The role of economic and demographic factors on dietary data availability across the world: an analysis from the Global Dietary Database 2018.

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Introduction:

Dietary data collection is necessary for capturing detailed latitudinal and longitudinal nutrition information at the population level. Such information is used to update knowledge on diet trends and patterns over time, diet-disease relationships, and diet-related policy effects. However, dietary data is heterogeneous across the world, and some populations are completely unrepresented in accessible dietary data.

Nutritional epidemiology has relied on high-quality diet intake data to examine the relationships between diet patterns and conditions such as cardiovascular disease. Findings show that individuals who have suboptimal diets are shown to have an increased risk for cardiovascular disease in their lifetimes. Diet data, both on quantity and quality of food, have also been used to establish connections between obesity and dietary intake across the world. This relationship is brought forth by the analysis of dietary intake patterns from long term diet data collection. Dietary data have also been used in important policymaking, such as the development of the Dietary Guidelines for Americans (DGAs), updated most recently for 2020-2025. These guidelines were developed after a thorough examination of scientific research into diet as well as studies into the prevention of diseases and included seven specific principles on the foods and nutrients to consume regularly and limit intake in order to maintain a healthy lifestyle. .

Though high-quality dietary data has afforded important advancements in this field, the quality and interpretation of data tools can vary widely by dietary assessment, leading to inconsistencies in diet data resolution across populations. Each diet assessment tool differs

substantially in its administration, level of detail, and cost. Twenty-four-hour recalls (24hR), widely considered to be the gold standard in diet assessment, are conducted by trained interviewers, and capture intake for the period of a day. However, the use of professionals to conduct these interviews make 24-hour recalls quite expensive to conduct, rendering them largely unavailable for low-resource areas. Food frequency questionnaires, or FFQs, on the other hand, offer a cheaper alternative, as they are self-reported. Data quality from FFQs is very different from 24hR, however, as they generally capture a person's long-term frequency in consuming foods from a predefined food list, leaving room for gaps in diet assessment. Diet diversity questionnaires are another option typically used in impoverished populations, but they only take food type into account, and completely omit the amount, making them among the cheapest but least accurate methods of assessment. Finally, household surveys measure the amount of money spent on food within a household. This measurement can then be converted to determine an average estimate on individual food consumption. While many tools exist to measure dietary data, the unstandardized use of these different assessment methods make analyses across populations extremely difficult.

Projects like the Global Dietary Database (GDD) aim to assemble and standardize all available global dietary data to promote equity in diet data availability across countries and populations. In the years 2008–2011 and 2014–2020, the GDD project collected and standardized datasets from diet intake surveys across the globe for use as inputs in a prediction model to estimate dietary intake around the world. Data were retrieved from publicly-available surveys or corresponding data owners as individual-level food group microdata or aggregate stratum-level data. The GDD, now combining all available dietary data into one database, has

enabled its use for projects including research and development of public health-promoting policies/guidelines.

Nevertheless, many countries in the world do not have available dietary data due to a multitude of reasons. The absence of data registers as a gap in diet trends for certain regions and can inhibit research studies or programs in these areas. There is a possibility that these gaps in dietary data may be related to the overall economic status of a country, as economic status may indicate the availability of resources a country or researchers within it have for dietary studies. Countries with higher gross domestic product (GDP) may have the budget for more government employees and to conduct studies into variables such as diet and health. This may be the opposite for lower GDP countries, despite the fact that populations in low GDP countries are likely ones that can benefit the most from dietary analyses and the intervention programs that often follow. Furthermore, population size may also influence survey efforts. Countries with smaller populations may have limited domestic resources and may also be low-priority targets for international public health initiatives due to their relatively small impact.

Overall, this paper aims to evaluate the possible relationship between economic status, country population, and availability of dietary intake data for countries worldwide.

Methods:

After the harmonization process, the GDD compiled a complete list of all countries with available dietary data from the years 1980-2018. This list of countries was cross-referenced with a list of the United Nations Officially Recognized Countries to identify the list of countries without available dietary data to establish the initial gap in knowledge. These lists were again cross-referenced with the World Bank's estimates of GDP in 2018 across the common metric of purchasing power parity (PPP). The United Nations Population Division's data was then utilized

to determine the average population of each country in thousands for 2018. If available, a country's income levels and population size data were plotted stratified by the availability of dietary data in the GDD. T-tests were conducted to determine the statistical relationship between available dietary data (binary), GDP (continuous), and population size (continuous). The variables of GDP and population were both log-transformed to maintain normal statistical distributions and provide accurate results from t-test analyses.

Table 1: Data availability, GDP (2018) , and population (2018) for all UN Recognized Countries. If GDD survey data were available, the table is denoted with "YES. " If the data were not available for the country, it is denoted with "NO." GDP values and the population of each country are included if available. Blanks denote that GDP or population data has not been recorded by the United Nations.

UN Recognized Countries	GDD Survey Data	GDP 2018 (PPP) in millions	Population in thousands
ABW	NO		106
AFG	YES	77442.05	37172
AGO	YES	218823	30810
AIA	YES		15
ALB	YES	38829.29	2883
AND	NO		77
ANT	NO		
ARE	YES	660680	9631
ARG	YES	1037340	44361

ARM	YES	734108	2952
ASM	YES		55
ATA	NO		
ATF	NO		
ATG	YES	2082.68	96
AUS	YES	1255450	24898
AUT	YES	504355	8891
AZE	YES	144681	9950
BDI	YES	8717.63	11175
BEL	YES	601842	11482
BEN	YES	37185.99	11485
BES	NO		26
BFA	YES	42899.82	19751
BGD	YES	734108	161377
BGR	YES	160951	7052
BHR	YES	74317.83	1569
BHS	YES	14623.97	386
BIH	YES	49582.38	3324
BLR	YES	183461	9453

BLZ	YES	2793.25	383
BMU	NO	5331.2	63
BOL	YES	100661	11353
BRA	YES	3131950	209469
BRB	YES	4602.51	287
BRN	YES	26535.58	429
BTN	YES	8769.77	754
BVT	NO		
BWA	YES	40718	2254
CAF	YES	4460.31	4666
CAN	YES	1856050	37075
CCK	NO		
CHE	YES	585015	8526
CHL	YES	464438	18729
CHN	YES	21746500	1427648
CIV	YES	129259	25069
CMR	YES	93081.56	25216
COD	YES	93512.81	84068
COG	YES	20988.53	5244

COK	YES		18
COL	YES	736866	49 661
COM	YES	2614.78	832
CPV	YES	3823.42	544
CRI	YES	101960	4999
CSK	NO		
CUB	YES		11338
CUW	NO	4089.4	163
CXR	NO		
CYM	YES	4703.46	64
CYP	YES	35217.18	1189
CZE	YES	437180	10666
DDR	NO		
DEU	YES	4556070	83124
DJI	YES	5121.69	959
DMA	YES	846.48	72
DNK	YES	332918	5752
DOM	YES	192811	10627
DZA	YES	503608	42228

ECU	YES	202337	17084
EGY	YES	1145970	98424
ERI	YES		3453
ESH	NO		567
ESP	YES	1905610	46693
EST	YES	48023.19	1323
ETH	YES	235352	109224
EU2	NO		
FIN	YES	274388	5523
FJI	YES	12530.94	883
FLK	NO		3
FRA	YES	3124870	64991
FRO	NO		48
FSM	YES	399.64	113
GAB	YES	32008.7	2119
GBR	YES	3137010	67142
GEO	YES	54423.95	4003
GHA	YES	158390	29767
GIB	NO		34

GIN	YES	31740.6	12414
GLP	NO		400
GMB	YES	5040.48	2280
GNB	NO	3742.36	1874
GNQ	NO	27299.71	1309
GRC	YES	327400	10522
GRD	YES	1918.18	111
GRL	YES		57
GTM	YES	141471	17248
GUF	NO		283
GUM	NO		166
GUY	YES	9956.9	779
HKG	NO	466068	7372
HMD	NO		
HND	YES	55707.62	9588
HRV	YES	116726	4156
HTI	YES	34094.82	11123
HUN	YES	311152	9708
IDN	YES	3117890	267671

IND	YES	9001760	1352642
IOT	NO		
IRL	YES	409561	4819
IRN	YES	1128850	81800
IRQ	YES	419686	38434
ISL	YES	20155.16	337
ISR	YES	358488	8382
ITA	YES	2604860	60627
JAM	YES	29275.76	2935
JOR	YES	102218	9965
JPN	YES	5275710	127202
KAZ	YES	478233	18320
KEN	YES	221309	51393
KGZ	YES	33246.52	6304
KHM	YES	69234.85	16250
KIR	YES	267.68	116
KNA	YES	1391.31	52
KOR	YES	2192610	51172
KWT	YES	213933	4137

LAO	YES	54922.86	7061
LBN	YES	109530	6859
LBR	YES	7389.76	4819
LBY	YES	102742	6679
LCA	YES	2843.51	182
LKA	YES	285567	21229
LSO	YES	5935.44	2108
LTU	YES	101826	2801
LUX	YES	70914.24	604
LVA	YES	59355.86	1928
MAC	NO	85347.57	632
MAR	YES	279171	36029
MDA	YES	34297.67	4052
MDG	YES	43395.93	26262
MDV	YES	9929.05	516
MEX	YES	2556350	126191
MHL	YES	232.68	58
MKD	YES	34726.4	2083
MLI	YES	44629.23	19078

MLT	YES	21392.2	439
MMR	YES	276689	53708
MNE	YES	13407.29	628
MNG	YES	38695.06	3170
MNP	NO		57
MOZ	YES	38968.77	29496
MRT	YES	22744.27	4403
MSR	YES		5
MTQ	NO		376
MUS	YES	28784.54	1267
MWI	YES	19375.65	18143
MYS	YES	890019	31528
MYT	NO		260
NAM	YES	24908.34	2448
NCL	NO		280
NER	YES	27609.8	22443
NFK	NO		
NGA	YES	1034350	195875
NIC	YES	37717.56	6466

NIU	YES		2
NLD	YES	997730	17060
NO	NO		
NOR	YES	367896	5338
NPL	YES	93588.23	28096
NRU	YES	149.27	11
NZL	YES	210920	4743
OMN	YES	141454	4829
PAK	YES	1030350	212228
PAN	YES	132848	4177
PCI	NO		
PCN	NO		
PCZ	NO		
PER	YES	418859	31989
PHL	YES	930383	106651
PLW	NO	338.67	18
PNG	YES	36968.51	8606
POL	YES	1214380	37922
PRT	YES	359232	10256

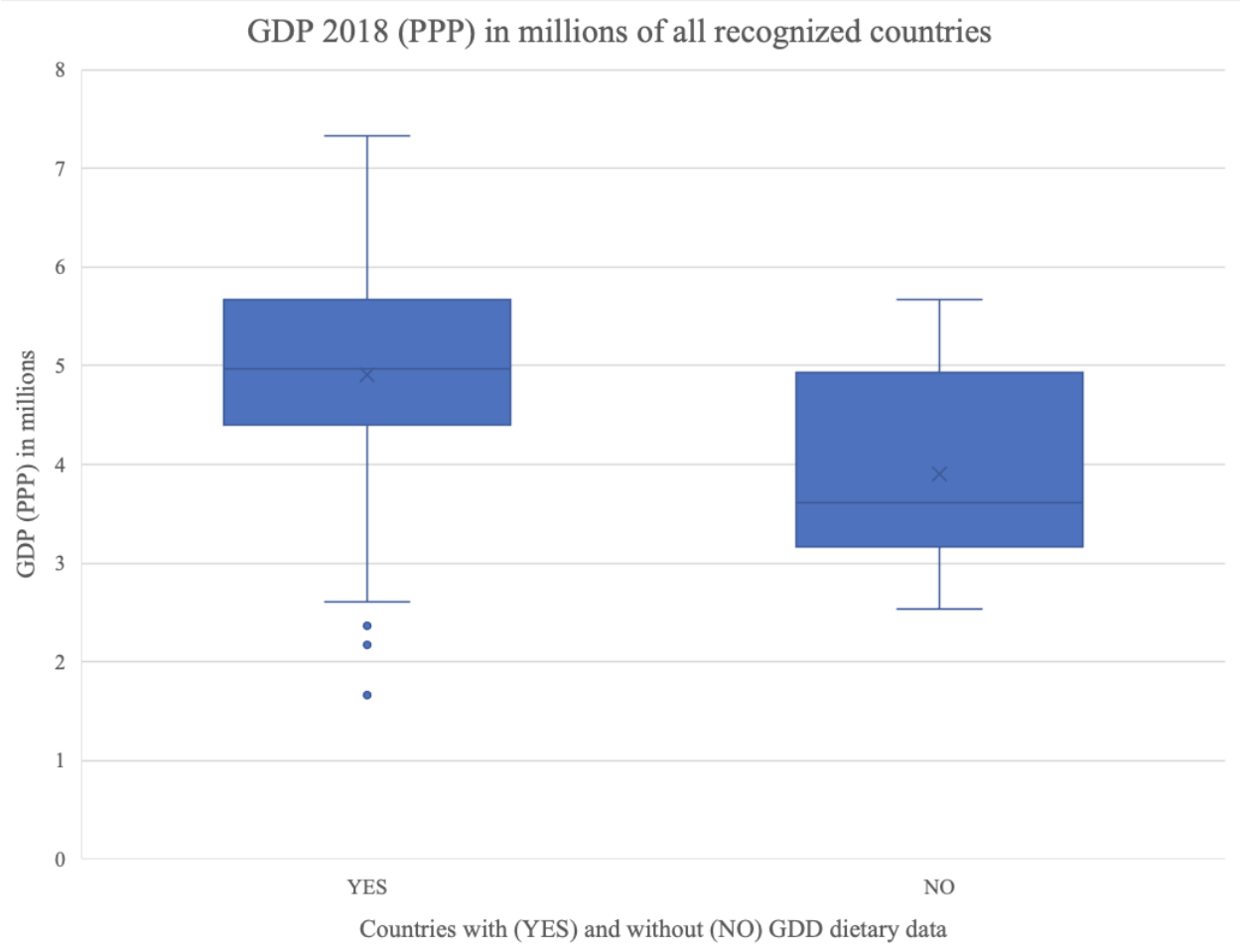
PRY	YES	91566.26	6956
PSE	YES	29571.69	4863
PYF	NO		278
QAT	YES	259214	2782
REU	NO		883
ROU	YES	569590	19506
RUS	YES	4242500	145734
RWA	YES	26321.68	12302
SAU	YES	1643080	33703
SCG	NO		
SDN	YES	176806	41802
SEN	YES	53834.02	15854
SGP	YES	564578	5758
SGS	NO		
SHN	NO		6
SLB	YES	1805.48	653
SLE	YES	13034.41	7650
SLV	YES	56665.97	6421
SMR	NO	2057.05	34

SOM	NO		15008
SPM	NO		6
SRB	YES	123843	8803
SSD	NO		10976
STP	YES	863.24	211
SUN	NO		
SUR	YES	9814.64	576
SVK	YES	171887	5453
SVN	YES	80706.92	2078
SWE	YES	544916	9972
SWZ	YES	9917.57	1136
SXM	NO	1471.8	42
SYC	YES	2775.02	97
SYR	YES		16945
TCA	NO	1086.58	38
TCD	YES	24992.2	15478
TGO	YES	12549.07	7889
THA	YES	1286310	69428
TJK	YES	30155.8	9101

TKL	YES		1
TKM	NO	88974.54	5851
TLS	YES	3963.7	1268
TON	YES	678.28	103
TTO	YES		1390
TUN	YES	127518	11565
TUR	YES	2300830	82340
TUV	YES	46.54	12
TZA	YES	145035	56313
UGA	YES	92878.34	42729
UKR	YES	534229	44246
UMI	NO		
URY	YES	76287.41	3449
USA	YES	20580200	327096
UZB	YES	228058	32476
VAT	NO		1
VCT	YES	1407.39	110
VDR	NO		
VEN	YES		28887

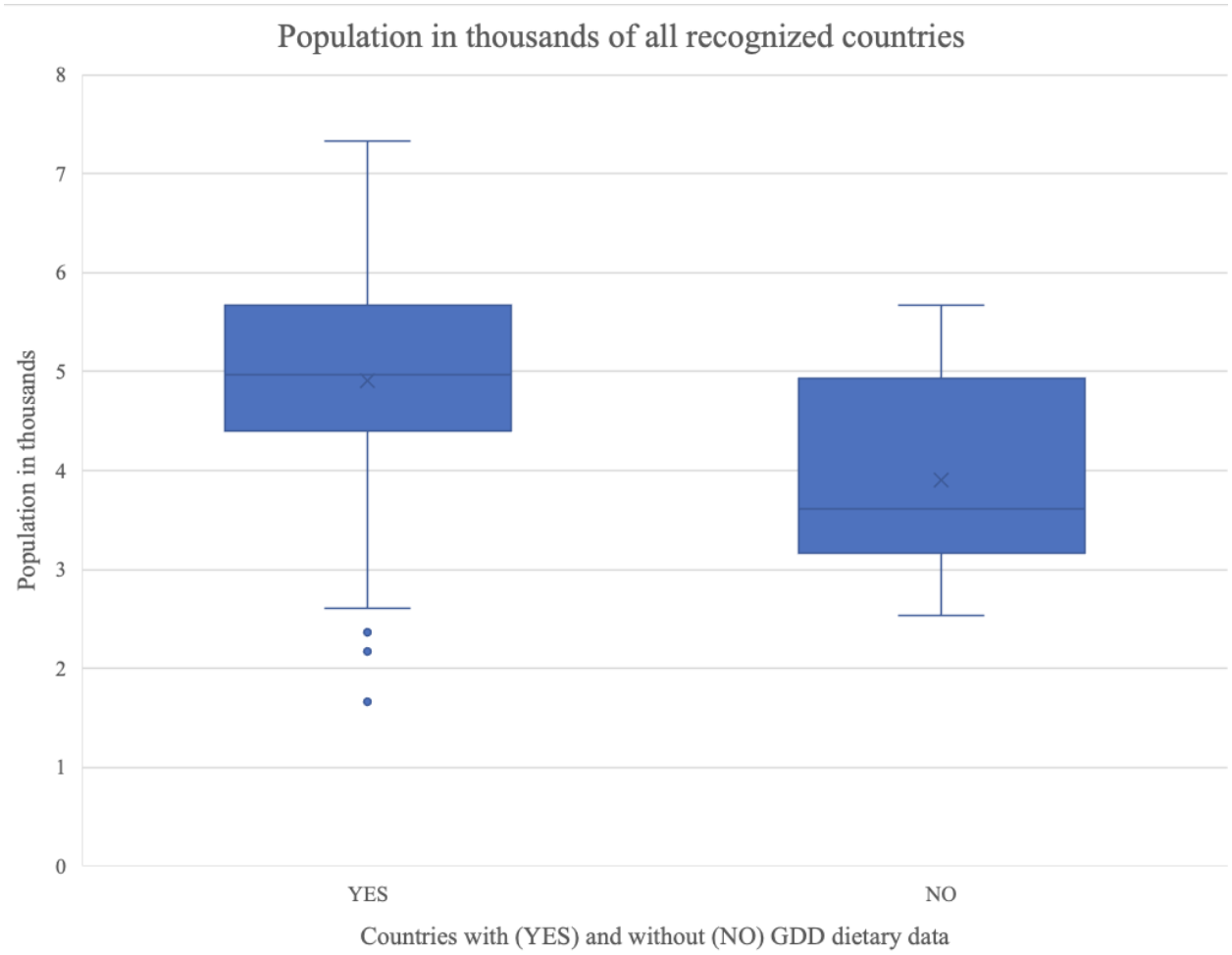
VGB	YES		30
VIR	NO		105
VNM	YES	742463	95546
VNM	YES	742463	95546
VUT	YES	937.95	293
WLF	NO		12
WSM	YES	1269.8	196
YEM	YES		28499
YMD	NO		
YUG	NO		
ZAF	YES	747578	57793
ZMB	YES	62593.3	17352
ZWE	YES	46295.49	14439

Figure 1: GDP (2018) for all UN Recognized Countries, stratified by the availability of dietary data.



Note: All GDP values were log transformed for statistical significance tests to ensure normal distribution. The countries included in the figure are only those with available and collected GDP data.

Figure 2: Population (2018) for all UN Recognized Countries, stratified by the availability of dietary data.



Note: All population values were log transformed for statistical significance tests to ensure normal distribution. The countries included in the figure are only those with available and collected population data.

Results:

After a thorough statistical analysis employing the use of t-tests and p-value comparisons, the null hypothesis (that there is no significance between GDP or population size and dietary data availability in countries worldwide) was rejected. T-test evaluations determined that countries without available dietary data had significantly lower GDP in 2018 than countries with available dietary data ($P<0.001$). T-test evaluations also determined that countries without

available dietary data were significantly smaller in population than countries with available dietary data ($P<0.001$).

Discussion:

The obtained results demonstrate the connection between a country's economic status and population with availability of dietary data. These results highlight the need for countries with more resources or global organizations to come to the aid of smaller countries (both in population and income) to obtain dietary data for otherwise ignored populations. It may be up to the World Health Organization or the Food and Agriculture Organization of the United Nations to conduct more specialized studies (ideally of high quality such as 24hR) to increase data collection rather than relying on country governments or domestic researchers (who often rely on government funding). Considering that dietary data is often used to create healthy lifestyle guidelines and other important first steps to improve a country's public health, such actions have wide-reaching implications on the health, wellbeing, and life expectancies of populations.

Data Sources

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