friedlander, J., & Iwaniec, H. (1998). The polynomial x2+ y4 captures its primes. Annals of Mathematics, 148, 945-1040.

4. Green, B., & Tao, T. (2008). The primes contain arbitrarily long arithmetic progressions. Annals of Mathematics, 481-547.

5. Heath-Brown, D. R. (2001). Primes represented by $x^3 + 2y^3$. Acta Math., 186(1), 1-84.

6. Jiang, C. X. (2003). Prime theorem in Santilli's isonumber theory (II). Algebras Groups and Geometries, 20, 149-170.

7. Jiang, C. X. (2006). The simplest proofs of both arbitrarily long arithmetic progressions of primes. preprint.

8. Jiang, C. X., (2002). Foundations of Santilli's Isonumber Theory: With Applications to New Cryptograms, Fermat's Theorem and Goldbach's Conjecture. International academic press.

9. Kra, B. (2006). The Green-Tao theorem on arithmetic progressions in the primes: an ergodic point of view. Bulletin of the American Mathematical Society, 43(1), 3-23.

10. Pati, T. (2007). the Riemann hypothesis. arXiv preprint math/0703367.

11. Riemann, B. (1859). Ueber die Anzahl der Primzahlen unter einer gegebenen Grosse. Ges. Math. Werke und Wissenschaftlicher Nachlaß, 2, 145-155.

12. Schadeck, L. (2008). Jiang Number Theory (JNT).

13. Tao, T. (2005). The dichotomy between structure and randomness, arithmetic progressions, and the primes. arXiv preprint math/0512114.

14. Wiles, A. (1995). Modular elliptic curves and Fermat's last theorem. Annals of mathematics, 141(3), 443-551.

15.Zhivotov,Y.(2006).Fermat last theorem and mistakes of Andrew Wiles. www.baoway.com/bbs/viewthread.php?tid=18162&fpage=3.

16.Zhivotov,Y.(2006).Fermat last theorem and Kenneth Ribet mistakes. www.baoway.com/bbs/viewthread.php?tid=18164&fpage=3.

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Determination of Hydroquinone in Skin- Lightening Creams Sold in Sudan-by Using High-Performance Liquid Chromatography

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ABSTRACT

The use of hydroquinone is forbidden as it is potentially carcinogenic and skin and respiratory irritant, nevertheless, it is still the most conventional and widely used in skin- lightening creams. In this study, thirty samples of Skin-lightening creams, local and imported, were analyzed for total hydroquinone by using high-performance liquid chromatography (HPLC). The concentration of hydroquinone ranged from 0.00% to 5.75 % and from 0.00% to 3.21% for local and imported creams, respectively. However, Fair and Lovely's cream ranged from 0.47% to 4.76% respectively. The use of such creams may lead to health hazards. Therefore, it is recommended that all skin-lightening creams should be checked for hydroquinone levels before marketing.

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1. Introduction:

Skin bleaching is a phenomenon that can be traced back to the ancient times amongst nations such as Japan. Skin bleaching was also practiced in ancient and medieval times in Asia, Egypt, Europe and China; it has gained real momentum in Sudan only recently (Hamed et al., 2004).

Most skin bleaching products contain one of the two active ingredients; hydroquinone and mercury. Other agents with skin lightening properties include alpha arbutin, beta-arbutin, licorice extract, niacinamide, mulberry extract, glycolic acid, lactic acid, lemon juice extract, Emblica, vitamin C, potato, and Tumeric. Potato is a natural bleaching agent. When the face is massaged with a slice of raw potato as often as possible, the skin can be lightened in color. The slice must not be washed before massaging the face, as it will lose its natural properties (Adebajo, 2002).

Hydroquinone have acute and chronic side effect in humans. The FDA & WHO Standards allows a maximum of two percent of hydroquinone in skin care products. European Bureau of Standards banned some hydroquinone containing skin-lightening creams (Siddique et al., 2012). Despite the side effects of hydroquinone, skin lightening creams containing these harmful chemicals are still found in the Sudanese market and are sold to the public. Considering the toxic effect of hydroquinone, it is important to control, its exposure to humans. This can have achieved if their levels in skin-lightening creams were known.

In Sudan, a little work has been undertaken to determine the levels of heavy metals and hydroquinone in toning creams even though concern have been expressed about the widespread use of skin lightening cream (Lee et al., 2007).

Many Sudanese women love to keep their skin toned, and thus use skin care products that bleach the skin. However, most of these bleaching products contain different kinds of chemicals that may be harmful to human health (Schaffer & Bolognia, 2001). Examples of such chemicals include hydroquinone (most common), mercury, kojic acid, kojic acid dipalmitate, azleic acid, arbutin, bearberry, vitamin C, magnesium ascorbyl phosphate, calcium ascorbate, and L-ascorbic acid.

From ancient history, humans have constantly labeled and stereotyped each other based on skin color (Raper, 1928). In most African and Asian communities, fairness was branded as beauty, grace, and high social status. Those with darker skin are seen as being of lowest social value, whereas, those with lighter skin are regarded as being of highest social value (Tai et al., 2009) This perception encourages most women to indulge in skin care products that lighten the skin. Hydroquinone is potentially carcinogenic and known to be a skin and respiratory irritant. It is also considered a primary topical ingredient for inhibiting the production of melanin, the amount of which determines skin color. Because hydroquinone is carcinogenic, it has been banned in some countries because of fears of a cancer risk, (Costin & Hearing, 2007). Some concerns about hydroquinone's safety on the skin have been expressed, but research has shown that when it comes to topical application, it has negative reactions which are minor but major as a result of using extremely high concentrations. This is particularly true in Sudan where adulterated skin lightening products are common.

The main objective is to determine levels of hydroquinone in some skin-lightening creams sold in the Sudanese market.

Moreover, to compare levels with standards recommended by the International Standards and to determine if consumers in Sudan are at risk.

2. Materials and Methods:

2.1 Reagents:

All reagents were of analytical reagent grade (BDH Chemicals Ltd, Poole, England) unless otherwise stated. The methanol used for the hydroquinone analysis was HPLC grade.

Standard solution of hydroquinone was prepared by dissolving 1.0g hydroquinone in methanol in a 100 cm^3 volumetric flask and made up to volume using methanol. Various concentrations (0.08, 0.12, 0.16 and 0.2 g/dm^3) were prepared by diluting aliquots of the stock hydroquinone standard solution with methanol.

2.2 Sampling:

Thirty samples of skin- lightening creams were obtained randomly from cosmetic shops in Khartoum, Khartoum- North and Omdurman Markets, local and imported samples, (Table-3).

2.3 Sample preparation:

About 0.10 g of each cream was weighed accurately into a 10 cm^3 flask and 8.0 cm^3 of methanol was added and heated at 40 ^oC in a water bath with occasionally shaking until it dissolved. It was allowed to cool and made up to the mark with methanol. The solution was filtered using a membrane filter before analysis.

2.4 Preparation of Reference Solution:

An accurate weight of 0.05g of hydroquinone standard was transferred to a 50 cm^3 volumetric flask, dissolved in small amount of mobile phase and volume was made up to the mark. 5 ml of this solution was pipetted into a 50 cm^3 volumetric flask. It was diluted and volume was made up to the mark by mobile phase.

2.5. Method Validation

2.5.1. Linearity:

In this study, 5 concentration levels were used to study the linear dynamic range of the method. Five different concentrations of standard working solutions, prepared from the stock solutions were analyzed

2.5.2. Accuracy

A lotion and cream samples containing no whitening agents were used as blanks in the recovery study. Recovery of the five whitening components was obtained at both low and high concentrations.

2.5.3. Precision:

The precision of the proposed method expressed as a relative standard deviation (RSD) percentage, was determined by analysis of each compound (Hardwick et al., 1989).

2.6. Instrument used for determination of hydroquinone

Determination of hydroquinone was carried out by high-performance liquid chromatograph (HPLC), Agilent 1100 series with DAD.

2.6.1. HPLC-Instrument conditions

- Column: (Hypersil C8 150*4.6mm*5µm)
- Stabilized pressure: 67 bar
- Column temperature: 30°C
- Flow rate: 1 cm^3/min
- Elution. Gradient

Table 1 shows HPLC instrument operation conditions.

Table 1: *Instrument operation conditions*

Time (min)	Methanol	Water Milli-Q
0	5	95
13	5	95
17	70	30
20	70	30
25	5	95

2.7. Recovery

Recovery of hydroquinone was determined by adding increasing amounts of standard hydroquinone solution to known weights of two different cream samples. The first flask contained only 0.1 g of each sample and the second flask contained 0.1 g of each sample and 0.08 g of hydroquinone.

The third flask contained 0.1g of each sample and 0.12 g of hydroquinone. The resulting solutions after extraction were analyzed for hydroquinone concentrations and the results obtained were reported in (Table 2), which shows the percentage of recovery of hydroquinone in different skin- lightening creams collected from the local market in Sudan which is ranged from 99.5 % to 102.4%.

Table 2: *Recovery results of hydroquinone for skin – lightening cream samples.*

Sample ID	HQ Percent (%)	HQ Added (mg)	HQ Found (mg)	HQ Recovery (mg)	Percentage of Recovery (%)
Sample -1	0.0	80.0	81.9	81.9	102.4 %
Sample -2	0.0	120.0	119.6	119.6	99.7 %
Sample -3	0.2	80.0	78.2	78.0	99.5 %
Sample -4	0.2	120	121.4	121.2	101.0 %
Sample -5	0.1	80.0	81.1	81.2	101.5 %
Sample -6	0.0	80.0	78.4	80.7	100.9 %

Where, HQ; hydroquinone.

In the same conditions as above, a solution independent from that used for the range was injected of test concentrations 0.5mg/dm³ and5mg/dm³, a blank with the dilution solvent.

The recovery rate relative to the target concentration was calculated. The accepted recover rate had to be between +/- 3% for the low test 100 +/- 5% for the high test, and LOD.

2.8. Calculations

Note: HPLC instrument software can be programmed to perform all necessary calculations. Analytic concentrations in digested samples (CS) were calculated using:

$$C\ (ppb) = \frac{CE \times V \times D}{W}$$

Where: -
CE = Analytic concentration in final extract, in µg/dm³
V = Final sample extract volume in mill- decimeters
D = Dilution factor (Diluted volume/aliquot volume) if secondary dilution was made
W = Sample Weight in grams.

All results were reported in µg/dm³, ppb or mg/dm³, ppm for liquid samples and µg/kg, (ppb) or mg/Kg, ppm for solid samples.

3. Results and discussion:

Hydroquinone was determined by recovery studies (Table-2). Analytical and matrix recovery studies for hydroquinone yielded results between 99.5% and 102.4% with a coefficient of variation between 4% and 9%. Hydroquinone results, for LC- ranged from 0.0 to 5.75%, F&L, 0.47 to 4.76% and for C- ranged from 0.0 to 3.21%. lightening - creams gave 4.76 % for the sample number (F&L 63), imported from Dubai, UAE, and the minimum concentration of HQ in the results of hydroquinone percentage contained in local and imported creams showed that out of the thirty samples analyzed, one cream contained up to 5.75% of hydroquinone. (Moreover, one skin-lightening cream of Fair & Lovely gave up to 4.76%).

The highest concentration was 5.75% and 3.05% recorded for local preparation sold in Omdurman market. F&L cream imported from India recorded 2.03% of hydroquinone. France cream recorded 1.38% of hydroquinone. Dubai skin lightening cream recorded the highest hydroquinone concentration of 4.76% followed by China cream (2.81%), which was also above the recommended value. In total, 92% of the creams analyzed recorded levels below 2% hydroquinone, which is the threshold limit, and 8% of the creams analyzed contained more than 2% hydroquinone, which is above the threshold limit.

The concentrations of hydroquinone in skin-lightening creams have also been the subject of study in the United Kingdom (European Foundation for the Improvement of Living, 2000). Eight out of forty-one cream samples analyzed were found to contain more than two (2%) percent hydroquinone which is the maximum concentration permitted by the United Kingdom cosmetic product regulations. (FDA, 2006).

Table 3: *Percentage of hydroquinone result in skin-lightening cream samples (local & imported).*

Sample ID	Type of Sample	Country of Origin	Lot No.	Color	Item No	HQ Results %
LC 51	Skin-lightening Cream	Local/K.N	-	White	-	0.11
LC 52	Skin-lightening Cream	Local/K.N	-	Off – white	1	0.51
LC 53	Skin-lightening Cream	Local/K.N		White		1.63
LC 54	Skin-lightening Cream	Local/OM	-	Off – white	2	0.10
LC 55	Skin-lightening Cream	Local/OM	-	White	03	5.75
LC 56	Skin-lightening Cream	Local/OM	-	Off – white	-	1.64
LC 57	Skin-lightening Cream	Local/OM	-	Off – white	2	ND
LC 58	Skin-lightening Cream	Local/K.N	-	Off – white	-	0.89
LC 59	Skin-lightening Cream	Local/OM	-	White	-	3.05
F&L 60	Skin-lightening Cream	India	-	White	01	2.03
F&L 61	Skin-lightening Cream	France	-	Off – white	01	1.38
F&L 62	Skin-lightening Cream	UAE Dubai	-	Trans parent Gel	01	0.47
F&L 63	Skin-lightening Cream	UAE Dubai	-	Off – white	01	4.76
F&L 64	Skin-lightening Cream	China	-	White	2	2.81

F&L 65	Skin-lightening Cream	China	-	White	-	0.52
C 66	Skin-lightening Cream	Italy	7702- k	Off – white	-	0.92
C 67	Skin-lightening Cream	Egypt	-	White	-	3.21
C 68	Skin-lightening Cream	Italy	-	Trans parent Gel	-	0.70
C 69	Skin-lightening Cream	Egypt	512	Trans parent Gel	1	ND
C 70	Skin-lightening Cream	India	-	Off – white	2	ND
C 71	Skin-lightening Cream	China	09	White	03	0.66
C 72	Skin-lightening Cream	France	154 LO	Trans parent Gel	-	1.08
C 73	Skin-lightening Cream	UAE Dubai	561	White	22	0.69
C 74	Skin-lightening Cream	Egypt	443	Off – white	-	ND
C 75	Skin-lightening Cream	Egypt	-	White	-	2.72
C 76	Skin-lightening Cream	Egypt	-	Off- white	01	ND
C 77	Skin-lightening Cream	Thailand	218Z	Trans parent Gel	01	0.39
C 78	Skin-lightening Cream	China	-	Trans parent Gel	01	1.02
C 79	Skin-lightening Cream	Thailand	92-Y	White	01	ND
C 80	Skin-lightening Cream	China	-	White	-	0.07

Where; ND, not detected. LC; local cream, F & L fair and lovely, and C; imported cream.

4. Conclusion

Most of the cream samples, analyzed for hydroquinone, had concentrations more than the US Food and Drug. Administration's acceptable limit of 1µg/g, reaching a percentage of up to 57% of all samples. The low concentrations of hydroquinone were detected in the imported cream samples Therefore the percentage levels which were higher than the recommended WHO limit of two (2%) was only 23%. Hydroquinone concentration ranged from below detection to 5.75 %. Twenty-three percent of the cream samples analyzed had hydroquinone concentration above the WHO threshold limit of 2 %. This is very alarming and consumers who apply any of these creams are at risk.

5. Recommendations

The routine analysis should be conducted to ascertain the levels of hydroquinone in creams sold in Sudan. Manufactures should be strongly encouraged to state the exact amount of bleaching agents in creams. Moreover, based on the above findings and keeping in view the harmful effects caused by hydroquinone as cited in this publication, it is highly recommended that there should be a regulatory body to check the quality of cosmetics available at Sudanese market.

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References:

1. Adebajo, S. B. (2002). An epidemiological survey of the use of cosmetic skin lightening cosmetics among traders in Lagos, Nigeria. *Mercury*, 5(7), 43-8.
2. Costin, G. E., & Hearing, V. J. (2007). Human skin pigmentation: melanocytes modulate skin color in response to stress. *The FASEB Journal*, 21(4), 976-994.
3. European Foundation for the Improvement of Living. (2000). Ten years of working conditions in the European Union. European Foundation for the Improvement of Living and Working Conditions.
4. Food and Drug Administration (FDA). (2006). Skin bleaching drug products for over-the-counter human use; proposed a rule. *US Department of Health and Human Services*, 29.
5. Hamed, S. H., Sriwiiyanont, P., Wickett, R. R., & Boissy, R. (2004). Effect of deoxyarbutin on melanogenesis: in vivo comparison with other melanogenesis inhibitor. *Journal of cosmetic science*, 55(1), 118.
6. Hardwick, N., GELDER, L., MERWE, C., & MERWE, M. (1989). Exogenous ochronosis: an epidemiological study. *British Journal of Dermatology*, 120(2), 229-238.
7. Lee, J., Jung, K., Kim, Y. S., & Park, D. (2007). Diosgenin inhibits melanogenesis through the activation of phosphatidylinositol-3-kinase pathway (PI3K) signaling. *Life sciences*, 81(3), 249-254.
8. Raper, H. S. (1928). The aerobic oxidases. Physiological Reviews, 8(2), 245-282.
9. Schaffer, J. V., & Bolognia, J. L. (2001). The melanocortin-1 receptor: red hair and beyond. *Archives of dermatology*, 137(11), 1477-1485.
10. Siddique, S., Parveen, Z., Ali, Z., & Zaheer, M. (2012). Qualitative and quantitative estimation of hydroquinone in skin whitening cosmetics. *Journal of Cosmetics, Dermatological Sciences, and Applications*, 2(03), 224.

11. Tai, S. S. K., Lin, C. G., Wu, M. H., & Chang, T. S. (2009). Evaluation of depigmenting activity by 8-hydroxydaidzein in mouse B16 melanoma cells and human volunteers. *International journal of molecular sciences*, 10(10), 4257-4266.

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