**Lower Thiol, Glutathione, and Glutathione Peroxidase Levels in Prostate Cancer: A Meta-Analysis Study**

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**ESF1 Table 1. Specific search for each database**

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| **PubMed/Medline** |
| ((prostate cancer\* OR PCa\* OR benign prostatic hyperplasia OR BPH) **AND** (thiol OR glutathione OR glutathione peroxidase OR glutathione reductase OR glutathione-s-transferase)) **45** |
| ***SCOPUS*** |
| TITLE-ABS-KEY (prostate cancer\* OR benign prostatic hyperplasia) AND TITLE-ABS-KEY (thiol OR glutathione OR glutathione peroxidase OR glutathione reductase OR glutathione-s-transferase) AND ( LIMIT-TO ( PUBYEAR , 2020 ) OR( LIMIT-TO ( PUBYEAR , 2019 ) OR( LIMIT-TO ( PUBYEAR , 2018 ) OR ( LIMIT-TO ( PUBYEAR , 2017 ) OR LIMIT-TO ( PUBYEAR , 2016 ) OR LIMIT-TO ( PUBYEAR , 2015 ) OR LIMIT-TO ( PUBYEAR , 2014 ) OR LIMIT-TO ( PUBYEAR , 2013 ) OR LIMIT-TO ( PUBYEAR , 2012 ) OR LIMIT-TO ( PUBYEAR , 2011 ) OR LIMIT-TO ( PUBYEAR , 2010 ) OR LIMIT-TO ( PUBYEAR , 2009 ) OR LIMIT-TO ( PUBYEAR , 2008 ) OR LIMIT-TO ( PUBYEAR , 2007 ) OR LIMIT-TO ( PUBYEAR , 2006 ) OR LIMIT-TO ( PUBYEAR , 2005 ) OR LIMIT-TO ( PUBYEAR , 2004 ) OR LIMIT-TO ( PUBYEAR , 2003 ) OR LIMIT-TO ( PUBYEAR , 2002 ) OR LIMIT-TO ( PUBYEAR , 2001 ) OR LIMIT-TO ( PUBYEAR , 2000 ) OR LIMIT-TO ( PUBYEAR , 1999 ) OR LIMIT-TO ( PUBYEAR , 1998 ) OR LIMIT-TO ( PUBYEAR , 1997 ) OR LIMIT-TO ( PUBYEAR , 1996 ) OR LIMIT-TO ( PUBYEAR , 1995 ) OR LIMIT-TO ( PUBYEAR , 1994 ) OR LIMIT-TO ( PUBYEAR , 1993 ) OR LIMIT-TO ( PUBYEAR , 1992 ) OR LIMIT-TO ( PUBYEAR , 1991 ) OR LIMIT-TO ( PUBYEAR , 1990 ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) ) **68** |
| **Google Scholar** |
| Any Field: **prostate cancer OR benign prostatic hyperplasia** **AND** (Any Field: \***Thiol**\* OR Any Field: \***Glutathione**\* OR Any Field: Glutathione peroxidase OR Any Field: \*glutathione reductase\* OR Any Field: glutathione-s-transferase) **AND** Population Group: Human **112** |
| **Cochrane Database of Systematic Reviews** |
| TITLE-ABS-KEY (prostate cancer\* or benign prostatic hyperplasia)  **AND** (thiol OR glutathione OR glutathione peroxidase OR glutathione reductase OR glutathione-s-transferase) AND ( LIMIT-TO ( PUBYEAR , 2020 ) OR( LIMIT-TO ( PUBYEAR , 2019 ) OR( LIMIT-TO ( PUBYEAR , 2018 ) OR ( LIMIT-TO ( PUBYEAR , 2017 ) OR LIMIT-TO ( PUBYEAR , 2016 ) OR LIMIT-TO ( PUBYEAR , 2015 ) OR LIMIT-TO ( PUBYEAR , 2014 ) OR LIMIT-TO ( PUBYEAR , 2013 ) OR LIMIT-TO ( PUBYEAR , 2012 ) OR LIMIT-TO ( PUBYEAR , 2011 ) OR LIMIT-TO ( PUBYEAR , 2010 ) OR LIMIT-TO ( PUBYEAR , 2009 ) OR LIMIT-TO ( PUBYEAR , 2008 ) OR LIMIT-TO ( PUBYEAR , 2007 ) OR LIMIT-TO ( PUBYEAR , 2006 ) OR LIMIT-TO ( PUBYEAR , 2005 ) OR LIMIT-TO ( PUBYEAR , 2004 ) OR LIMIT-TO ( PUBYEAR , 2003 ) OR LIMIT-TO ( PUBYEAR , 2002 ) OR LIMIT-TO ( PUBYEAR , 2001 ) OR LIMIT-TO ( PUBYEAR , 2000 ) OR LIMIT-TO ( PUBYEAR , 1999 ) OR LIMIT-TO ( PUBYEAR , 1998 ) OR LIMIT-TO ( PUBYEAR , 1997 ) OR LIMIT-TO ( PUBYEAR , 1996 ) OR LIMIT-TO ( PUBYEAR , 1995 ) OR LIMIT-TO ( PUBYEAR , 1994 ) OR LIMIT-TO ( PUBYEAR , 1993 ) OR LIMIT-TO ( PUBYEAR , 1992 ) OR LIMIT-TO ( PUBYEAR , 1991 ) OR LIMIT-TO ( PUBYEAR , 1990 ) ) **27** |

**ESF Table 2. Total excluded papers and reasons**

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|  | **1rst author (year)** | **Reason to be excluded** |
| 1 | Battisti (2011) | Data were shown in graphs, and numerical data were not provided upon request.  |
| 2 | Cramer (2017) | Did not match the study interest. |
| 3 | Freitas (2011) | The study was an *in-vitro* study.  |
| 4 | Heckbert (1992) | Patients with prostate cancer were included with other types of cancer. No individual data were provided. |
| 5 | Hietanen (1994) | Full-text was not provided upon request. |
| 6 | Laur (2008) | Did not have data on included antioxidant levels. |
| 7 | Rao (1999) | Data were shown in graphs, and numerical data were not provided upon request.  |
| 8 | Richie (2014) | Did not have numerical data of GSH levels. |
| 9 | Topaktas (2019) | Did not have a healthy control group. |
| 10 | Topaktas (2019) | Did not have a healthy control group. |

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**ESF Table 3. Systematic Review**

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| **Authors, year** | **Antioxidant levels** | **n (PCa, BPH, HC)** |  | **Age (years)** | **Diagnotic Criteria** | **Country** | **Latitude** | **Ethnicity** | **Type of Sample** | **Results** |
| **PCa** | **BPH** | **HC** | **PCa** | **BPH** |  |  |  |  |  |
| **Abou Ghalia and Fouad** **(2000)** | GSH (mM/L), GPx (U/g), GST, GR (U/L) | 41 (21, 10, 10) | NR | NR | NR | Biopsy | Biopsy | Egypt | 30.076 | NR | Blood | PCa=BPH=HC: GSH, GR. PCa>HC, BPH=HC: GPx, PCa<BPH=HC: GST. |
| **Ahmad et al (2012)**  | GST, GR (U/mg), GSH (umol/mg) | 90 (N/A, 45, 45) | N/A  | 57-83 | 57-83 | N/A | Urinary symptoms, DRE, PSA, TRUS, biopsy | India | 27.9186 | Asian | Plasma | BPH<HC: GST, GR, GSH |
| **Ahmed Amar et al** **(2018)** | GSH (mmol/gpr) | 50 (25, N/A, 25) | 45-70 | N/A | 45-70 | NR | N/A | Turkey | 38.5012 | Asian | Serum | PCa<HC: GSH |
| **Akinloye et al (2009)** | GSH (ug/ml) | 92 (42, N/A, 50) | 24-73 | N/A | 24-73 | PSA | N/A | Turkey | 7.3569 | Black | Blood | PCa<HC: GSH |
| **Arsova-Sarafinovska et al** **(2009)** | GPx (U/ml) | 149 (34, 100, 15), 163 (73, 67, 23) | 67.5, 68.9 | 65.4, 71 | 60.3, 69.6 | Biopsy | Biopsy | Turkey, Macedonia | 39.9783, 42.005 | Asian, Caucasian | Erythrocytes | PCa<BPH<HC: GPx |
| **Asare et al (2018)** | GPx (ng/ml) | 90 (N/A, 60, 30) | N/A  | 65.8 | 51.9 | N/A | Biopsy |  Ghana  | 5.5684 | Black | Serum | BPH<HC: GPx |
| **Aydin et al (2006)** | GPx (U/ml) | 85 (25, 36, 24) | 67.5 | 64.3 | 65 | DRE, PSA, transrectal ultrasound, biopsy | Biopsy | Turkey | 39.9783 | Asian | Erythrocytes | PCa<BPH=HC:GPx |
| **Duru et al (2014)** | GPx (U/L) | 104 (40, 32, 32) | 53-85 | 53-85 | 53-85 | NR | NR | Nigeria | 6.4584 | Black | Plasma | PCa=BPH<HC: GPx |
| **Hacer et al (2004)** | GSH (umol/g), GPx, GR, GST (U/g) |  41 (21, N/A, 20) | 69.4 | N/A | 63.7 | NR | N/A | Turkey | 41.004 | Asian | Erythrocytes | PCa<HC: GSH, GPx, GR. PCa>HC: GST. |
| **Hanikoglu et al** **(2016)** | SH (umol/L) | 35 (18, N/A, 17) | 65.5 | N/A | 66.7 | NR | N/A | Turkey |  36.8945 | Asian | Serum | PCa<HC: SH |
| **Hardell et al (1995)** | GPx (ukat/g) | 316 (164, 152, N/A) | 70 | 69 | N/A | NR | NR | Sweden | 60.1282 | Caucasian | Erythrocytes | PCa=BPH: GPx |
| **Koike et al (2020)** | SH (uM) | 204 (73, 67, 64) | 61.8 | 63.3 | 51.7 | Biopsy | Biopsy | Brazil | -23.3045 | NR | Serum | PCa<BPH<HC: SH |
| **Kotrikadze et al** **(2008)** | GPx, GR (uM/g/min), GSH (uM/L) | 45 (15, 15, 15) | 60-75 | 60-75 | 60-75 | DRE, biopsy, echographic examination | DRE, biopsy, echographic examination | Georgia | 41.7151 | Caucasian | Erythrocytes | PCa<HC, BPH>HC: GPx. PCa>HC, BPH>HC: GR, GSH.  |
| **Solakhan et al (2019)** | SH (umol/L) | 80 (25, 30, 25) | 70.6 | 60.5 | 64.3 | Gleason score, PSA | PSA | Turkey | 37.0751 | Asian | Serum | PCa=BPH<HC: SH |
| **Sonmez et al (2018)** | SH (umol/L) | 89 (29, 30, 30) | 69.5 | 69.7 | 66.6 | PSA, DRE, TRUS, Gleason score | PSA, DRE, TRUS | Turkey | 37.8573 | Asian | Serum | BPH<PCa<HC: SH |
| **Srivastava and Mittal** **(2005)** | GSH (mg %), GPx (U/L), GST (U/ml.min) | 125 (45, 55, 25) | 61.9 | 59.6 | 60.5 | Clinical, biomedical, and histological criteria | Clinical, biomedical, and histological criteria | India | 28.6925 | Asian | Serum | PCa<BPH<HC: GSH, GPx. BPH>PCa>HC: GST. |
| **Surapaneni and Ramana** **(2006)** | GSH (mg/g), GST (umol/dl) | 60 (30, N/A, 30) |  NR | N/A | NR | Histological criteria | N/A | India | 15.9129 | Asian | Erythrocytes, Plasma | PCa<HC: GSH, PCa=HC: GST |
| **Wozniak et al (2012)** | GPx (U/g) | 90 (60, N/A, 30) | 67.4 | N/A | 61.9 | NR | N/A | Poland | 53.0195 | Caucasian | Erythrocytes | PCa<HC: GPx |
| **Yilmaz et al (2003)** | GPx (U/ml) | 121 (21, 50, 50) | 66 (Median) | 63.5 (Median) | 66 (Median) | DRE, PSA, Transrectal ultrasonography, biopsy Gleason sum | NR | Turkey | 39.9783 | Asian | Erythrocytes | PCa=BPH<HC: GPx |
| **Zachara et al (2004)** | GPx (U/L) | 113 (39, 42, 32) | 61 | 68 | 48 | NR | NR | Poland | 52.7993 | Caucasian | Erythrocytes, plasma | BPH<PCa=HC: GPx (erythrocytes). PCa<BPH=HC: GPx (plasma) |

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